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LECTURES

ON THE

DIAGNOSIS AND TREATMENT

OF

DISEASES OF THE CHEST

THROAT, AND NASAL CAVITIES

BY

E. FLETCHER INGALS, A.M., M.D.

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PREFACE.

These lectures are designed to present a complete exposition of the subject of Physical Diagnosis so far as it relates to diseases of the Chest, Throat, and Nasal Passages; to give the essential symptoms of each disease; to point out the symptoms and signs which are of most value in a differential diagnosis; and to outline briefly the proper treatment for the various affections. The anatomical characteristics and the causes of these diseases have been pointed out wherever they are of special value in enabling the reader to understand the physical signs, or to properly apply remedial measures. When these lectures were delivered, nothing was said about treatment, but in order to enhance the value of this work to both physician and student, I have appended to the consideration of the diagnosis of each disease, an outline of the treatment which I have found most satisfactory. In so doing, I have not even mentioned many methods of treatment of more or less value which have been recommended by other physicians.

In the preparation of these lectures I have availed myself of every source of information at my command, and I hope that little has been overlooked which would be of value to the student or practitioner. The study of this subject for several years, in connection with my lectures, and a large personal experience with these affections have enabled me to discriminate as to the relative importance of different signs and to detect numerous exceptions to the general rules. These exceptions, some

of which are extremely rare, are of little importance to the general practitioner, and the study of them is a positive injury to the student unless their true significance is understood. Matter relating to them has, therefore, been set in small type, so that it may be omitted until the student has become thoroughly familiar with the facts that are essential.

The nature of these lectures which contain information gathered from many different sources by study and by personal observation, and the fact that much of which they treat has long since become public property, renders it impossible for me in every instance to give the credit to individual authors which I desire, but I freely acknowledge my indebtedness to all who have preceded me in this field. I am indebted to the courtesy of Doctors J. Solis Cohen, of Philadelphia, and Lennox Browne and Morell Mackenzie, of London, for permission to use some of the cuts which illustrate their works. I take special pleasure in expressing my obligation to my clinical assistants, Doctors Philip Leach, W. H. Taylor, and J. T. Eggers, for valuable aid in the revision of my notes.

Messrs. Sharp & Smith, of this city, have kindly furnished electrotypes for the illustrations of instruments.

E. F. I.

188 Clark Street,
CHICAGO, November 15th, 1880.

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PULMONARY DISEASES.*

LECTURE I.

PHYSICAL DIAGNOSIS.

In the course of lectures upon which we are entering, I shall first describe to you the methods for detecting disease, which are based upon the pathological changes in the organs affected. Next I shall point out the characteristics and significance of the various signs, and finally I shall consider the diagnosis and treatment of individual diseases.

The term physical diagnosis is used to designate these methods, whether used in the examination of the chest or in the examination of any other part of the body. Some of these methods are in use by all classes of physicians, no matter what the disease; but as it is in the exploration of the chest that such methods have yielded the most brilliant results, it is now customary to apply the term physical diagnosis simply to the examination of the thorax.

It is in this limited sense that I shall generally use it, though it will also be applied to the examination of the upper air-passages.

The principal methods of physical examination, six in number, are named: Inspection, Palpation, Mensuration, Succussion, Percussion, and Auscultation. Unfortunately the majority of physicians confine themselves to one of these, relying for their diagnosis almost exclusively upon auscultation. It will not be necessary to enlarge upon the fallacy of this course

* In the following pages, things which are exceptional, or of comparatively little importance, will be found in smaller type, which the student is advised to omit until he is familiar with the essentials. In the tables illustrating the differential diagnosis of diseases, signs common to both are omitted, for the sake of making the distinction clearer.

when I tell you that there are many cases in which it will be necessary for you to use every method and to scrutinize every symptom, before you can arrive at an accurate diagnosis.

The evidences of disease which these methods furnish are known as signs or physical signs.

There is a marked difference between symptoms and signs. Symptoms, which are chiefly derived from the statements of the patient, may be called *presumptive* evidence of disease, while signs are considered *positive* evidence.

The value to you of these signs will depend upon your knowledge of the alterations which produce them.

The early students of physical diagnosis noted the various characteristics of a sign accurately and located it upon the surface of the chest, then at the autopsy they sought to ascertain its causes. At present we only need to study the sign clinically, for its causes may be learned from our text-books; however, it will be of great advantage for you to study the signs in clinical cases, noting their location and their various characteristics, and inspecting at the autopsy, whenever possible, the lesions which caused them.

To simplify the study of physical diagnosis, and to enable us to fix accurately in our minds the position of the intra-thoracic organs, the chest has been divided into a number of artificial regions.

These regions are purely arbitrary; consequently you will find their boundaries vary with different authors.

Prof. Da Costa divides the chest into four regions: the anterior, the posterior, and a lateral region on each side; and he subdivides the anterior and the posterior into an upper and a lower region. He locates signs found in these regions by certain fixed marks which may be found on the surface of the chest. For instance, anteriorly, a sign may be located in a certain intercostal space, or beneath a rib or beneath the clavicle, at a given distance from the sternum. Posteriorly, a sign may be located in a similar manner with reference to the spinous processes, or to the angles and the borders of the scapulæ.

This division is well enough for the record of cases, but it does not aid us in remembering the location of the intra-thoracic organs. The division I shall adopt is similar to that

quite commonly taught, with only such changes as make it plainer and easier to be remembered.

While learning these boundaries, I wish you also to fix in your minds the exact position of the intra-thoracic organs.

We will divide the chest primarily into anterior, posterior, and lateral regions, and these we will subdivide as follows.

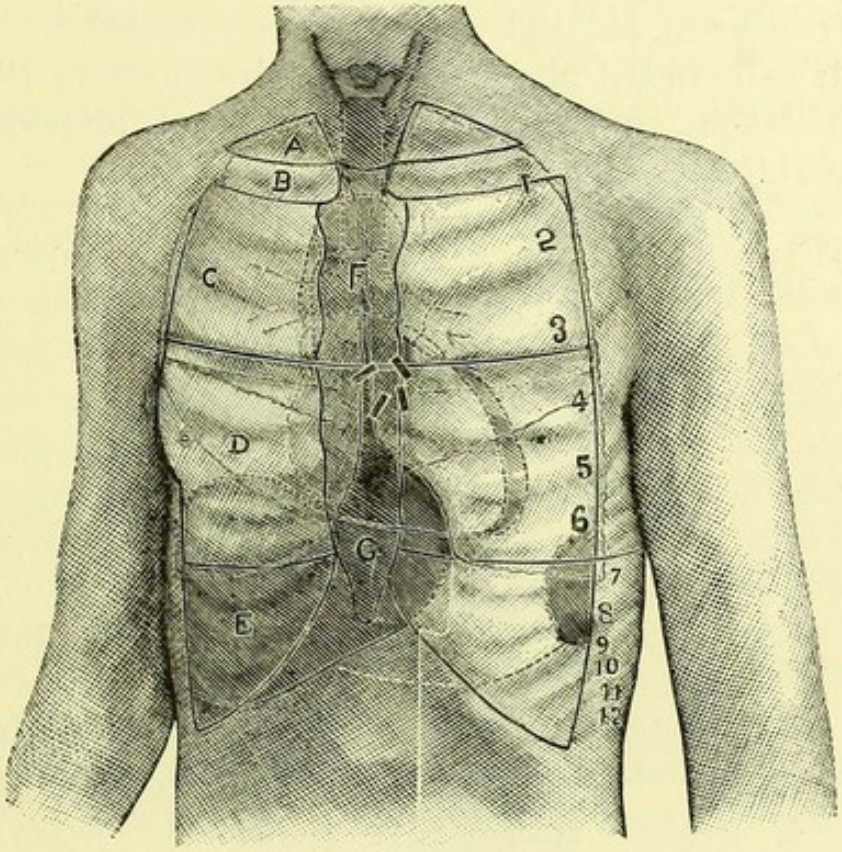


FIG 1.—A, Supra-clavicular region. B, Clavicular region. C, Infra-clavicular region. D, Mammary region. E, Infra-mammary region. F, Upper sternal region. G, Sternal or lower sternal region.

The wavy lines represent the borders of the lungs and the pulmonary fissures. The dotted lines correspond to the outlines of the various organs, viz., trachea, aorta, bronchial tubes, heart, liver, spleen, and stomach. The very dark shading over the solid viscera shows the normal areas of flatness, and the shading next lighter over the upper part of the liver shows the hepatic dulness. The black rectangular spots near the third rib correspond to the position of the valves of the heart.

Upon the anterior surface of the chest on either side, from above downwards, we have first the supra-clavicular region, then the clavicular, the infra-clavicular, and still farther down the mammary, and below it the infra-mammary; between these two lateral halves we find the supra-sternal and the sternal regions; the sternal being also subdivided into the superior-sternal and the inferior-sternal.

The posterior portion of the chest, on each side, is subdivided into the supra-scapular and the scapular regions, between these the inter-scapular region, and below the scapulæ the infra-scapular regions (Fig. 2). Laterally we have the axillary and the infra-axillary regions.

THE SUPRA-CLAVICULAR REGION corresponds to that portion of the pleural cavity which extends above the clavicles. It is triangular in form, located with its base internal, its apex external. It is bounded above by a line drawn from the upper ring of the trachea outward to the junction of the middle with the external third of the clavicle.

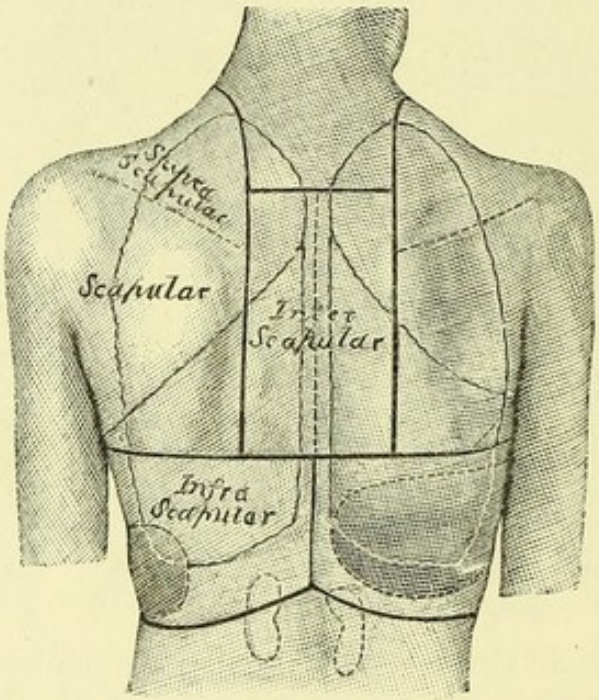


FIG. 2.—The wavy lines correspond to the borders and fissures of the lungs. The dotted line across the scapular region indicates the position of the spine of the scapula. The dotted lines and shaded areas in the infra-scapular regions indicate the position of the liver and spleen.

The inferior boundary of this region corresponds to the upper margin of the inner two thirds of the clavicle. The internal boundary corresponds to the sterno-cleido-mastoid muscle. This region contains, on either side, the apex of the lung, and portions of the subclavian artery and vein.

THE CLAVICULAR REGION corresponds to the inner two thirds of the clavicle and is bounded above and below by the borders of the bone. It contains lung tissue on either side. Upon the right side externally, we find the subclavian artery, and at the inner extremity the arteria innominata, and the recurrent

laryngeal nerve as it passes up to supply the muscles of the larynx. Aneurisms in this locality, by pressing upon this nerve, give rise to serious symptoms due to paralysis or spasm of the glottis. Upon the left side at the inner end of this region, we find the carotid and the subclavian arteries, deeply seated and running almost at right angles with the clavicle.

THE INFRA-CLAVICULAR REGION is bounded above by the clavicle, internally by the margin of the sternum, and externally by a straight line let fall from the outer extremity of the clavicular region, and passing about an inch externally to the nipple.

It is bounded below by the lower margin of the third rib.

This region contains lung tissue on either side. On the right side, close to the border of the sternum, we find portions of the ascending aorta and of the descending vena cava. Just beneath the second costal cartilage, we find the right bronchus as it passes into the right lung. Upon the left side, in the second intercostal space, close to the margin of the sternum, the pulmonary artery is located. In the same space is found the left bronchus, which inclines more downward and is located lower than the main bronchus on the opposite side. A portion of the base of the heart occupies the internal inferior angle of this region.

THE MAMMARY REGION, which lies immediately below the preceding, is bounded internally by the margin of the sternum, externally by a continuation of the line which bounds the infra-clavicular region, and inferiorly by the lower margin of the sixth rib. You will easily remember the boundaries of the infra-clavicular and the mammary regions, by recollecting that we have three ribs in each. The inferior border of the third rib forms the lower boundary of the upper region and the lower margin of the sixth rib bounds the lower region inferiorly.

This region contains lung tissue on both sides. On the right side, the thin margin of the lung, which overlaps the liver, reaches to the sixth interspace and extends even lower in full inspiration.

Deeper seated we find the upper convex surface of the liver, carrying the diaphragm above it, as high as the fourth intercostal space. The nipple is usually located in the fourth inter-

costal space; therefore, we expect to find the upper border of the liver beneath it. A small portion both of the right auricle and of the right ventricle extends into this region.

In the upper part of the *left* mammary region, the lung tissue is in front as low as the fourth rib. At this level, the border of the lung passes outward and downward to the fifth rib, leaving between it and the median line, a triangular space in which the heart and its investing membrane are superficial.

THE INFRA-MAMMARY REGION is bounded externally by a continuation of the outer boundary of the mammary region; above by the lower margin of the sixth rib, and internally and inferiorly by the margin of the sternum and by the lower borders of the false ribs. This region contains, on the right side, the liver, and occasionally the inferior margin of the lung during full inspiration.

On the left side, near the sternum, we find a portion of the left lobe of the liver; a little farther outward near the middle of the region, we have the stomach, and in the outer third is a portion of the spleen. The stomach and the spleen usually extend as high as the sixth rib.

The mammillary or nipple line is a vertical line drawn through the nipple which, according to some authors, forms the external boundary of the infra-clavicular, mammary, and infra-mammary regions.

The regions between the lateral halves of the anterior part of the chest are three in number. The first of these from above downward, is the

SUPRA-STERNAL REGION. It is bounded inferiorly by the upper end of the sternum, or inter-clavicular notch; laterally by the sterno-cleido-mastoid muscles, and above by the first ring of the trachea. The most important organs in this region are the trachea and the thyroid gland, the lobes of which lie on each side of the trachea, and are connected by the isthmus in the upper part of this region. Here are also found certain small veins and arteries which are of interest to the surgeon.

In the lower right angle of this region, the innominate artery is found, and in the inter-clavicular notch we can frequently feel the arch of the aorta. Beneath this region we have the

SUPERIOR STERNAL REGION which is bounded below by a line connecting the lower margins of the third ribs, and laterally

by the borders of the bone. This region contains lung tissue. Superficially, the inner or anterior margin of each lung reaches the median line. Deeper, we find the descending vena cava, the ascending, transverse, and a part of the descending portion of the arch of the aorta, and at the left a portion of the pulmonary artery. At a point opposite the junction of the second costal cartilages with the sternum, is the bifurcation of the trachea.

THE INFERIOR STERNAL REGION, known also as the sternal region, has for its boundaries the borders of all that portion of the sternum lying below the third ribs. In it the anterior margin of the right lung corresponds to the median line, and is superficially situated. But the corresponding margin of the left lung recedes from the median line at the level of the fourth rib, and passes outward and downward, leaving a triangular space between it and the margin of the right lung. In this space the right ventricle of the heart is superficial. In the upper part of this region we find a large portion of the right auricle. Near its upper border we find also the origin both of the aorta and of the pulmonary artery. The portions of the left side of the heart which present anteriorly lie to the left of this region.

In this region we find portions of the four sets of valves which guard the orifices of the heart (Fig. 1). At the left edge of the sternum, under the third rib, are the pulmonary valves; a trifle lower, beneath the centre of the sternum, are located the aortic valves; lower down, at its left border in the third intercostal space, we find the mitral valves. We locate the tricuspid valves beneath the middle of the sternum on a line with the fourth costo-sternal articulation.

These valves lie so closely together that a circle scarcely more than an inch in diameter will include all of them, and a circle of half that diameter will embrace a portion of each.

At the lower part of this region, we have a portion of the liver and of the attachment of the pericardium to the diaphragm.

The mesosternal line is an imaginary line passing down the centre of the sternum.

The parasternal lines correspond on each side to the borders of the sternum.

Posteriorly we have the supra-scapular and the scapular re-

gions, extending from the second to the seventh rib and corresponding very nearly to the outlines of the scapula, when the patient's arms are hanging loosely by his side (Fig. 2).

THE SUPRA-SCAPULAR REGION corresponds to the supra-spinous fossa.

THE SCAPULAR REGION corresponds to the infra-spinous fossa. These regions are occupied by lung tissue.

THE INTER-SCAPULAR REGION on each side lies between the border of the scapula and the spinous processes of the vertebræ, and extends from the level of the second dorsal vertebra to the level of the seventh. These regions contain lung substance, the main bronchi, and the bronchial glands. The descending aorta runs along the left of the spinal column, beside the œsophagus. The trachea bifurcates opposite the third dorsal vertebra. In these and in the two preceding regions, the chest walls are very thick.

THE INFRA-SCAPULAR REGION is bounded internally by the spinous processes of the vertebræ; externally by a perpendicular line let fall from the inferior angle of the scapula; above by the lower margin of the scapular and inter-scapular regions, which corresponds to the seventh rib; and below by the inferior margin of the false ribs. This region contains lung tissue on either side, extending to the tenth or to the eleventh rib. On the right side, below the margin of the lung, we have the liver. On the left side, the intestines are superficial near the middle portion of the region, and externally we find the spleen (Fig. 2). The kidneys are located near the spinal column on either side. The left kidney extends an inch higher than the right, and its upper extremity is frequently found in this region.

LATERALLY we have two regions, the axillary and the infra-axillary.

THE AXILLARY is bounded below by a line drawn from the lower margin of the mammary region backward to the inferior angle of the scapula; above by the axilla; in front by the outer boundaries of the infra-clavicular and the mammary regions, and posteriorly by the axillary border of the scapula. This region contains lung tissue on each side and, deeply seated, the main bronchi.

THE INFRA-AXILLARY REGION.—Below this we have the infra-

axillary region. It is bounded posteriorly, by the outer margin of the infra-scapular region; anteriorly, by the external margin of the infra-mammary region; below, by the margin of the false ribs. On either side, we find the lower border of the lungs running from near the upper anterior angle of this region downward and backward. Below this, on the right the liver, and on the left the spleen, and a portion of the stomach, are superficial.

Pulmonary fissures.—At a point about three inches below the apex of the lung, which corresponds very nearly to the inner end of the spine of the scapula, we find the beginning of the pulmonary fissures which separate the upper from the lower lobes. These fissures run obliquely downward and forward, the one on the left side coming to the anterior border of the lung, beneath the fourth intercostal space (Figs. 1 and 2).

It is a common error with students to suppose that the interlobar fissures run in the opposite direction, that is, downward and backward from the upper part of the anterior margin of the lung.

On the right side the fissure commences at the same level and reaches the anterior margin of the lung near the fourth costal cartilage. At a point on this fissure, four or five inches from the sternum, we find the commencement of another fissure, which passes downward and inward to the margin of the lung on a level with the fifth intercostal space. By this fissure a small triangular portion is cut off from the upper part of the lower lobe to form the middle lobe of the right lung. The positions of these fissures necessarily change considerably with inspiration and expiration.

INSPECTION.

By inspection we learn the general appearance of the patient, the color of the integument, the presence or absence of subcutaneous emphysema, œdema, or tumors; and the size, form, and movements of the chest.

Whatever method of physical diagnosis you pursue, it is necessary, first, to be familiar with the healthy conditions which it would reveal. Therefore I wish to call your attention to the aspect of a healthy chest.

It has a generally rounded or convex appearance; the shoulders are level, the clavicles, horizontal, and the two sides are almost perfectly symmetrical; however, in many cases more or less depression will be observed in the supra-clavicular and infra-clavicular regions, and not infrequently the pectoral muscles are better developed on one side than on the other.

Considerable difference in the form and in the movements of the chest exists in persons of different ages and sexes. In women the upper portion is more prominent than in men. The inspiratory movements vary accordingly, being more marked at the upper part in women, at the lower part in men. In children of either sex, the chest walls often hardly move at all; and the respiration seems to be performed by the abdominal muscles.

This disparity is most conspicuous in rapid respiration.

The respiration in these three localities gives the names superior-costal, inferior-costal, and abdominal breathing. In men a deep furrow just below the fifth rib marks the lower border of the pectoralis major muscle. At the border of the sternum, about an inch below the clavicle, we often notice rounded prominences about an inch in diameter, which mark the position of the second costal cartilages. These are frequently mistaken by students for abnormal swellings. In some patients the ribs and the intercostal spaces are very distinct, while in others they are hidden by adipose tissue. The obliquity of the inferior ribs varies greatly in different individuals.

In the fifth intercostal space, about two inches to the left of the sternum, we observe the impulse of the chest-walls caused by the apex beat of the heart.

In health, the respiratory movements are repeated sixteen or twenty times a minute in adults, and from twenty to twenty-five or even thirty times in children.

Occasionally we find local bulging or depression, independent of disease of the internal organs. The prominent sternum known as pigeon breast, usually due to violent cough, or obstructed respiration, as from catarrh or enlarged tonsils in childhood; the pear-shaped chest due to rachitis, and the long, narrow and flat chest, which often results from rapid growth, are all found independent of intra-thoracic disease (Fig. 3).

There is often bulging of the præcordial region, especially in children. I have seen deep depressions of the lower sternal region, and of the ribs in rare instances, in healthy individuals. I have here a cast taken from life, which shows a depression of the lower sternal region from an inch and a half to two inches in depth; yet the individual from whom it was taken enjoyed perfect health.

Most deviations from symmetry in the two sides are due to slight curvatures of the spinal column. In the examination of a large number of patients, not more than one in seven will be found with a perfectly symmetrical chest.

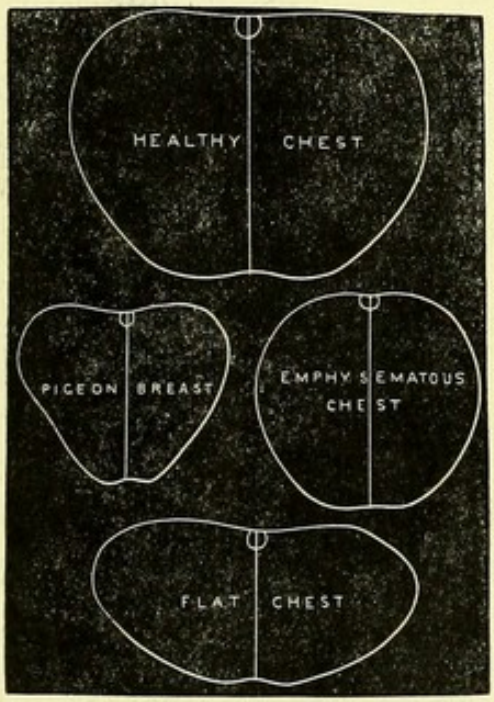


FIG. 3.—Transverse outline of chest (Thompson).

The movements of the chest are altered considerably, irrespective of pulmonary or cardiac disease. In health, the respiratory movements are readily accelerated by active exercise, and in hysterical patients they are nearly always rapid and superficial, being confined mostly to the upper part of the chest. In persons suffering from some diseases of the brain, the respiratory movements become slower and slower until they may not exceed three or four per minute. In hemiplegia the respiratory movements are incomplete or wanting, on the affected side of the chest.

Pregnancy, ascites, or large abdominal tumors, cause pressure on the diaphragm, and consequent interference with

respiration. The pain of peritonitis compels the patient to restrain the movements of the abdominal muscles, and thus confines the respiratory movements to the chest, and renders them deficient, and consequently more frequent.

Among the first signs which we will often notice on inspecting a patient with disease of the intra-thoracic organs are pallor, cyanosis, icterus, pityriasis, dropsy, and subcutaneous emphysema.

Pallor of the surface and emaciation are seen in chronic pulmonary disease. Pallor also results from fatty degeneration of the heart, and, in some cases, from mitral disease.

Cyanosis more or less marked indicates incomplete oxidation of the blood, due to obstruction of the air passages or to diminution of breathing surface; also to affections of the heart, such as congenital malformations or valvular disease. Occasionally this sign results from interference with the descent of the diaphragm by disease of the abdominal organs.

Icterus is found in bilious pneumonia and in the later stages of those cardiac diseases which cause congestion of the portal circulation.

Pityriasis is often found with phthisis pulmonalis, but it also occurs with other diseases, and sometimes even in apparently healthy individuals.

Dropsy due to recent *renal* disease usually shows itself first in the lower eyelids, and subsequently disappears from this locality, to appear in the lower limbs, and in the backs of the hands. Dropsy due to *cardiac* disease usually appears first over the instep, and gradually extends upward, involving the limbs, trunk, and serous cavities.

Subcutaneous emphysema may be caused by internal or external injuries of the larynx, of the trachea, or of the lungs. Air escaping from the larynx or the trachea causes emphysema in the region of the throat. Rupture of the air cells from overdistention, as in croup, diphtheritis of the larynx, whooping cough, bronchitis in children, and emphysema in the aged, causes subcutaneous emphysema, which appears first in the areolar tissue of the neck, and subsequently extends to the chest. The air in these cases finds its way into the mediastinum, and thence to the neck. Subcutaneous emphysema from external injury appears first on the chest.

Alterations in the form and in the movements of the chest may be most advantageously studied when grouped together as they occur in different thoracic diseases.

Pleurisy.—First, let us consider the modifications found in pleurisy. This disease is divided into three stages: first, a dry stage, in which the serous membrane at first becomes dry from diminution of its natural secretion, and subsequently becomes coated with exudation.

Second, a stage in which liquid effusion is found in the pleural sac; and third, the stage of resolution, during which the fluid is absorbed. In the first stage, the patient, if in bed, will usually be found resting upon the sound side.

In a few instances, especially with children, the patient's efforts to restrain the movements of the affected side of the chest give rise to temporary curvature of the spine towards the affected side

In this stage the respiratory movements are rapid, short and catching, as the result of the patient's efforts to restrain the movements, and thus avoid the pain incident to the friction of the inflamed pleuritic surfaces.

This sign, although nearly always present, is not diagnostic of pleurisy; for in intercostal neuralgia and in pleurodynia, you may find similar respiratory movements.

In the second stage, the decubitus will be upon the affected side. If there is a considerable amount of fluid, movements of the affected side will be diminished, and the intercostal depressions will be less marked than in health.

The impulse of the heart will be more or less displaced to the right or to the left, according as the left or the right pleura is distended. We notice also an apparent increase in the size of the affected side, but a quantity of fluid sufficient to dilate the side of the chest is exceptional in acute pleurisy.

In the third stage, the signs of the second stage gradually subside, the movements of the chest return, the intercostal spaces regain their natural appearance, and the heart gravitates to its normal position.

Sub-acute pleurisy is characterized by mildness of the symptoms and by the exudation of an excessive amount of serum. Its first stage is seldom observed. Subsequently, the signs are the same as those of acute pleurisy, with excessive exudation.

Chronic pleurisy is a term which is occasionally applied to the last-mentioned disease, but it is more generally used to designate that form of pleurisy known as empyema, in which there is a collection of pus in the pleural cavity. The signs of this variety, on inspection, do not differ from those already mentioned. In chronic pleurisy, particularly in the suppurative variety, the elasticity of the lung is impaired by long compression, so that it cannot regain its original volume when absorption or evacuation of the liquid takes place, and consequently contraction of the chest results. The affected side becomes flattened, especially at its lower part; and the shoulder is depressed. The nipple is also depressed, and is found nearer the median line than on the sound side; the inner border of the scapula projects like a wing, and the dimensions of the affected side are reduced. Often there is a lateral curvature of the spine, the convexity being directed toward the sound side, excepting in rare cases, when the convexity may be found in the opposite direction.

This phenomenon is due to the dorsal muscles of the sound side being no longer counterbalanced by those of the affected side. The latter soon become paralyzed from the persistent pressure. The ribs are drawn downward toward the pelvis, and the intercostal spaces are nearly or completely obliterated.

Respiratory movements of the affected side are limited in proportion to the deficient expansion of the lung.

LECTURE II.

INSPECTION CONTINUED—PALPATION, MENSURATION, AND SUCCUSSION.

In pulmonary emphysema, on first sight of the patient, we notice a dusky hue of the countenance, and often a sunken condition of the cheeks, with marked general emaciation and more or less turgescence of the superficial veins of the neck and upper extremities. There is elevation and drawing forward of the shoulders, with anterior curvature of the spine, giving the patient the stooping appearance of old age, though he may still be young. The nostrils dilate in inspiration, and there is a peculiar drawing downward of the corners of the mouth.

When we come to inspect the chest, a peculiar form, known as the "barrel-shaped chest," will generally be seen. In this condition, the antero-posterior diameter of the chest is increased (Fig. 3, page 11), its surface is rounded, and the upper anterior portion stands out considerably beyond its normal plane. Laterally, the diameter of the chest is diminished, and its inferior portion, in the region of the false ribs, is more or less retracted. The elevation and the drawing forward of the shoulders cause the neck to appear considerably shorter than usual. The scaleni and the sterno-cleido-mastoid muscles are hypertrophied and prominent, so that they stand out like tense cords. This results from the excessive inspiratory efforts, which call into greater activity the muscles which elevate and fix the anterior and upper part of the thorax.

The patient has comparatively little difficulty in inspiration, but, as has been aptly said, "His whole aim in life seems to be to get air out of his chest."

Inspiration is short and quick, but it is followed by prolonged and labored expiration. With the inspiratory movements of the chest, the anterior and superior portions are lifted as though they were composed of a single bone, and there is apparently no anterior or lateral expansion of the chest-walls,

because the ribs are already rotated as far as their articulation with the spinal column will permit. The ribs have less obliquity, and they form with the costal cartilages more obtuse angles than in the normal chest.

The intercostal spaces at the upper part of the chest are noticed to be much wider than usual, but at the lower, lateral portion of the chest, the ribs are closer together than in the normal condition, and thus the spaces between them are sometimes obliterated.

With inspiration, the movements of the lower part of the chest are reversed, so that instead of lateral expansion, there is, very generally, retraction of the inferior ribs, if the case is well marked. This falling in of the ribs and of the soft parts of the thoracic walls is not noticed if the disease is slight, but as the case progresses it may be seen: first, in the supra-clavicular and supra-sternal regions, then just below the clavicles and about the same time in the lower portion of the chest. Sometimes we meet with local emphysema, where a single lung or only one of its lobes is affected. In such instances, we notice local prominence, or bulging with loss of motion, in the corresponding portion of the thoracic walls.

In extreme emphysema, the anterior margin of the left lung overlaps the heart to such an extent that the apex cannot strike the chest-wall, and therefore no impulse can be seen. In milder cases, the impulse may be seen closer to the sternum than in health.

In Pneumonia, upon first glancing at the patient, we generally notice a dusky flush of the cheek and accelerated respiratory movements. Upon inspection of the chest, we will observe diminished motion over the diseased organ. This loss of motion may be marked, but it is seldom or never complete. Usually, these are the only signs which inspection furnishes in this disease.

In Pulmonary Phthisis, the signs obtained by inspection are of considerable value. If the case is advanced, the portion of the chest-wall covering the diseased lung will be found depressed, and its movements will be restricted. This depression and loss of movement in phthisis is more apt to occur at the apex, and, contrary to the general belief, it is quite as likely to be found upon the right as upon the left side. These phe-

nomena are due to local shrinkage and to loss of elasticity of the lung.

In Pneumothorax, in which condition the pleural sac is more or less filled with gas or air, the signs obtained by inspection are distention of the chest, proportionate to the tension of the air or gas in the pleural sac, and a corresponding loss of motion. If the amount of air or gas is small, the distention may scarcely be perceptible, and fair motion may remain; but when the sac is distended, the lower ribs do not move, the side is expanded to its utmost extent, and the intercostal spaces are prominent in the lower part of the chest, as in sub-acute pleurisy.

Exceptional.—In some rare cases of this disease, the upper portion of the affected side seems to move more than the corresponding part of the sound side.

This is due to the extreme efforts on inspiration by which the superior ribs are lifted directly upwards as in emphysema, though there is little or no anterior expansion.

Hydrothorax.—In hydrothorax we have a condition, on both sides, similar to that found in pleurisy with effusion upon one side. This gives rise to loss of motion and to more or less bulging of the infra-axillary regions.

Pericarditis.—In this affection, if the amount of effusion is sufficient, there is considerable bulging of the præcordial region, especially when the disease occurs in children; but in adults and older patients, on account of the firmness of the cartilages, this is not so likely to occur. There is also diminution of the respiratory movements on the left side, due to pressure from the distended pericardium.

Hypertrophy of the Heart.—This disease will also occasion local bulging, most marked in young patients. The impulse of the apex, if visible, will be seen to the left, and below its normal position. Its area will also be increased.

Tumors within the thoracic cavity will give rise to bulging as soon as they have attained sufficient size to press upon the parietes.

If the tumor happen to be aneurismal, or if it be solid and rests upon a large artery, it will be very likely to pulsate synchronously with the contraction of the heart. An enlarged liver or an enlarged spleen may occasion local bulging.

In cases of pneumothorax and pleurisy with great effusion, we obtain valuable information by examining the impulse

caused by the apex of the heart, which will be seen crowded from its normal position toward the unaffected side.

Membranous croup.—In membranous croup and in several other affections of the larynx or of the trachea, such, for example, as œdema glottidis, foreign bodies in the larynx or in the trachea, or morbid growths, the amount of air entering the lung at each inspiration is considerably less than normal. This has the effect of prolonging inspiration and of rendering it laborious, though expiration is not notably affected. In these affections the respiration is not quickened as in most pulmonary diseases, and it may be even slower than usual. The difficulty in respiration, in these cases, differs from that in emphysema in that here there is obstruction to inspiration, and in the latter the principal obstacle is in the way of expiration.

In all of these affections of the larynx and of the trachea, when the obstruction is considerable, we will observe sinking of the soft parts of the chest above the clavicle and in the intercostal spaces, especially at the lower part of the chest, during the inspiratory act. This is due to atmospheric pressure from without, as the chest-walls expand more rapidly than air can enter through the obstructed passage to fill the lungs.

Bronchitis.—In chronic bronchitis the signs obtained by inspection are of little value, though we may occasionally observe prolonged expiration, and in some instances, there is irregular expansion of the chest-walls, in different parts, due to plugging of the bronchial tubes by their secretions. Most cases of chronic bronchitis are associated with emphysema.

PALPATION.

This method consists of physical exploration by the sense of touch, either by the tips of the fingers or with the palms of the hands.

In practicing palpation upon the chest, the palmar surface of the hands should be used, and in many instances you will find it desirable to cross the hands so that, as you sit in front of the patient, your right hand rests upon his right side, and your left upon his left side.

If the signs to be obtained are only slight, you will thus appreciate them more clearly.

By the sense of touch, we are enabled to appreciate very slight alterations in the movements of the thoracic walls, and sometimes to detect intra-thoracic tumors which cause no bulging of the surface. By this method we determine the nature of tumors, whether they are hard or soft, solid or fluid, and whether or not they pulsate. By it, we differentiate between the pain found in three points along the course of the superficial nerves in intercostal neuralgia, and the pain found in the superficial muscles in pleurodynia, or deep-seated in pleurisy.

The information regarding size, form, and movements, which is obtainable by this method, is essentially the same as that furnished by inspection. If your hand is placed gently upon the chest of a healthy person while he is speaking, you will notice a peculiar trembling of the chest-wall which is known as the *normal vocal fremitus*. It is produced by the transmission to the chest-wall of the vibrations of air in the bronchi, caused by the act of speaking. Modifications of the vocal fremitus are among the most important signs which are obtained by this method.

The normal vocal fremitus varies in different individuals. It is not usually marked in women and children. In males it will be found more or less defined in proportion to the pitch or force of the voice. Voices of low pitch cause a more distinct fremitus than those which are higher. The distinctness of this sign will also depend upon the thickness of the chest-walls, upon the diameter of the bronchi conveying the vibrations to the chest-wall, upon the proximity of the bronchi to the parietes, and also upon the distance of the point examined from the larynx. It is, therefore, more marked upon the right than upon the left side, and in the infra-clavicular region than in the lower part of the chest.

In adult females, this sign may be obtained over the upper portion of the chest, but it is seldom found over the lower part. In males it is usually perceptible over the whole chest.

The normal vocal fremitus is altered by disease in its force, which may be increased or diminished; or the fremitus may be absent. As a rule, it is increased by all those diseases which cause consolidation of lung tissue. The most important of these are *phthisis*, *pneumonia*, *œdema*, and *apoplexy* of the lungs. The fremitus is generally increased by *dilatation of the bronchial*

tubes, in which there is more or less induration of the parenchyma of the lungs.

Exceptional.—There is an exception to this rule in pneumonia, when the bronchial tubes are completely filled by the inflammatory deposit. In such an instance the vocal fremitus would not be felt.

Owing to the great variation of this sign in different individuals, and to its mutations in disease without clearly-defined causes, it is not of very much value when taken alone.

The vocal fremitus is diminished or suppressed by any disease which separates the lung from the chest-wall, whether it be by the intervention of air, of gas, or of fluid between the pleural surfaces. In *pneumothorax*, in *hydrothorax*, and in *pleurisy* with effusion, absence of vocal fremitus over the air or the fluid is a sign of great value.

Exceptional.—Its presence is not always a certain sign that fluid does not exist, as shown by a few rare cases. If these diseases are only slight, so that there is but a small collection in the pleural sac, the vocal fremitus is simply diminished.

In the early stage of pleurisy, an exudation of lymph takes place upon the surface, which often becomes formed into new tissue, and remains after recovery. Although this separates the lung from the chest-wall, it does not materially alter the vocal fremitus.

Emphysema.—In emphysema the vocal fremitus is diminished.

Aneurismal or other intra-thoracic tumors cause a diminution or an absence of the vocal fremitus directly over them, providing no lung tissue intervenes between the tumor and the chest-wall.

The evidence derived from a study of the vocal fremitus is principally of value in differentiating between consolidation of lung tissue and fluid in the lower part of the chest. When the lung tissue is consolidated, the fremitus is increased. When there is a collection of fluid, it is absent. The exceptions to this rule are so few that they hardly need a thought.

Friction and Ronchial Fremitus.—Vibrations caused by rubbing together of the roughened surfaces of the pericardium or pleura, or by bubbling of air through fluid in the air-passages, may often be detected by palpation. Those produced within the pleural or the pericardial sacs are known as *friction fremitus*, and are indicative of inflammation of these membranes, with

exudation, which causes roughening of the surface. In acute or in chronic bronchitis, especially in children, when secretion is abundant, the chest-walls are thrown into vibration by air bubbling through fluid within the bronchi. These vibrations are termed the *ronchial or bronchial fremitus.* They communicate to the hand a distinct bubbling sensation, which cannot be mistaken.

Fluctuation of fluid within the pleural cavity may often be felt in the intercostal spaces by the fingers of one hand, while tapping at a little distance with the fingers of the other hand.

MENSURATION.

Mensuration, or measurement of the chest, is a method not ordinarily used, excepting when we wish to make a record of the case, as the signs which it furnishes can usually be obtained with sufficient accuracy and much more quickly by the two preceding methods. A great variety of instruments have been devised for determining the size and the capacity of the chest, as well as its degrees of curvature or of flatness. The only measurement which is of any special clinical value is that of the circumference, in inspiration and in expiration, which may be readily taken by means of a simple tape. A very good device for measuring the size of the chest consists of two tapes joined at their extremities and so padded near the line of junction as to form a sort of saddle, which rests upon the spinous processes and prevents slipping.

In using this instrument, adjust the pads to the spine, and carry the tapes about the chest on both sides, to the median line in front. The exact amount of motion of the two sides may be easily ascertained in this manner.

In measuring with a single tape, the best method is to place your thumb nail at a certain point on the tape, with the first finger about one fourth of an inch nearer its end. Then press the tape with the thumb nail against the middle of a spinous process and press the forefinger down beside it. This will enable you to hold the tape firmly in position, and by preventing the skin from sliding in respiration, will give you a fixed point from which to measure.

It is always desirable to mark the median line in front before commencing this measurement. The circumference of the

chest may be taken above or below the nipples, but the best place is on a level with the sixth costo-sternal articulation. In recording cases, you should always note the level of the measurement.

The measurement should be taken both during full inspiration and during forced expiration, and the two should be compared to determine the full amount of expansion. The two sides must be compared to ascertain whether either is distended or more or less deficient in movement. Doctors Quain and Carroll invented very satisfactory instruments for taking these measurements, known as stethometers. Dr. Quain's instrument (Fig. 4) consists of a cylindrical box with a dial and an index, which is moved by a rack to which is attached a cord long enough to compass the chest. Each rotation of the index about the dial indicates one inch of movement. In using it, the box is placed upon the centre of the chest in front, and the string is carried horizontally around the chest; then, as the patient inspires and expires, the index will revolve about the dial, registering minutely and accurately the expansion of the chest-walls. Dr. Carroll's stethometer is simple and exact (Fig. 5). Ordinarily, the physician may as well use the simple tape.

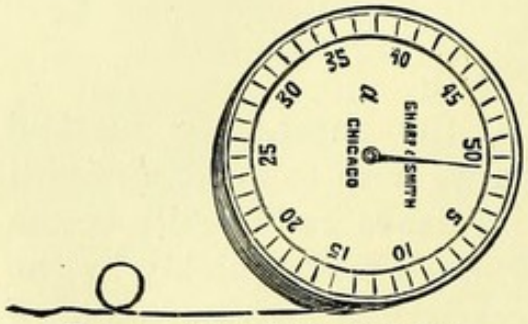


FIG. 4.—Quain's Stethometer.

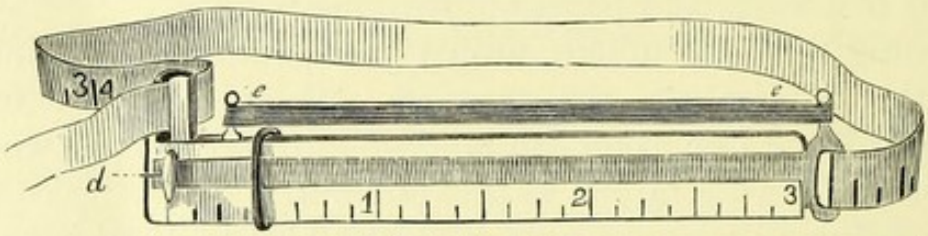


FIG. 5.—Carroll's Stethometer.

The measurements of the healthy chest, of course, vary in different individuals. The average is thirty-two and one half inches. Generally, the right side exceeds the left by half an inch, but in left-handed persons the left side is usually the larger.

In disease, the affected side may be distended or contracted, and its movements may be diminished or increased. These conditions are usually noticeable on inspection and by palpation, but they may be more accurately determined by mensuration.

It is not uncommon to find, upon mensuration, that a side which had the appearance of distention is smaller than its fellow; and frequently expansion, which has seemed comparatively free, by the tape will be found not to exceed one eighth of an inch.

The diseases causing expansion or contraction, and loss of movements of the chest-walls, were mentioned in speaking of inspection.

The transverse diameter of the chest may be obtained by means of a pair of calipers, or by Prof. Flint's cyrtometer (Fig. 6).

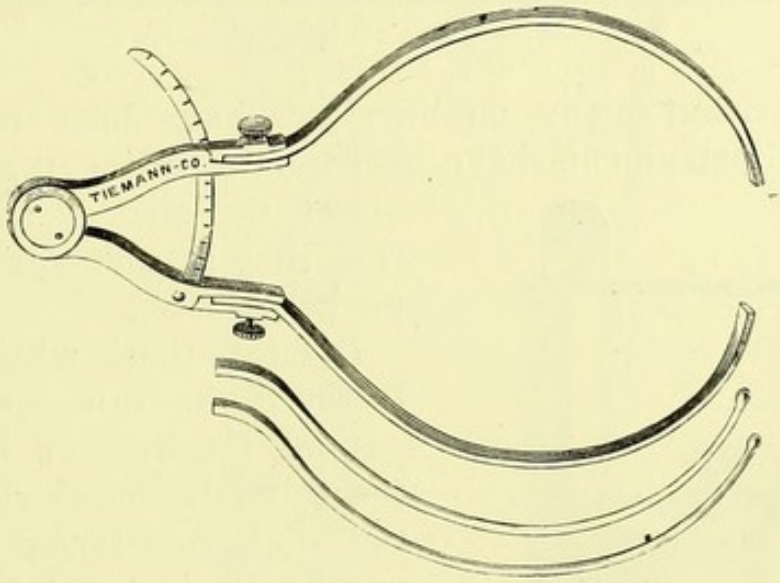


FIG. 6.—Cyrtometer.

Dr. Gee's cyrtometer, which consists of two pieces of composition gas pipe joined together by means of a piece of rubber tubing, is the cheapest, and perhaps the best instrument for ascertaining the transverse outline of the chest. In using it, the joint is placed upon the spine, and the pieces of pipe are accurately moulded round the chest. The instrument is then removed and laid on paper, when an exact tracing can be made. In a well-formed chest, the antero-posterior diameter between the spine and the sternum, will be to the transverse diameter, in males, as three to four, in females, as four to five (Fig. 3, page 11). Dr. Allison invented an instrument, known as a stethogoniometer, for measuring the curves or the flatness of the surface of the chest (Fig. 7). It has been claimed by some physicians, that the infra-clavicular space should always be convex in healthy persons. With this instrument the curvatures could be accurately ascertained, but unfortunately, the information is of very little value, because, in healthy individuals, this region is often flat or even concave.

Spirometers are used for measuring the capacity of the chest. Dr. Hutchinson was, I think, the inventor of the

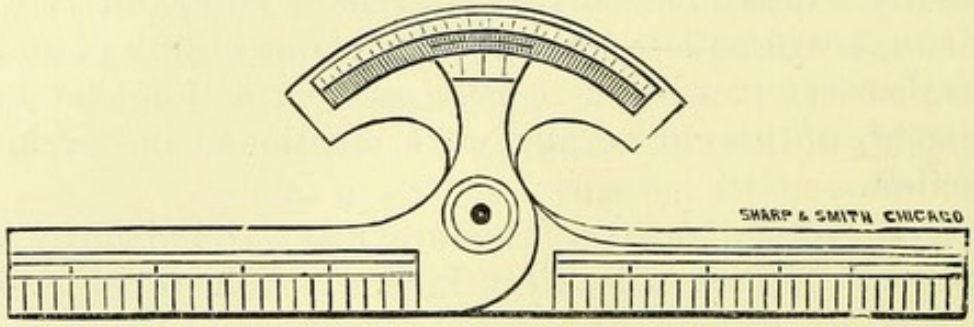


FIG. 7.—Allison's Stethogoniometer.

spirometer, but many modifications have been made since. Recently instruments have been made for the same purpose about the size of a watch, so that they may be carried in the pocket.

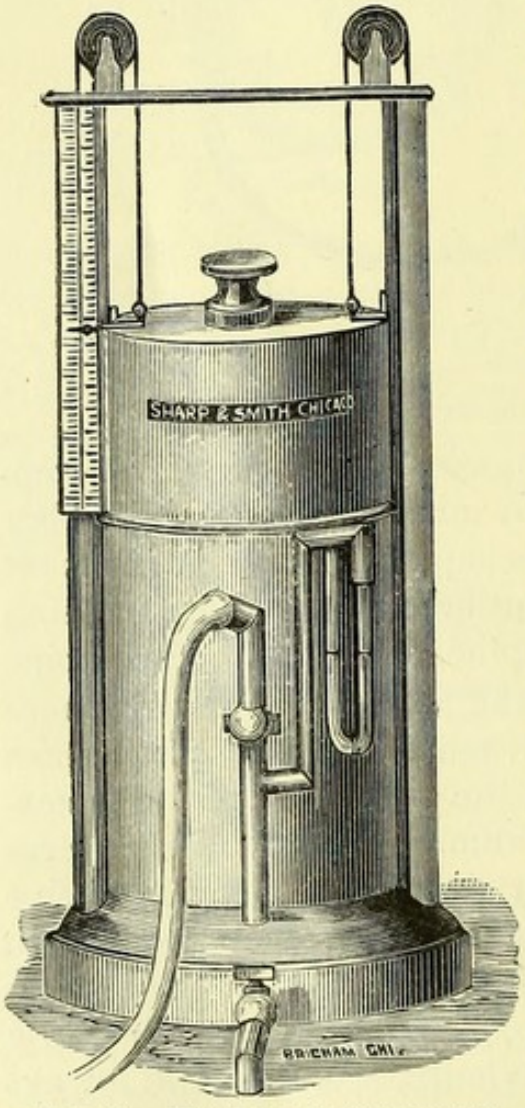


FIG. 8.—Hutchinson's Spirometer.

In one of these, which is manufactured in this city, as the patient inspires, or blows into the tube, the index revolves on the dial, registering the exact number of cubic inches of air which have been inhaled or expired. Another instrument, devised by the same party, consists of a rubber sac and a graduated tape for measuring its circumference when inflated. In using this, the patient inflates the sac as fully as possible with one expiration, and then measures its circumference with the tape, which is so graduated as to indicate the number of cubic inches of air which the sac contains. The instruments of this kind which I have seen, easily get out of order.

Dr. Hutchinson found that people five feet in height, usually possess a vital capacity of one hundred and seventy-four cubic

inches, and for every inch above five feet, eight inches should be added to the healthy standard. There are many obstacles to the use of this method which render it practically useless. For

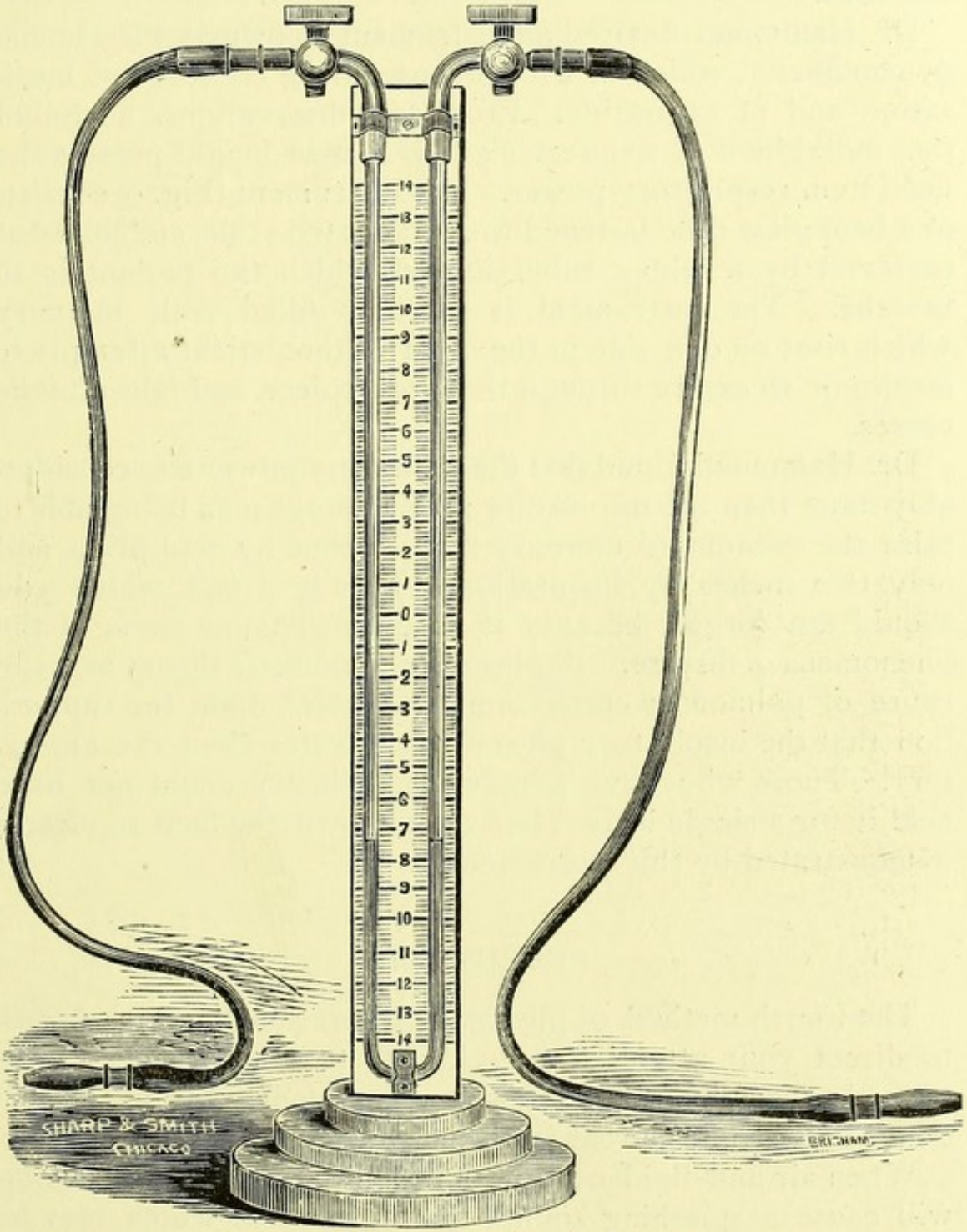


FIG. 9.—Hammond's Hæmadynamometer.

instance, it takes most persons a long time to learn how to blow into one of these instruments. A patient may at one time expire only one hundred and fifty cubic inches, and at another time, without any change in his health, the instrument might

register two hundred cubic inches. Again females and males, the young and the old, all have different vital capacities, and it has never yet been possible to arrive at an accurate healthy standard.

Dr. Hammond devised an instrument known as the Hæmadynamometer, which he used for measuring the force of inspiration and of expiration. From his observations, he found that individuals of five feet eight inches in height possess the maximum respiratory power. His instrument (Fig. 9) consists of a bent glass tube fastened to a graduated scale, and joined at each end by a rubber tube, through which the patient is to breathe. The instrument is partially filled with mercury which rises on one side or the other as the patient attempts to inspire or to expire through the mouth-piece, and falls after he ceases.

Dr. Hammond found that the expiratory power was considerably more than the inspiratory ; the average man being able to raise the column of mercury three inches by expiration, and only two inches by inspiration. This is a fact which you should not forget, because it at once explains some of the phenomena of disease. For instance, Laennec's theory as to the cause of pulmonary emphysema was based upon the supposition that the inspiratory power was greater than the expiratory. Those who have adopted this theory could not have held it for a single instant had they known the facts so clearly demonstrated by this instrument.

SUCCUSSION.

The fourth method of physical exploration to which I wish to direct your attention was known to Hippocrates. It is termed succussion. This consists of suddenly shaking the patient's body while the ear is placed against his chest.

When air and fluid occupy the pleural sac, this proceeding will cause a splashing sound, similar to that which may be heard by shaking a bottle partially filled with fluid. The sign is of value in the single disease, pneumo-hydrothorax (Fig. 22, page 98). The succussion sound will vary more or less in quality with the density of the fluid. Thick pus will not yield the same sound as thin serum, but the quality of these

sounds is not usually sufficiently distinctive to aid us materially in our diagnosis.

Metallic tinkling, due to dropping of fluid from the upper part of the cavity into the effusion below, can usually be heard when the succussion signs are present (Fig. 22, page 98).

LECTURE III.

PERCUSSION.

Percussion is the art of eliciting sound by striking with the fingers, or with instruments constructed for the purpose.

As a means of diagnosis, it is generally supposed to have originated during the last century with Avenbrugger, a physician of Vienna, but the works of Hippocrates indicate that he was familiar with it, to a limited extent.

The method recommended by Hippocrates, and which was practiced by Avenbrugger, was that which is now known as *immediate* percussion, in which the blow is struck directly upon the chest-wall.

This form of percussion has been nearly supplanted by one which originated about fifty years ago, with M. Piorry, termed *mediate* percussion, in which the blow is received on some in-

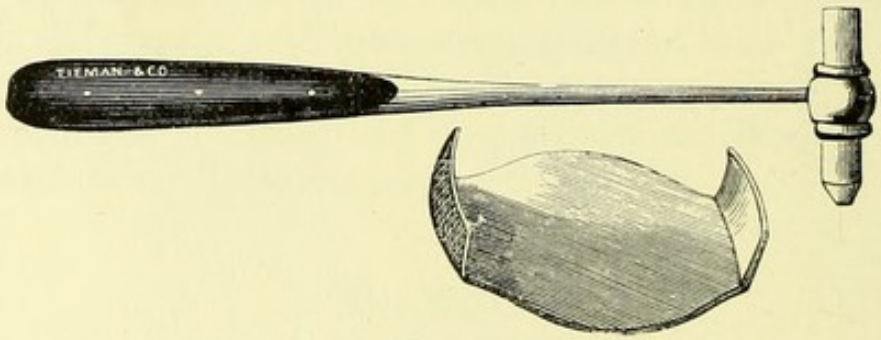


FIG. 10.—Flint's Hammer and Pleximeter.

tervening substance. Before mediate percussion was employed, it was quite essential to intensify the sounds in some way; this was accomplished by placing the patient with his back against a hollow wall. In some females the signs elicited by immediate percussion are quite distinct over the upper part of the chest, but usually this method is very unsatisfactory. In the method now most commonly practiced, known as mediate percussion, certain instruments are used, consisting of a small hammer or plexor, and an instrument known as a pleximeter or plessimeter.

The hammers in common use consist of a cylindrical rubber

head attached to a light handle about eight inches in length. Metallic hammers faced with rubber are sometimes employed, but they are objectionable on account of their weight, which renders the blow so forcible that it is likely to cause pain. Pleximeters are made of various materials, as rubber, bone, wood, ivory, and leather. Some of them are graduated on the surface, in order that they may be used in mensuration.

The one which I think the best consists of a narrow oval disk of hard-rubber, with large ears at each extremity. The instrument should be narrow in order that it may be placed between the ribs, and it should have a large projecting piece at each end, so that it may be firmly grasped. I have used considerably as a pleximeter a small cylinder of soft rubber about two inches long and half an inch in diameter. It has the advantage over most pleximeters of being easily adapted to the intercostal spaces, and of emitting no sounds of its own when struck. For ordinary percussion you will do better to throw aside these instruments entirely, using the middle or index finger of the left hand in place of the pleximeter, and two or three fingers of the right hand, with their tips brought into line, as a hammer. The fingers of the right hand should be brought as nearly to a right angle at the second joint as can be, so that the terminal phalanges may strike vertically upon the finger of the left hand.

There is a certain sense of resistance noticeable when percussion is performed with the fingers, which is entirely lost if we employ instruments. Often this sense of resistance would enable us to detect changes in the intra-thoracic organs, even if our ears were completely stopped. This is so valuable in intricate cases that, when I have any difficulty in making an accurate diagnosis, I always employ the fingers instead of instruments.

The sounds obtained by percussion are generally described as clear, dull, and tympanitic, but these terms are not sufficiently precise to aid you much in studying the method. I prefer a classification of these sounds, based upon their acoustic properties. The elements of sound which concern us in percussion are intensity, pitch, quality, and duration.

INTENSITY.—The intensity of a sound is the element which determines the distance at which the sound may be heard.

Other things being equal, the intensity of a sound in pulmonary percussion varies with the force of the blow, the volume of air in the lung, and with the thickness and the elasticity of the chest-walls. It is diminished by thick layers of fat or muscle, by rigidity of the costal cartilages, and by contraction or consolidation of the lung, and it is increased by the opposite conditions.

PITCH.—The pitch of a percussion sound is subject to the same variations as the pitch of musical notes; that is, it may be high or low. Any one familiar with music will understand this, but it is a common mistake to confound pitch with intensity. Many students suppose that the higher the pitch of a sound, the greater will be its intensity. The reverse of this is usually true in pulmonary percussion, intense sounds being low pitched, and high-pitched sounds possessing feeble intensity.

Any of you can recognize this difference between pitch and intensity, by striking two notes at opposite ends of the keyboard of a piano. By striking a high note forcibly you will obtain a sound loud enough to be heard some distance, then by gently tapping a key at the other end, you will obtain a sound which can be heard at exactly the same distance, but which is of a much lower pitch.

The pitch of the percussion note over a healthy lung is always low, but it will vary in different portions of the chest, owing to the difference in the volume of air and to the position of other intra-thoracic organs.

QUALITY.—The quality of sound is that element by which we distinguish between the tones of musical instruments, and by which we distinguish the voices of different individuals, which may have the same intensity and the same pitch.

In pulmonary percussion, we obtain a peculiar quality which is termed vesicular. Language cannot describe it, but it may always be obtained by percussing the healthy chest. This sound is soft and low in pitch, and usually seems as though it came from a point a couple of inches beneath the surface. You can learn it only by studying the healthy chest.

DURATION.—The duration of the healthy percussion note is dependent upon the same causes as its pitch. If its pitch is high, the duration is short; if the pitch is low, the duration is prolonged. Indeed we find a definite relation existing between

all of these different elements; that is, sounds which are intense are apt to be low pitched; sounds which are feeble are generally short and high pitched, and instead of the vesicular quality, they possess a solid character.

Percussion seems very simple as you see it practiced by an adept, but you will find that accuracy is not acquired without much practice.

There are certain rules which it is essential to follow for accurate percussion. In order that you may the more readily become skilful, I wish to fix them in your minds.

First. Have regard to the covering of the patient's chest. The surface should be bare, but if for any reason this cannot be secured, have the covering soft, thin, and smooth. It is absolutely useless to percuss the chest of a patient who has on one or two shirts, and perhaps a chest protector and corsets.

Second. The patient should be in a comfortable position, whether sitting, standing, or lying upon the back, and the two sides must be in corresponding positions.

Third. You must not allow the patient to twist the body or to move the arms, while percussion is being made, because such motions will change the relations of the muscles, and thus alter the percussion note. Your own position should be easy and unrestrained, or you will not recognize slight differences in sound.

Fourth. It is quite important that the physician should be squarely in front of the patient. If he stand partially to one side, the signs obtained on that side, even though they may be the same as those on the other side, will reach the ear with a different tone.

Fifth. In percussing any particular region of the chest, you should aim to have the chest-walls as thin and as tense as possible. To secure this when examining the anterior portions of the chest, the arms should hang at the side and the shoulders should be thrown backward. In examining the lateral regions, it is a good plan to have the hands rested upon the head. If the arms are held up, the muscles stand out so prominently that they interfere with obtaining the pulmonary resonance. In percussing the posterior regions, the trunk should be bent forward and the arms crossed in front.

The patient may be sitting, standing, or recumbent. The

first two positions are preferable, but I would advise you not to have very sick patients rise for the examination; it will be better to make a less critical examination than to endanger your patient. I have seen a vigorous man, suffering from pneumonia, fall dead, simply from getting quickly out of bed. Persons suffering from diseases which cause feebleness of heart, should not be asked to sit or to stand. I recently saw the necessity of caution in these cases illustrated in a little patient convalescing from diphtheria. The child had no symptoms of paralysis, but when she got out of bed and stood for a minute or two, the heart stopped, simply because it was overtaxed.

Sixth. In percussing the chest, we must compare corresponding portions of the two sides. If changes from the normal condition are slight, they can be detected in no other way. The percussion sound varies slightly at different periods of the act of respiration. Therefore, whenever the changes are so slight as to require great care for their discrimination, the sides should be compared during the same stage of the respiratory act. Ordinarily it is sufficient to repeat a series of strokes first on one side, then on the other, or to percuss both sides repeatedly in quick succession. The best period at which to make the comparison is at the close of a forced expiration.

Exceptional.—In health the two sides are not always equally affected as regards the disparity between the note elicited in full inspiration and that elicited in forced expiration.

Seventh. In applying the finger or the plexímeter, be careful that it presses evenly upon the surface and displaces all the air from beneath it. Otherwise, in percussing, the resonance of the plexímeter is obtained instead of that from the chest, and at the same time the air is suddenly forced out, causing a sound very similar to that known as "cracked-pot" resonance.

Eighth. The force of the stroke should be moderate; and alike on both sides. It should never be great enough to cause the patient pain. In percussing the superficial portions of the lung, the stroke should be very gentle, but it must be more forcible to obtain the resonance from deeper parts. Beginners commonly strike much too hard.

The stroke should be from the wrist alone, whether made with the hammer or with the finger. When striking from the elbow, we cannot control the force of the blow. Some diag-

nosticians are accustomed to strike slowly, with a single blow, first upon one side, then upon the other; but I think we get better results by making three or four taps in rapid succession.

The direction of the stroke is a matter of considerable importance. It should always be perpendicular to the surface of the chest. If we percuss obliquely, instead of obtaining the resonance from the lung immediately beneath the plexímeter, we get that from a rib or from more distant tissue.

In percussing near the sternum, in the upper portion of the chest, we obtain resonance from the trachea instead of from the lung tissue, unless care be taken to direct the blow toward the central portion of the apex.

Ninth. The stroke should be a simple tap, the finger or hammer being allowed to rebound instantly, instead of resting on the plexímeter a moment after the blow has been given. Allowing the fingers or the hammer to rest a moment on the plexímeter, has an effect on the pulmonary resonance similar to that produced by touching one of the prongs of a vibrating tuning fork. In percussing with the fingers, be careful to strike with their tips, instead of with the pulps.

As the signs in a healthy chest vary in its different regions, you must take special pains to familiarize yourselves with all the healthy sounds. There are no two healthy people whose chests are exactly alike, therefore you can take no one person as a standard for comparison, but after percussing many healthy chests, you may form for yourselves an ideal standard from which no great variation can occur without indicating disease.

In health the most perfect vesicular resonance is obtained in the left infra-clavicular region, and this, being the sound obtained over the parenchyma of the lung or air vesicles, is taken as the standard for comparison in pulmonary percussion. It is named normal vesicular resonance.

In the right infra-clavicular region the percussion note is nearly the same, but it is slightly harder or more tubular in quality owing, probably, to the greater size of the bronchial tubes.

In the middle of the supra-clavicular region, the resonance is soft or vesicular in quality, but as we approach the inner part of this region, it becomes harder in quality or tubular, and higher in pitch. Dr. Flint calls this an approach to tympanitic

resonance. Externally in this region the vesicular quality is diminished. In percussing over the central portion of the clavicular region, the sound is fairly vesicular, but it becomes less and less so as we approach either end of the clavicle.

In the mammary regions the sounds are altered on one side by the presence of the heart, and on the other side by the presence of the liver (Fig. 1, page 3). In the upper part of the right mammary region, we obtain vesicular resonance which extends down to the line of hepatic dulness in the fourth interspace. Below this, on forcible percussion, dulness is appreciable which gradually becomes more and more distinct until we reach the lower border of the lung at the sixth rib. This point is known as the line of hepatic flatness; below which we lose all pulmonary resonance.

The lines of hepatic *dulness* and of hepatic *flatness*, the first at the uppermost part of the liver, and the second at the lower margin of the lung, are ordinarily about two inches apart.

Exceptional.—In deep inspiration the lower line may be carried an inch and a half or two inches lower, and in forcible expiration it may be elevated from one to five inches, therefore the area of hepatic dulness, between the two lines, may vary from two inches to seven or eight inches. This wide range is not common, but its occasional occurrence forcibly illustrates the necessity for studying the chest both in inspiration and in expiration.

In the left mammary region pulmonary resonance is obtained over the outer part. Near the middle portion of the region forcible percussion elicits cardiac dulness. Near the sternum the heart is superficial, covered only by the pericardium and by cellular tissue; here there is a small, flat, triangular space about an inch and a half in width at its base, which corresponds to the sixth rib, and extending from the fourth to the sixth costal cartilage. The apex of this triangle is located at the margin of the sternum on a level with the fourth rib. This space is caused by the receding border of the left lung, which leaves the median line near the fourth rib and passes obliquely downward and outward to a point corresponding nearly to the junction of the sixth costal cartilage with its rib.

The resonance of the mammary region is modified more or less by the thickness of the muscles in males, and by the mammary glands in females.

In the infra-mammary region, on the right side, there are no

organs but the liver, and hence we have resonance, termed flatness, like that obtained by percussing on the thigh. If the colon happens to be distended by gas, we will obtain tympanitic resonance in the lower part of this region.

In the infra-mammary region of the left side we will find flatness extending a couple of inches to the left of the median line, caused by the left lobe of the liver. In the outer portion of this region we will obtain a similar sound from the spleen, and between these two points we elicit tympanitic resonance from the stomach.

In the upper sternal region, as low as the level of the second costal cartilages, the sound is tubular, or according to Flint, tympanitic. This is due to the presence of the trachea, the sounds of which are modified by the anterior borders of the lungs which are in apposition throughout this region. Below the second ribs, on light percussion, pulmonary resonance may be obtained, though modified by the timbre of the bone. But on deep percussion dulness is found, resulting from the presence of the great blood-vessels.

Over the lower portion of the sternum—lower sternal region—by light percussion pulmonary resonance will be obtained to the right of the median line, while on forcible percussion there is dulness. Left of the median line, the heart is superficial and yields flatness. At the inferior portion of this region, flatness is due to the left lobe of the liver.

Over the scapula, the vesicular sound is indistinct, owing to the thickness of the muscular tissue, but above the spine of the scapula, it is much more marked than below, and in the upper part of this region it is quite clear.

Between the scapulæ, in the inter-scapular regions, the sounds are quite hard and high-pitched, because the chest-walls are thick. There is, however, in all cases a little pulmonary resonance. The note is a trifle higher on the left side, on account of the aorta.

In the infra-scapular regions the vesicular resonance is well defined, though not quite so clear as in the infra-clavicular region. It extends downward to the tenth or eleventh rib. On the right side, we find the line of hepatic dulness at the eighth rib, and the line of hepatic flatness at the eleventh rib; but

these vary from one to two inches during forcible respiration (Fig. 2, page 4).

On the left side, the resonance is slightly modified near the spine, by the presence of the liver. Below the tenth rib, the intestinal canal, if filled with gas, causes a tympanitic sound. In the outer part of this region, between the ninth and the eleventh ribs, dulness is obtained from the presence of the spleen, and for a short distance about this dull region the resonance is rendered more or less tympanitic by the stomach and the intestines. In the lower part of the left infra-scapular region, close to the spinal column, dulness is found over the kidney, and in a similar position, though a trifle lower, it occurs on the right side.

In the axillary regions, the resonance is often more marked than in the infra-clavicular regions. These regions contain vesicular lung tissue, with the main bronchi.

In the infra-axillary region, the resonance is modified on the right side by the liver, and upon the left by the stomach and spleen.

In this region, the margin of the lung passes obliquely downward and backward from the anterior portion near the sixth rib, to the posterior border near the tenth rib. On the right side, hepatic flatness is found below this line, and hepatic dulness a couple of inches higher. On the left side, below this line we find tympanitic resonance in front over the stomach, and dulness posteriorly over the spleen. The pulmonary resonance is often modified by the stomach, in this region, as high as the fourth rib.

The spleen varies considerably in its size, even in health. The area of dulness which it causes seldom exceeds two and one half inches in height; laterally it extends about four inches, about half of which dull space is in the infra-scapular and half in the infra-axillary region.

Exceptional —In rare cases the spleen rises as high as the lower portion of the axillary region, or the stomach may yield decided tympanitic resonance as high as the fourth rib.

In the infra-scapular region, upon the right side in children, dulness is sometimes very pronounced, due to the disproportionate size of the liver in early life. This is not infrequently mistaken for the consolidation of pneumonia.

The percussion sounds in different regions of the chest are

modified by age, sex, and by various idiosyncrasies. In old age, the chest-walls are not so elastic as in middle life, and the lung tissue has undergone some change which renders the sounds harder in quality and higher in pitch, or, in other words, less vesicular. In children, the lungs are very resonant, and the costal cartilages are elastic; consequently we obtain a low-pitched, intense, vesicular sound. In males, the percussion note over the upper portion of the chest is not usually so resonant as in females, but it is more distinct over the lower portions. It will be seen, from what has already been said, that there is notable dissimilarity of the percussion sounds on the two sides in the mammary regions, as also in the infra-mammary, infra-axillary, and infra-scapular regions. In all other portions of the chest, the resonance is nearly identical on the two sides, but the slight normal disparity in the infra-clavicular regions is a point of great importance.

LECTURE IV.

PERCUSSION IN DISEASE.

In disease, the percussion sounds of which I have been speaking, may pass through every gradation from normal to tympanitic resonance. These varieties of the percussion sound have been variously classified by different authors. Dr. R. E. Thompson classifies them as clear, dull, tympanitic, amphoric, and "cracked-pot" resonance. Dr. Flint arranges them under six heads; and Dr. Loomis, under seven, as follows: Exaggerated pulmonary resonance, dulness, flatness, tympanitic resonance, vesiculo-tympanitic resonance, amphoric resonance, and "cracked-pot" resonance, or the cracked-metal sound.

EXAGGERATED PULMONARY RESONANCE differs from the normal vesicular sound only in its intensity. The pitch and quality of the sound are exactly the same as in health, but the intensity is increased. This sound is obtained over lung-tissue which is receiving more than the ordinary amount of air, and which might therefore be said to be in the highest degree of health.

The sign is, therefore, only negative, as it points to no disease whatever in the place where it is obtained, but rather it points to deficient action in some other portion of the respiratory tract. Exaggerated pulmonary resonance, obtained in the adult, is very nearly the same as the normal resonance in children. The sign results from obstruction to the entrance of air into some portion of the respiratory tract, whether from filling up of the air-cells by inflammatory exudation, as in pneumonia; or from narrowing of the bronchial tubes; or from collapse of the air-cells. Pneumonia of one lung or of a single lobe of a lung, causes exaggerated resonance over healthy portions of the lungs. Compression of the lung, whether it be by air or by fluid in the pleural sac, will give rise to exaggerated resonance on the sound side. If the main bronchus is occluded,

whether it be from causes within the bronchus or from causes external to it, the resonance is exaggerated on the opposite side. In extreme anæmia, we get exaggerated resonance on both sides, which is said to be due to a diminished amount of blood in the pulmonary circuit. As the chest is practically a cavity with unyielding walls, any diminution in its fluid contents must cause a corresponding increase in the amount of air.

DULNESS indicates that there is a small amount of air beneath the part percussed. It can always be obtained in the healthy chest where the lung overlaps the liver. This sign differs from normal vesicular resonance in pitch, quality, and duration. Its pitch is high, its quality hard, and its duration comparatively short. The intensity of the sound is usually less than that of the vesicular resonance. Varying degrees of dulness should be carefully studied on the healthy chest. Over the liver, on forcible percussion, slight dulness is found in the fourth intercostal space, and as the examination is extended downward, the sign becomes more and more distinct, becoming gradually higher in pitch, harder in quality, and shorter in duration, until the lower margin of the lung is reached.

This sign, when obtained in a position which should yield vesicular resonance, indicates that something has occurred to diminish the normal amount of air in that portion of the lung. It is a sign that is obtained when there is *consolidation of the lung*, whether it be from simple inflammation or from phthisis, from compression of the lung or from collapse of the air-cells. Dulness is also obtained over *collections of fluid* in the bronchi or in the air vesicles, as in pulmonary œdema and hemorrhage; also over *moderate exudations* in the pleural sac, which separate the lung from the chest-walls; but effusions of any considerable amount give rise to another sign, known as flatness. Dulness is obtained over *intra-thoracic tumors*, whether solid or fluid, provided only a small portion of lung tissue intervenes between them and the thoracic wall. This is, therefore, one of the signs which can be found in *pneumonia*, *pleuritis*, *phthisis*, *atelectasis*, and in *intra-thoracic abscesses*, *aneurisms*, *and other tumors*.

Exceptional.—It results occasionally from pulmonary apoplexy. In such cases it is usually found at the lower angle of the scapula. It may arise from brown induration of the lung, due to a varicose condition of the pulmonary veins. In this disease it is found near the middle of the lungs on both sides. It may arise from enlarged

bronchial glands; and in a few instances this sign is found in bronchitis over the apex of the lungs; or more marked dulness may be found at the lower posterior part of the chest, due to a collection, within the bronchi, of the secretions from the mucous membrane.

FLATNESS.—Dulness differs from flatness in that it still retains something of the vesicular resonance. Flatness has no pulmonary resonance. The one indicates that there is some air beneath the point at which the stroke is made, the other that there is none. Dulness is obtained over that portion of the liver which is overlapped by lung tissue; flatness, from that portion below the sixth rib, which is superficial. Dulness is obtained in pleurisy where the exudation of inflammatory lymph has separated the lung a short distance from the chest-wall and caused a corresponding diminution in the volume of air. Flatness will be found in the same disease, when an effusion of serum lifts the lung above it and consequently removes all of the air-containing tissue from beneath the point percussed.

Flatness is found in *pleurisy* with effusion oftener than in any other disease.

Exceptional.—In a few rare cases of pneumonia, the inflammation runs to such height that not only the air cells, but also the bronchial tubes are filled with the exudation, and in such cases absolute flatness will be found over the lung tissue. Again, when the lung becomes completely collapsed from pressure, or obstruction of a large bronchus, flatness results.

Tumors or abscesses within the thorax, when they rest against the chest-walls, cause flatness.

TYMPANITIC RESONANCE is the name given to the sound which may be normally obtained over the stomach or the intestines when filled with air or gas.

Under certain conditions, this sign is met with over the thorax. Tympanitic resonance is usually described as of higher pitch than the vesicular sound. Its duration may be longer or shorter, and its quality is hollow, conveying the idea of more or less tension; it is also somewhat hard, metallic, and ringing. We find conflicting statements, by different authors, concerning the pitch of this sign. Some hold that it is high, others that it is low-pitched. The disparity seems due to a difference in the musical sense or training of various observers; musicians would doubtless have no difficulty in deciding. It seems to me that the discrepancy has arisen from mistaking

the ringing, hollow quality of the sound for a high pitch, when it may really be low. I find the weight of opinion in favor of a high pitch. Dr. R. E. Thompson, in his little work on the physical examination of the chest, states that the pitch of this sign may be either high or low; high when the tension of the volume of air is great, and low when it is slight.

This variety of resonance is never found in the healthy chest, unless it be transmitted from some of the organs beneath the diaphragm; but it is frequently obtained in normal conditions of the thoracic organs, below the fourth rib, on the left side, as the result of distention of the stomach or the intestines with gas. It is occasionally obtained over the infra-mammary region on the right side when the colon is distended. When it is obtained over portions of the chest which should yield a vesicular sound, the sign is usually indicative of a collection of air or of gas in the pleural sac, as in pneumothorax. Occasionally it is found over a large cavity in the lung tissue containing air.

Pulmonary cavities are generally produced by phthisis; therefore we lay down as a rule, that there are only two diseases of the chest in which this sign is found, viz., pneumothorax and phthisis.

Exceptional.—It is claimed by Guttman, Gee, and some others that this variety of resonance sometimes results from diminished tension of the pulmonary parenchyma, and that it may be found in any of those conditions causing partial collapse of the lung.

Perfect tympanitic resonance may be obtained in that very rare condition in which air or gas collects in the pericardium. It is said to be found in some cases of emphysema and of acute tuberculosis.

Tympanitic resonance from the stomach may be elicited far above its normal seat, when the lung is retracted and the stomach and intestines are correspondingly elevated.

VESICULO-TYMPANITIC RESONANCE is a quality of sound midway between the vesicular and the tympanitic.

This sign occurs in extreme emphysema, where the air-cells and the chest-walls are distended.

AMPHORIC RESONANCE is a sound which may be closely imitated by tapping the cheek gently when the mouth is filled with air, but not much distended. The sound is hollow, and somewhat metallic. It is obtained in very much the same conditions as "cracked-pot" resonance—that is, over an empty pulmonary cavity with yielding walls; but to produce this

sign the cavity must communicate freely with a large bronchial tube, so that the air can be driven quickly from it by the percussion stroke. It is found also over collections of air in the pleural sac, when this cavity opens through the lung into a large bronchus.

Pulmonary cavities are generally caused by phthisis, but they may result from abscess. Amphoric resonance is therefore a sign of *pneumothorax*, *phthisis*, and possibly of *abscess* or of *gangrene*.

Bell Sound. While listening over a large pulmonary cavity, if percussion be made on the opposite side of the chest, with one large coin striking upon another used as a pleximeter, a ringing bell sound will be heard, which is sometimes very loud.

Cracked-pot Resonance (*bruit de pot fêle*).—This sign may be imitated by placing the hands loosely together, palm upon palm, and striking upon the knee. It is described as resembling the clinking of coin or the *timbre* of a cracked metallic kettle. Generally the sign seems to be the result of forcing air suddenly from a pulmonary cavity through a *small* opening. This sound has been considered, by some authors, as diagnostic of a pulmonary cavity; but this is a mistake, for the sign may occasionally be obtained when no cavity exists, and sometimes even in healthy individuals. Something closely resembling this resonance is very likely to be heard during percussion if the pleximeter is placed lightly against the surface, so that air remains beneath it which is suddenly forced out by the blow.

It is said that occasionally this sound may be elicited in the bronchitis of children, or just above the level of the fluid in pleurisy with effusion.

As a rule, cracked-pot resonance is a sign of a cavity, but the majority of cavities do not produce it. The sign, where found, can seldom be heard more than two or three times together, and it requires an interval of rest before it can be reproduced. This is probably due to the small opening into the cavity—the air, having been driven out, returns slowly.

THE PLESSIGRAPH.

Before leaving the subject of percussion, I wish to call your attention to a little instrument known as the plessigraph, which was devised by Dr. Michael Peter, of Paris. In per-

cussion with the ordinary pleximeter, no matter what its material or its form of construction, all the tissue beneath it is thrown into vibration. This renders it next to impossible to define sharply the outlines of dulness when solid tissue is overlapped by the lung, because the pleximeter covers too much space, and the sounds from the tissues containing air and from those which do not are blended. For instance, in attempting to determine the lower border of the lung, where it overlaps the liver, we commence above and percuss downwards till we get complete flatness, then upwards again to a point where the vesicular resonance is clear, and thus back and forth, until two adjacent points are reached where we obtain on the one hand quite perfect pulmonary resonance, and on the other, flatness. Then we judge that the border of the lung lies midway between the two.

To avoid throwing too much tissue into vibration, the size of the pleximeter must be abridged; but as the size is diminished, unless compensated for in some way, the intensity of the sound is correspondingly lessened. These difficulties seem to have been overcome in the construction of the plessigraph.

This instrument consists of a small cylindrical piece of wood, about four inches in length, and five eighths of an inch in diameter, with a disk at one end upon which percussion is to be made. The other end consists of a truncated cone, the plane surface of which measures nearly an eighth of an inch in diameter. In using the instrument, the small end is placed on the surface of the chest, and percussion is made upon the other end, with the pulp of a single finger. Care must be taken that the instrument is held perpendicular to the surface. On account of the smallness of the surface which rests against the chest, the sound obtained would be very feeble, were it not in a measure intensified by the body of the instrument, which acts as a sounding-board. Trousseau tells us that it is not necessary to strike upon the disk, but that we may simply tap upon it with the pulp of the finger. He states that, by means of this instrument, even students may rapidly map out the liver or heart, when with ordinary percussion this might be impossible, even for a skilled diagnostician. The instrument as constructed by Dr. Peter, had upon the side an arrangement holding a crayon which could be pressed down to mark the skin when

the border of the lung had been found, so that, when through percussing, a dotted line would be left corresponding to the outlines of the solid viscus or tumor. I have found this instrument very satisfactory in determining superficial dulness, so long as it is employed only in the intercostal spaces, but not when applied over the ribs.

AUSCULTATORY PERCUSSION.

This method of percussion was instituted by Drs. Camman and Clark in 1840. It consists, as the name implies, of combined auscultation and percussion. In practicing it, a stethoscope is needed. For this purpose the originators of the method devised a peculiar instrument, which consists of a solid cylinder of wood formed at one end into a truncated wedge, and at the other into a disk (Fig. 11). In using the instrument, the wedge-shaped extremity is placed upon the surface, in an intercostal space, over the most superficial portion of the organ or tumor to be examined, and the examiner's ear is placed upon the disk. An assistant is then directed to percuss from the healthy lung tissue toward the instrument. The moment percussion is made over solid tissue, the changed sound will at once reveal the fact to the listener, and thus enable him to determine the deep outlines of the solid mass much more accurately than by ordinary percussion. The ordinary binaural stethoscope with the smaller chest-piece may be used for the same purpose. The advantages claimed for this method of examination are, that it enables persons to map out intrathoracic tumors or to determine the outlines of the heart or of the liver much more accurately and rapidly than by other means. Outlines of the liver, the spleen, and the kidney may be ascertained with considerable accuracy, even when ascites is present.



FIG. 11.—Camman's Stethoscope for Auscultatory Percussion.

One serious obstacle has been found to the practice of this method, namely, a second person is necessary to make the percussion, and it is often impossible to get a skilled assistant at the time we need one. To overcome this difficulty, I have devised an instrument known as the Emballometer (Fig. 12). It

consists of a hollow cylinder about three inches in length by five eighths of an inch in diameter, within which plays a metallic plunger. To the objective end of the instrument is fitted a soft-rubber chest-piece, against which the plunger strikes. To the other end is attached a rubber tube about eighteen inches in length, which connects it with a rubber bulb. Compression of the rubber bulb drives the plunger against the chest-piece; at the instant the pressure is removed, the bulb expands and the plunger is forced upward by atmospheric pressure. In practicing auscultatory percussion by the aid of this instrument,

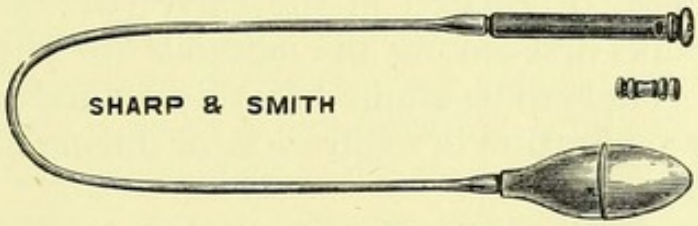


FIG. 12.—Ingals' Emballometer.

the stethoscope is held with the left hand; the bulb of the emballometer is held in the palm of the right hand by the last three fingers, and the cylinder is held by the thumb and forefinger. This enables the physician to move the instrument without restraint, to strike any point as rapidly or as slowly as he chooses, and with whatever force may be desirable. You will observe that I can strike with great rapidity if I desire, and that I can give a light tap or a blow which may be heard all over this amphitheatre. By means of this little instrument and the binaural stethoscope, auscultatory percussion can be satisfactorily practiced without the aid of an assistant. In using the binaural stethoscope for this purpose, the small chest-piece should be employed, and probably one still smaller or one flattened, so that it might be applied between the ribs, would give even better results.

LECTURE V.

AUSCULTATION.

Auscultation, or the art of listening to the sounds produced within the chest, originated in the early part of the present century; it ranks first among the methods for physical exploration. The sounds to be studied by this method are produced during either inspiration or expiration, or during both portions of the respiratory act.

There are two methods of auscultation, known as mediate and immediate. In mediate auscultation, the sounds are conducted to the ear through an instrument known as the stethoscope. Immediate auscultation is practiced by placing the ear directly on the surface of the chest, or on the chest but slightly covered. The first of these methods is the one which was first introduced to the profession in the year eighteen hundred and sixteen. In this connection, a brief notice of Laennec, the inventor, may be interesting. He was born in an obscure province in France, and at the age of nineteen went to Paris to obtain his medical education, where he very soon attracted the attention of the profession by his diligence and attentiveness at the hospitals. These studious habits ere-long opened places which enabled him to prosecute his investigations with vigor and success.

From the time that he entered Paris until his final departure, about five years before his death, his whole life seems to have been given to careful clinical study, and verification of the results in the necropsy theatre. The fruit of this labor we find in papers written by him, on inflammation, melanosis, encephaloid cancer, and numerous other topics, but especially in the great work of his life, his treatise on auscultation. This treatise was published in 1816, when the author was about thirty-five years of age. It was the introduction of auscultation to the profession, and its author was so thorough and his conclu-

sions so accurate, that since his day it has been hardly possible to add to the information upon this subject which he gathered and bequeathed to us. Not long after he published this work, close application began to undermine his health, and in a few years the very method which he had introduced disclosed the signs of phthisis in his own chest. Realizing fully the importance of these signs, he resigned his work in Paris and retired to his native province, where he died at the age of forty-five, leaving a name which will be remembered when most of those now prominent have sunk into oblivion. Since his death, the method known as immediate auscultation, which Laennec states was first practiced by Boyle, has received great favor with the profession. At the present time, many physicians consider this the only proper method of auscultation, while there are a few others who rely entirely upon the mediate method. Whatever the advantages of either may be, you must become familiar with both if you wish to be accurate diagnosticians.

There are some objections to the use of the stethoscope. The first and main objection is, that it has a peculiar ringing sound, which is always confusing to beginners. Until you become sufficiently familiar with the instrument to ignore this, you will be unable to appreciate the pulmonary sounds. Another prominent objection is that many of these instruments are poorly constructed, and are consequently worthless. The stethoscope is of very little value in examining children, because it is likely to frighten them; besides, the respiratory murmur in them is so loud that it can be easily heard with the unaided ear.

In examining the lungs, the ear alone is sufficient; but when we wish to differentiate between the sounds produced at the various orifices of the heart, we must employ the stethoscope, the small chest-piece of which excludes in a great measure all sounds excepting those produced immediately beneath it.

Some of the advantages of mediate auscultation are: it greatly intensifies the intra-thoracic sounds, so that signs which could not be heard at all by the unaided ear, may be readily recognized through the instrument; some portions of the chest cannot be easily examined by immediate auscultation—for instance, in the axillary space and in the region just above the clavicle; therefore, the instrument becomes necessary; again, there are

instances where it would be unpleasant to apply the ear to the chest, and others where, for the sake of delicacy, it would not be advisable.

The advantages claimed for immediate auscultation are: it yields no humming sound; it obviates the necessity of carrying an instrument; it does not frighten little children, and the results obtained are usually sufficiently accurate.

If the stethoscope moves slightly upon the chest, it produces a grating sound much more intense than the respiratory murmur. The same thing occurs if the finger moves upon the instrument, if the hand is drawn over the surface of the chest, or if the patient's clothes move upon the chest or upon the instrument. In some cases, neither mediate nor immediate auscultation alone yields accurate results, while the two combined enable us to make a proper diagnosis.

There is now a great variety of stethoscopes. They may be classified, however, under two heads, solid and flexible some of which are binaural and others single. The binaural



FIG. 13.—Solid wooden stethoscope.

instrument is provided with two tubes which conduct the sound simultaneously to both ears. The single stethoscope is designed only for one ear. The solid stethoscope most in use is a tubular instrument, about six inches in length, which is generally turned from a single block of wood. It is expanded at one end into a bell-shaped chest-piece about an inch and a fourth in diameter. At the other extremity is a disk or ear-piece about two inches in diameter (Fig. 13). Some of these instruments are so made that the ear-piece may be removed for convenience in carrying, and have a soft-rubber ring encircling the disk, so that it may be used as a hammer in percussion. I think physicians generally find more difficulty in examining the chest with this instrument than with the binaural stethoscope. A binaural stethoscope was devised by Dr. Leared, of London, about the time the one in common use was invented by Dr. Camman, of New York. Dr. Leared's

stethoscope was made of gutta-percha and consisted of two tubes, one for each ear. The auricular extremities of these tubes were disk-shaped, and the other ends were fitted in a hollow cylindric, or cup-shaped, chest-piece. The elasticity of the tubes kept the disks in firm apposition with the ears. This instrument was exhibited in London in the year eighteen hundred and fifty-one, but it attracted little attention. About the same time Dr. Camman, of New York, introduced the binaural instrument that bears his name. This consists of two metal tubes so curved as to fit into both ears and connected with each other by a hinge-joint. These, when placed in the ears, are held in position by an elastic which passes from one to the other just above the joint, or by springs of various contrivance.

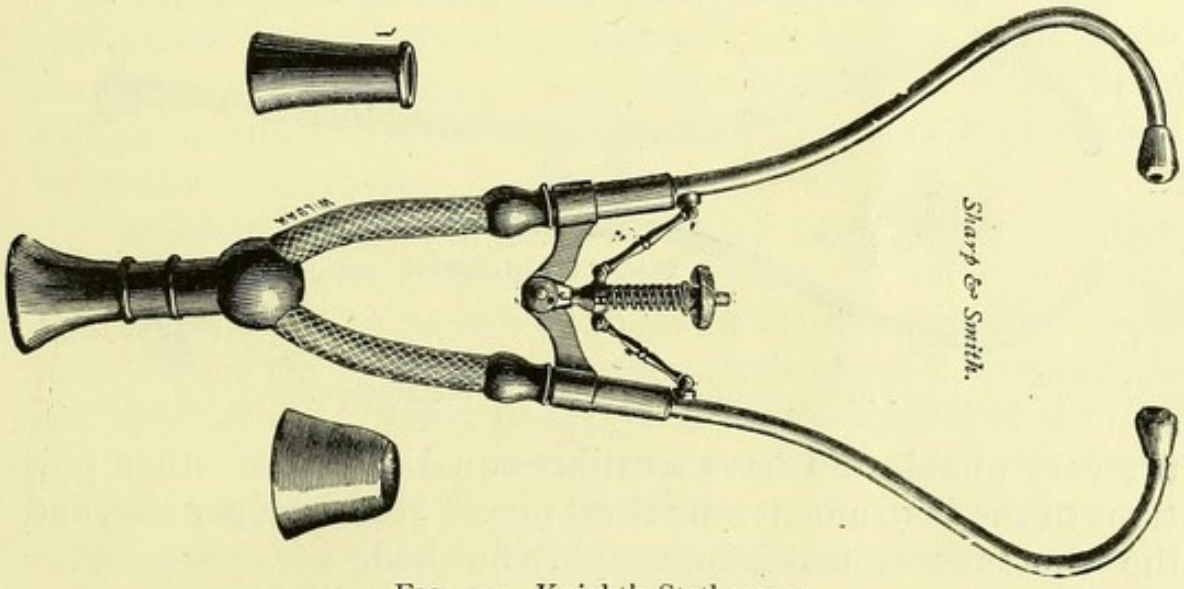


FIG. 14.—Knight's Stethoscope.

The auricular ends of these tubes are tipped with gutta-percha or ivory, of sufficient size to close the external meatus, and prevent the entrance of external sounds. To the other ends are fitted two flexible tubes which connect them with the body of the instrument to which the chest-piece is attached (Fig. 14). Each of these instruments has two chest-pieces, one about an inch and a quarter in diameter, for examination of the lungs, the other five eighths of an inch in diameter, for the examination of the heart. With many instruments a soft-rubber chest-piece is furnished which may be fitted over the end of the smaller of these, and is designed for the examination of emaciated patients. This chest-piece, however, is practically worthless on account of the creaking which is produced during the respiratory move-

ments, by friction with the wooden chest-piece on which it is adjusted. An instrument known as the differential stethoscope was invented by Dr. Scott Allison. It is essentially the same as Camman's, with the exception that the flexible tubes are each fitted with a distinct chest-piece, so that sound can be conducted to the two ears simultaneously from different portions of the chest (Fig. 15). Of the various modifications of Camman's stethoscope, the one known as Knight's is the best. It possesses all of the essential points of a good instrument, viz., the metallic ear-tubes are curved at the proper angle to conduct the sound directly into the auditory canal; the ear-tips are of proper size to exclude external sounds and are not so small as to pass into the auditory canal and thus occasion pain; the flexible tubes which connect the ear-pieces with the chest-piece

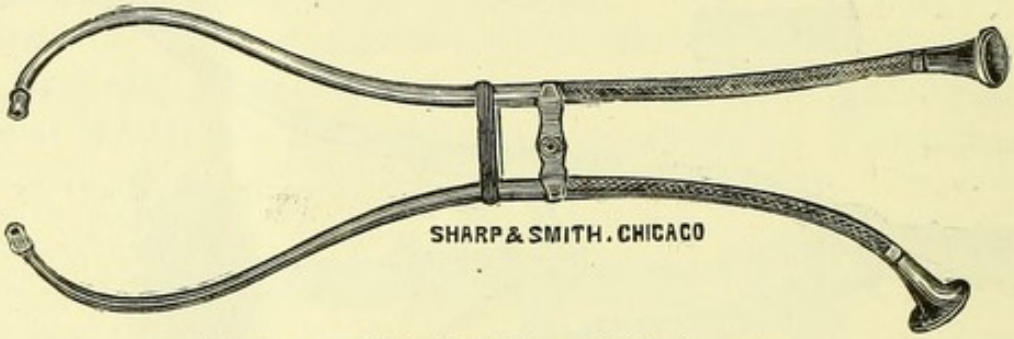


FIG. 15.—Allison's Differential Stethoscope.

are very pliable and have a calibre equal to that of other portions of the instrument; the chest-pieces are of proper size, and the whole instrument is thoroughly finished.

I have found that a stethoscope which will fit one person perfectly and allow the sounds to be conducted without obstruction into the auditory canal, with another may rest against the external ear in such a position as nearly to occlude the orifice of the ear-piece. The larger chest-piece ought never to exceed one and one fourth inches in diameter. If larger than this, it cannot be accurately applied to an emaciated patient; consequently air will pass beneath it, and produce a humming sound, which will drown the pulmonary signs. The apparatus on Knight's stethoscope for adjusting the pressure of the ear-pieces works perfectly, and is often very useful, though a simple rubber band of proper strength would answer the purpose, if only one person were using the instrument. A rubber band, which could be lengthened or shortened by

a buckle, would allow the instrument to be easily adjusted to any head, and would be less expensive.

Considerable practice is required in order to perform auscultation properly. That you may become expert the more readily, I wish to call your attention to a few rules.

In the first place, in mediate auscultation the chest must be bared; in immediate auscultation, the covering must be as soft, thin, and smooth as possible.

The position of both patient and examiner should be easy and unrestrained. If the patient is in bed, it is preferable to have him sitting, if his health will permit. If the examiner is in an uncomfortable position, he cannot properly concentrate his attention upon the sounds.

In examining a child, or a patient in bed, it is a good plan to rest on one knee, so that the head will not be on a plane lower than the body, otherwise the gravitation of blood to the brain will cause fulness of the head and dizziness, and will obtund the sense of hearing.

You must early learn to concentrate your whole attention on the sound to which you are listening.

It is desirable to have the room as quiet as possible, especially if you are practicing immediate auscultation, for then the ear which is not applied to the chest is waiting to catch every extraneous sound. In immediate auscultation it is well to stop the ear, which is not applied to the chest, with the finger.

The ear or the stethoscope should be applied firmly, but not with great force, to the surface, and in such manner that no air can pass beneath it.

Compare corresponding portions of the two sides with each other, during both natural and deep respirations. If one side is examined during ordinary or forcible respiration, the other must be examined under the same conditions.

The pulmonary sounds are not exactly alike in any two individuals, nor are they the same in different regions of the chest, in the same individual; therefore, it is necessary to study healthy cases carefully, in order to familiarize yourselves with all varieties of healthy sounds. This familiarity must be so perfect that no effort of the mind is required to remember the variations in different localities. I cannot urge this too forcibly, because, until you can easily recognize the healthy

sounds, it is absolutely useless for you to attempt to detect the signs of disease.

Physiological Action of the Respiratory Organs.

When the blood leaves the right side of the heart surcharged with carbonic acid and other debris of tissue metamorphosis throughout the body, it makes a peculiar impression upon the respiratory nerves, which is transmitted to the brain as a call for more oxygen. Instantly a message is flashed back to the inspiratory muscles over the nerves, which causes them to contract. By this action the diaphragm is shortened and its convexity is lessened; the ribs are lifted, and by rotation on their articulations with the spinal column they are at the same time carried forward and outward. Thus the diameters of the chest are increased in every direction, and the air rushing in through the open glottis distends the elastic lungs, so as to keep pace with the expansion of the chest. Immediately the respiratory act ceases, the muscles relax, the elastic tissue of the lung asserts itself, and the air is expelled from the pulmonary vesicles. This latter is a passive action, in which the expiratory muscles take little part, excepting in forcible expiration.

While inspiration is taking place, we hear a soft breezy or rustling sound, which is known as the inspiratory murmur. As soon as it ceases, a sound soft and breezy, but less intense and much shorter, occurs, which is the expiratory murmur. This is followed by a period of rest, which completes the cycle of respiration.

AUSCULTATION IN HEALTH.

A variety of signs may be obtained in the normal chest owing to the position of surrounding organs, and the difference in the force and volume of the current of air producing the sounds.

Auscultatory sounds are possessed of elements similar to those found in the percussion note, viz., intensity, pitch, quality, duration; and to these we will add rhythm. The latter refers to the relation which the different portions of the respiratory act bear to each other. The *intensity* of the sound varies in different people. The *pitch* and the *quality* are practically the same in all healthy cases.

The *duration* of the sound also varies in different cases, but is about equal to the duration of the respiratory act which produces it. All modifications of the respiratory murmur which may be obtained in different regions of the chest are simply alterations in one or more of these elements. Thus, in different portions of the respiratory tract, we will obtain the normal vesicular murmur, bronchial breathing, and tracheal and laryngeal respiration, each of which differs from the others more or less in intensity, pitch, quality, duration and rhythm. The most perfect vesicular murmur is obtained in the infra-clavicular and infra-scapular regions. Bronchial respiration, or more properly broncho-vesicular respiration, may be heard over the bronchial tubes, and for an inch or more about them in every direction, either upon the anterior or upon the posterior surface of the chest. Laryngeal and tracheal respiration are essentially the same. They are obtained over the larynx and the trachea.

THE VESICULAR MURMUR, which is the sound obtained over the pulmonary parenchyma, is taken as the standard of comparison for all others. This sound may be best studied in the infra-scapular region, though it is more intense, in front, below the clavicle; but in the latter position the heart sounds interfere with its easy recognition. The vesicular murmur, like all other respiratory sounds, is possessed of two parts. The first of these, the inspiratory, begins as a soft and distant blowing sound, and gradually increases in intensity and approaches more nearly to the ear toward the end of the act, when it is breezy or rustling in character. It varies in intensity in different individuals, but it is generally easily heard. Its pitch is low, in duration it corresponds with the inspiratory act. Its quality is named vesicular, but cannot be accurately described, though it may be easily learned by practice upon a healthy chest. This sound is followed immediately by a gentle rustling sound, the expiratory murmur, which passes off gradually into a low breath or puff. It is less intense than the preceding, being usually so feeble that it must be listened for very attentively; it is of the same low pitch, and of about one fourth of the duration of the inspiratory sound. Though termed vesicular, its quality is neither strictly vesicular nor bronchial, but slightly blowing.

In listening to the respiration of muscular subjects, a continuous, low-pitched, superficial, rumbling murmur is heard where the muscles are thickest, which is due to the contraction of muscular fibre. In rare cases this is so marked as closely to resemble the vesicular murmur.

The normal vesicular murmur is modified in different regions of the chest, by the size of the bronchial tubes, and more or less by the thickness of the chest walls, and by the position of other organs. It is heard in perfection in the left infra-clavicular region. On the right side, the sound is more intense, and the expiratory sound is generally slightly prolonged; there may be a very slight interval between the inspiratory and the expiratory murmurs, and the quality of both is usually slightly tubular. This disparity is doubtless due to the direction and size of the right bronchus as compared with the left.

Over the upper portion of the sternum and the inner third of the infra-clavicular regions, the vesicular sounds are altered by the proximity of the trachea and of the large bronchial tubes, being somewhat tubular or broncho-vesicular in quality.

In the inter-scapular space, owing to the thickness of the chest-walls, the vesicular sounds are less distinctly heard; owing to the presence of the main bronchi they are more tubular in character, so that, in this position also, we find a sound which might properly be termed the broncho-vesicular murmur, but which is usually called normal bronchial breathing.

In the scapular regions, the thickness of the chest-walls renders the vesicular sound indistinct.

In children, the vesicular murmur is much more intense than in adults. Over the upper portion of the chest it is usually much more intense in the female than in the male. In the aged, it frequently loses something of its soft quality, and becomes slightly more tubular, and is altered in its rhythm, the expiratory sound being occasionally preceded by a short period of silence, and having a duration nearly or quite equal to the inspiratory murmur. This change in the aged seems due to partial atrophy of lung tissue and to changes in the elasticity of the chest-walls.

In extreme anæmia, the vesicular murmur is intensified over the entire chest.

Laryngeal and Tracheal Respiration.—Over the larynx

and the trachea the respiratory murmur is practically the same; it is known as laryngeal and tracheal respiration. This differs from the vesicular respiration in its intensity, pitch, quality, duration and rhythm. The inspiratory sound in these varieties of respiration is much more intense than the vesicular murmur, its pitch is higher, its quality tubular, and there is a marked interval between it and the expiratory sound.

The expiratory sound is generally found to be more intense than the inspiratory, and even higher in pitch. It has the same tubular quality, and about the same duration. To sum up these points of distinction, we find that these varieties of respiration differ from the vesicular in being more intense, higher pitched, and tubular in quality; in having an interval between the two portions of the act, and in the expiratory sound being of equal length with the inspiratory, or of greater duration.

Bronchial Respiration, or, perhaps more properly, broncho-vesicular respiration, is next in importance to the vesicular. It may always be found in the healthy chest, but it is only heard over a limited area, immediately over and surrounding the large bronchial tubes. I think the latter term more appropriate, as this combines both the bronchial and the vesicular varieties. True bronchial breathing is the same as tracheal, excepting that it is usually less intense. It is the sound which is obtained in pulmonary diseases where the air-vesicles are completely filled by inflammatory lymph or other products. Broncho-vesicular respiration holds a place midway between bronchial and vesicular, and is the sound which is obtained when only a portion of the air-vesicles are occluded.

The sound heard over the main bronchial tubes in the healthy chest is more intense than the vesicular murmur and its pitch is higher; its quality is a combination of the vesicular and tubular, and a slight interval may be noticed between inspiration and expiration. The expiratory sound is of nearly equal duration with the inspiratory.

You will at once perceive the necessity, of being able to recognize these normal sounds, and of knowing the localities in which they are obtained; for some of these when heard in abnormal positions, become the signs of grave diseases.

LECTURE VI.

AUSCULTATION IN DISEASE.

The auscultatory sounds are altered by disease, principally in their intensity, rhythm and quality.

The intensity may be increased, giving rise to what is known as exaggerated, compensatory or supplementary respiration. It may be diminished, and is then called feeble respiration; or the sounds may be entirely suppressed. The rhythm of the murmur may be interrupted. It is then termed, jerking, wavy, or cog-wheel respiration; and the interval between the two portions of the act may be lengthened, or the expiratory sound may be prolonged.

The quality of the sound may be rude, which is termed broncho-vesicular; it may be bronchial; it may be cavernous or amphoric.

EXAGGERATED RESPIRATION differs from the normal respiratory murmur in intensity and in duration, both the inspiratory and the expiratory sounds being intensified and somewhat prolonged. It is produced in lung tissue which is performing more than its ordinary function. When obtained over the chest of an adult, it closely resembles the natural sound in a child; therefore, it has been termed puerile respiration. It is also termed supplementary or compensatory respiration. Like exaggerated percussion resonance, it may be said to indicate the highest degree of health in the organs where it is produced; but it also points to disease of some other portion of the respiratory tract, and is therefore a valuable negative sign. The causes of this sign are found in any of those conditions which may interfere with the entrance of air into a portion of the respiratory organs, and thus occasion more activity in the remainder. Thus, when the *lung is partially consolidated or collapsed*, we get exaggerated respiration well marked in the sound portion of the affected organ, and more or less also on the sound side.

When the *lung is compressed* by air or fluid in the pleural sac, the respiration of the opposite side is exaggerated.

Diminution of the calibre of a bronchial tube, as by compression from aneurismal tumors or enlarged glands, thickening of its mucous membrane or contraction of its wall, and obstruction from the presence of fluid or other foreign substance in sufficient quantity to interfere materially with the transmission of air, will give rise to this sign in the portions of the lung not thus obstructed.

Œdema of the lungs may cause exaggerated respiration over their apices. In *hemiplegia*, the respiratory muscles on one side act imperfectly, and cause exaggerated respiration on the other side.

Feeble Respiration differs from the normal vesicular murmur in being less intense, and shorter in duration. The inspiratory part of the sound is most affected. The sign may be occasioned by anything which interferes with the perfect transmission of sounds to the surface, as thick chest-walls, whether due to muscular or to adipose tissue; it is also caused by small quantities of air, fluid, or inflammatory lymph in the pleural sac.

It may result from loss of elasticity of the lung tissue in consequence of dilatation of the air-vesicles, as in pulmonary *emphysema*, or from *tubercular or inflammatory consolidation* of the lung; also from deficient action of the respiratory muscles, occurring in cases of *paralysis;* or it may exist in *diseases of the abdominal* or *thoracic organs* which give rise to pain, and cause the patient to restrain the muscular movement.

Collections of *fluid or gas* in the pleural cavity, *tumors* in the chest, or in the abdomen—as a pregnant uterus—may interfere with the function of the lung, and prevent the descent of the diaphragm by mechanical pressure, thus causing feeble respiration.

Obstructions of the larynx, trachea, or bronchi have a similar effect on the vesicular murmur. This may be caused by collections of mucus, pus, blood or other fluid; by thickening of the mucous membrane; by the pressure of a tumor on a bronchial tube, or by contraction of its walls. It may also be due to foreign bodies in the air-passages; or to obstructions at the glottis, as for example, œdema, spasm, croupous or diphtheritic membranes, neoplasms and the like. More rarely it results

from paralysis of the dilators of the glottis. Bronchitis of the smaller tubes causes feeble respiration. The vesicular murmur is also diminished in spasmodic contraction of the muscular fibres of the bronchial tubes, as in asthma.

When this diminished murmur is found in the upper part of one lung it often indicates phthisis; if found over the lower part of the lung, it is very often an indication of pneumonia; found over the lower portion of both lungs, it may be indicative of œdema.

SUPPRESSED RESPIRATION is produced by the same causes which, occurring in a less degree, give rise to feeble respiration. This sign is often observed over the diseased portion of a lung, the remainder of which yields the exaggerated respiratory murmur. It results from perfect *occlusion of the air-passages* by fluid or foreign bodies within them, or by pressure from without, and from mechanical interference with the expansion of the lung, as in *pneumothorax* and in *hydrothorax*.

INTERRUPTED RESPIRATION, also known as *cog-wheel respiration*.—In this variety of respiration, either or both parts of the respiratory act may be broken into two or more parts, the sound being suddenly interrupted, to return again, and perhaps again and again, before a single respiration is complete. The interruption takes place most frequently with inspiration. The sign is found under a variety of circumstances, and not only in several diseases, but also in health, so that it is not of much importance, though it will sometimes help to confirm a diagnosis based on other evidence. It is sometimes noticed over the whole chest, and at other times it is confined to a limited space.

When occurring in health, it is often heard over the whole chest; but when resulting from pulmonary disease, it is more apt to be localized. In the incipiency of phthisis, this sign is frequently obtained directly over the diseased lung, especially when the lesions are situated in the left apex.

This sign may be produced by any disease which renders respiration painful, as *intercostal neuralgia*, *pleurisy*, and *rheumatism* of the thoracic-walls. It also occurs in nervous persons who are agitated by the examination, and is very apt to be found in *hysterical patients*. When due to nervousness or to pain, the sign will be found over the entire lung, or over both lungs.

As an indication of disease, interrupted respiration is a sign of very little value, excepting in the early stage of phthisis.*

INTERVAL PROLONGED.—The interval between inspiration and expiration may be prolonged by shortening of the inspiratory murmur, or by a delay in the commencement of the expiratory murmur.

Shortened Inspiration.—The inspiratory sound ceases before the act is complete, and is correspondingly shortened in partial consolidation of the lung due to *inflammatory or tubercular* deposits. It is deferred in its commencement after the inspiratory act begins, and thus is shortened where the air-vesicles are dilated.

Deferred Expiration.—The expiratory sound is delayed when the air-vesicles are distended by pulmonary *emphysema.*

PROLONGED EXPIRATION.—This results from a loss of elasticity of the lungs, either by consolidation or by detention.

When due to consolidation, a prolonged expiratory murmur is usually more intense than the normal sound. It is high-pitched and more or less tubular in quality, and usually possesses so much of the bronchial element as to be termed broncho-vesicular. The prolonged expiratory murmur which is sometimes found in healthy chests possesses the same pitch and quality as the normal vesicular sound, which enables us to distinguish it from the prolonged expiration of consolidation, in which the pitch is always high, and the quality somewhat tubular. We must not forget that in health the vesicular murmur over the right apex is more or less tubular, and high in pitch, and that the expiratory sound is prolonged, as compared with the left side. Therefore, in this position, the sign cannot always be considered as indicative of disease, unless it be taken in connection with other signs.

When obtained on the left side, abnormally prolonged expiration is nearly always due to phthisis or to emphysema. The difference in the two instances is, that in consumption the expiratory sound is high-pitched and more or less tubular in quality; while in emphysema, it is usually even more prolonged —it may be two or three times as long as the inspiratory murmur—and it has a low pitch, it is not tubular but rather vesicular

* In this condition the immediate cause of this sign seems to be forcible contraction of the heart, whereby an abnormal amount of blood is forced into the pulmonary circuit, thereby causing some narrowing of the calibre of the bronchial tubes.

in quality, and it is apt to be considerably less intense than the inspiratory sound.

Whenever the prolonged expiratory murmur is high in pitch and tubular in quality, it indicates consolidation of the pulmonary parenchyma. But the normal disparity between the two infra-clavicular regions must not be forgotten, for this character of respiration on the right side is not necessarily indicative of disease unless the inspiratory murmur, and other signs be altered.

Occasionally, prolonged expiration may be caused by interference with the free exit of air from the lungs, as obstruction in the larynx or in the bronchial tubes. In these cases, it is usually associated with a deferred inspiratory murmur, in which the sound does not begin with the inspiratory act.

Exceptional.—Prolonged expiration having the pitch and quality of the healthy murmur is obtained with cavernous respiration in rare cases. In such instances its significance is ascertained by the character of the inspiratory sound and by other signs.

RUDE RESPIRATION, *Broncho-vesicular or Harsh Respiration.* —This closely resembles the sound which can be obtained by listening directly over the bronchial tubes in a healthy chest.

The respiratory sound is raised in pitch in proportion as the tubular supplants its vesicular quality. The expiratory sound is always higher in pitch than the inspiratory, its quality is more or less tubular, and it is prolonged. The extent of the alteration in pitch and in duration is in proportion to the preponderance of the tubular over the vesicular quality.

Disease may furnish all degrees of broncho-vesicular respiration according to the amount of consolidation, from the *normal vesicular murmur* to perfect *bronchial breathing.*

This sign is due to the better transmission of the vibrations from the larynx, trachea, and bronchial tubes to the surface of the chest, in consequence of the consolidation of the air-vesicles, which makes the parenchyma a better conductor of sound-waves, and renders the bronchial tubes more rigid, so that they transmit these waves from the upper air-passages with less resistance.

The sign is obtained in *incipient phthisis* over the upper part of the lung, and in *pneumonia,* usually over the lower lobe. It is also heard in some cases of *pulmonary apoplexy,* and over a lung which has been pressed upon for a considerable time by *fluid or air in the pleural sac;* or over a lung a portion of whose air-vesicles have collapsed from any cause.

It is most valuable as a sign of incipient phthisis.

Exceptional.—In cases where broncho-vesicular respiration occurs, either the inspiratory or expiratory murmur may be absent; then, as in similar instances of bronchial respiration, its detection will depend on the pitch and quality of the sounds which are present, and upon concomitant signs.

BRONCHIAL RESPIRATION is one of the most important varieties of the healthy sounds, which may sometimes be indicative of disease. Its quality and its other elements are almost exactly the same as those of normal tracheal respiration. The intensity of this sound is usually greater by far than that of the vesicular murmur, but sometimes it is very feeble; the pitch is high, the quality tubular, and the duration both of inspiration and expiration is prolonged and the two are of about equal length. There is an appreciable interval between the inspiratory and expiratory sounds.

Exceptional.—In this variety of respiration, either portion of the respiratory murmur may sometimes be absent.

Laennec taught that the bronchial sound was always produced in a healthy chest, but that it was not usually heard because of the intervention of air vesicles between the tubes and the chest-walls. When obtained in disease, he considered the sign due simply to the better transmission of the sounds to the surface. Skoda believed that consolidation of the air-vesicles surrounding the bronchus was necessary for the production of the perfect sign. Whichever of these views is correct, or whether both are in part true, matters little to us, so long as we know that the sign always indicates consolidation of lung tissue (Fig. 23, page 121). The tubular sounds in this variety of the respiratory murmur are transmitted for a considerable distance beyond the consolidated lung, which accounts for the fact that the bronchial and the vesicular elements are frequently combined in the regions immediately surrounding that which yields simply bronchial respiration. The greater intensity of the expiratory sound in bronchial respiration accounts for the fact that occasionally we obtain a vesicular inspiratory, and a bronchial expiratory sound; as the intensity of the bronchial sound drowns the vesicular, in expiration.

Bronchial respiration is found in greatest perfection, in *pneumonia*, over the consolidated lung. It is obtained also in some cases of *phthisis;* but in this affection we are more apt to hear broncho-vesicular respiration.

Exceptional.—In rare cases cancer of the lung yields bronchial breathing. Pulmonary apoplexy sometimes causes the sign; and it is heard over the entire chest, though more distant than in consolidation, in a few cases of pleurisy with extensive effusion.

CAVERNOUS RESPIRATION has been likened to both bronchial and vesicular. We are told by one author that it closely resembles the former, and by another that great care is necessary to distinguish it from the latter. This discrepancy is doubtless due to confusion in the application of the term to different signs. Prof. Flint has made the distinction clear by introducing another term, viz., broncho-cavernous, to designate those sounds which, although conveying the idea of a cavity to the listener, do not correspond with true cavernous respiration, which latter does not resemble bronchial breathing. The intensity of cavernous respiration is usually feeble, so that unless searched for carefully, it will be overlooked. The pitch is low; and the quality, instead of being vesicular or tubular, is soft and blowing or puffing. The expiratory portion of the sound is prolonged to about the same length as the inspiratory, and is even lower in pitch than the latter. The failure of some diagnosticians to appreciate the quality of this sound has caused them to deny its existence. I am satisfied that the true cavernous murmur, as just described, can be heard occasionally, but I think it a very rare sign. This sign is produced in empty pulmonary cavities, the walls of which are so flaccid that they expand readily in inspiration and collapse in expiration (Fig. 16). It is a sign, therefore, of any of those diseases which might cause such a cavity, viz., consumption, pulmonary abscess, or gangrene of the lung.

Broncho-cavernous respiration is made up of both the bronchial and the cavernous sounds. It is usually described as cavernous, but it is higher in pitch and more tubular in quality than the latter.

This sound occupies a position midway between bronchial and cavernous. Its quality is not sufficiently tubular to be called bronchial, nor yet sufficiently soft and puffing to be termed cavernous. It is produced in pulmonary cavities, surrounded by lung tissue more or less consolidated; the tubular element being dependent upon the amount of consolidation. Sometimes the first part of the inspiratory murmur may be

tubular in quality and the last part cavernous; and again we may obtain cavernous inspiration with bronchial expiration, due to the presence of consolidated lung tissue near the cavity. In the latter case, the intense expiratory bronchial murmur doubtless drowns the cavernous sound, which was heard with the feebler inspiratory murmur.

Broncho-cavernous respiration is the characteristic sign of the latter stages of *consumption*, but is also produced in the cavities due to *abscess* or to *gangrene*.

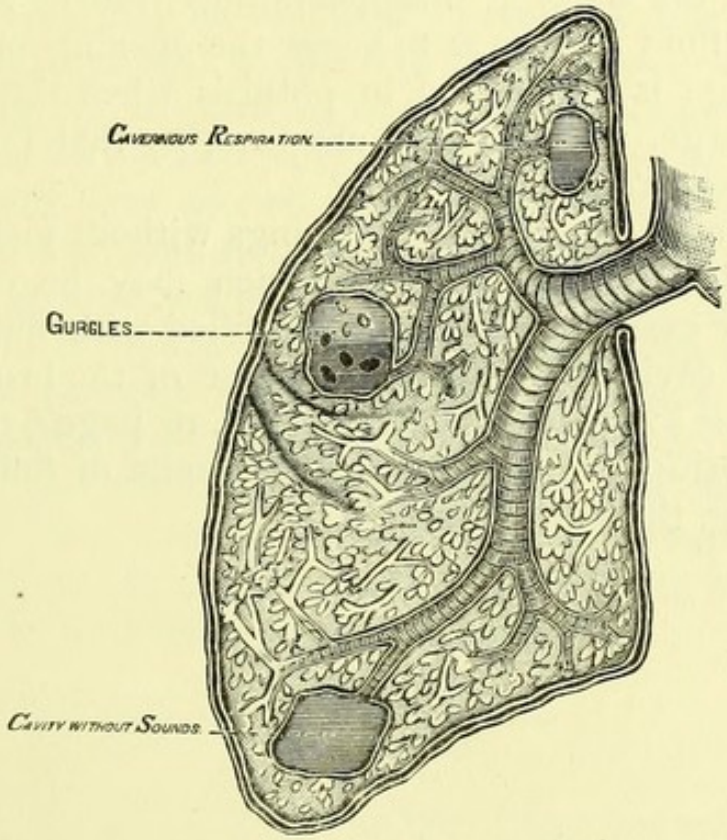


Fig. 16.—Phthisis.

Amphoric Respiration is a sound resembling that produced by blowing into the mouth of an empty bottle, hence the name. It is of a metallic musical quality, and may be heard during either inspiration or expiration, or during both portions of the respiratory act, but it is generally most marked in expiration. The expiratory sound is lower in pitch than in bronchial breathing. In this connection I wish to call your attention to the necessity of studying the pitch of the respiratory sounds, for in some instances there is absolutely no other means of distinguishing between the sounds transmitted from the bronchial tubes in consolidated lungs and those heard over pulmonary

cavities. The distinction in these cases is easy if we remember that the expiratory sound in the former instance is always high in pitch, and that its pitch is low in the latter case.

Amphoric respiration occurs under the same conditions as amphoric resonance, and is frequently found in connection with cracked-pot resonance. It is due to the passage of air, in and out, through an opening from a bronchus into a large pulmonary cavity or into the pleural sac (Fig. 22, page 98). The sign is obtained most perfectly in *pneumothorax* or in pneumo-hydrothorax. In the latter it disappears and returns again, as the quantity of fluid rises so as to cover the opening or falls below it. This sign is also heard in phthisis when the pulmonary cavity is large, and its walls are firm, so that they will not collapse in expiration.

Cavities may exist within the lungs without yielding either of the varieties of respiration, which may be caused by a vomica; for example, if a cavity be filled with fluid, or if the fluid in the cavity rise above the orifice of the bronchial tube, none of these sounds will be heard (Fig. 16, page 63); but if the patient's position be changed or the amount of fluid decreased by coughing, the signs return.

LECTURE VII.

ADVENTITIOUS SOUNDS.

The auscultatory sounds, which we have thus far been studying, are such as may be obtained, in more or less perfection, over the healthy chest. I wish now to direct your attention to the accidental or adventitious sounds which occur only in disease. These may accompany normal sounds, or take their place, and will vary according to their origin. Those produced within the lungs are called râles, or ronchi; those upon the pleural surfaces are termed friction sounds. Râles are as numerous and as different in variety as the shades of color, but they may be grouped into a few distinct classes, which are generally capable of some peculiar interpretation. All of them are either dry or moist; therefore we take this characteristic as the starting point for a classification, and group the different sounds under one of these heads, according to peculiarities in their pitch and quality, as shown below.

Râles Ronchi, or Rattles.
- Dry.
  - Sonorous râles.
  - Sibilant râles.
- Moist.
  - Mucous râles (large and small).
  - Subcrepitant râles.
  - Crepitant râles.
- Gurgles large and small.
- Mucous click.

Râles may originate in the larynx, trachea, bronchial tubes, air-vesicles, or in any cavity connected with the bronchial tubes. They are produced by various conditions which interfere with the passage of air through the tubes and into the air-vesicles. They are sometimes heard in inspiration, at other times in expiration, and again during both portions of the respiratory act.

Dry Râles are distinguished as sonorous, or sibilant, accord-

ing to their pitch, which depends on the size of the bronchial tube in which they are produced.

SONOROUS RÂLES are usually musical, or snoring, resembling the sound produced by blowing through a tube; they are sometimes cooing, sighing, or moaning in character. They may be heard both during inspiration and expiration, but are most frequent in expiration. These râles vary in intensity, from a sound which can be scarcely recognized, to one which may be heard at a distance from the chest. The pitch of these râles is always low, and the quality more or less musical. They are produced in bronchial tubes exceeding one eighth of an inch in diameter. They are caused by the vibrations of viscid mucus, or by a fold of mucous membrane; or by anything which constricts the calibre of the tube, as pressure upon its external surface from tumors of any sort, bands of cicatricial tissue resulting from former diseases, or contraction of the circular muscular fibres, causing a uniform narrowing of the tube (Fig. 17). These sounds are not removed by coughing, unless caused by tenacious mucus adhering to the side of the bronchial tube. Though in the great majority of instances, after coughing, or after deep inspiration, an individual râle may disappear, other râles will remain in some portion of the chest. This sign is obtained in greatest perfection in the early stages of *acute bronchitis*, and in *asthma*. It is also heard in some cases of *chronic bronchitis*, occasionally in *phthisis*, and rarely in *pneumonia*. In these latter instances, it is associated with other adventitious sounds.

When obtained in phthisis, the dry râles are few in number, and are associated with moist râles.

In the early stage of asthma, sonorous râles may be heard in great numbers over the entire chest.

SIBILANT RÂLES occur both in inspiration and in expiration, but are heard mostly in inspiration. They are not so intense as the sonorous sounds. Their pitch is high, and in quality they vary almost as much as sonorous râles, being sometimes whistling, sometimes hissing, and sometimes almost creaking. They are caused in the smaller bronchial tubes by the same conditions which give rise to râles in the larger bronchi (Fig. 17).

They are heard most frequently and abundantly in *asthma*

and in *capillary bronchitis.* In ordinary acute bronchitis, these râles will be heard, though in limited numbers.

They are heard occasionally in phthisis, due then to localized bronchitis, or to tubercular deposits. They are sometimes, though not often, heard in pneumonia. Occasionally, even in healthy or apparently healthy chests, we may hear two or three of these fine sounds near the borders of the lungs.

Sibilant râles may be altered, but they are seldom removed, by coughing or by forced inspiration.

MUCOUS RÂLES are also produced in the bronchial tubes, and are large or small according to the tubes in which they are produced. They are caused by air bubbling through fluid, which may be mucus, pus, serum, or blood (Fig. 17). If the

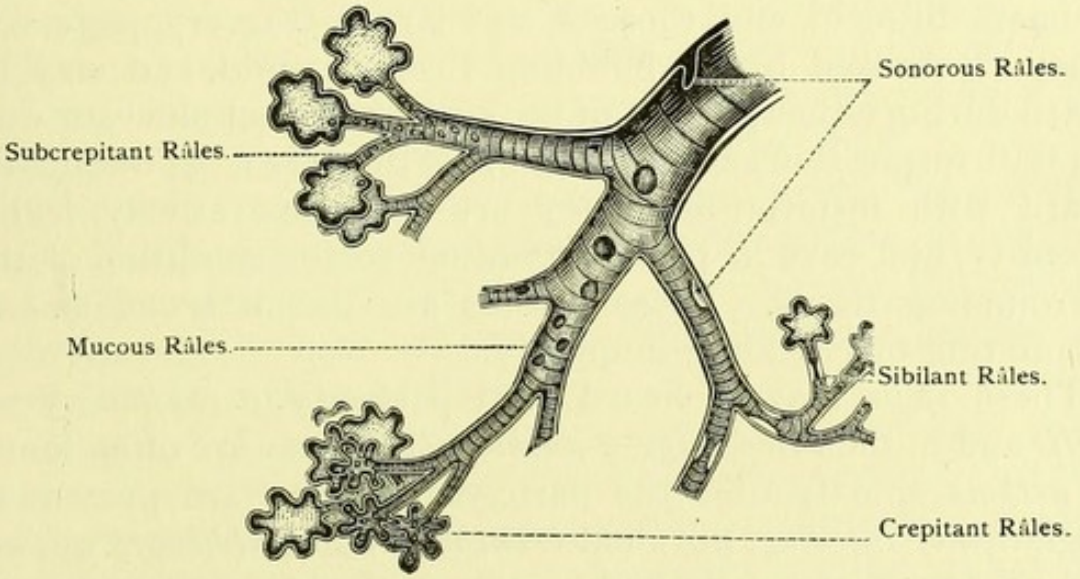


FIG. 17.—Bronchial râles, dry and moist, and subcrepitant râles.

bubble happen to be in the large bronchus we get a large, coarse, mucous râle; if in a smaller bronchus, the râle is much finer.

These râles are heard during both inspiration and expiration. They vary greatly in intensity. Sometimes, like sonorous râles, they may be heard at a distance from the chest, while at other times they are hardly audible. The pitch of mucous râles depends upon the condition of the surrounding lung tissue. In simple inflammation of the mucous membrane the râles are low-pitched, but when consolidated lung tissue surrounds the bronchial tubes, as in pneumonia and in phthisis, the pitch is high. These sounds are obtained with greatest perfection in *chronic bronchitis.*

They may be heard in acute bronchitis after the dry stage has passed. They are present in greater or less degree in nearly all cases of *consumption*, in the *third stage of pneumonia*, and in *pulmonary œdema*. These râles are numerous when *hemorrhage* has taken place into the bronchial tubes until coagulation occurs. In phthisis they are found over a limited space, due sometimes to associated bronchitis, at other times to the escape of fluid from a cavity into the bronchial tubes. These, unlike the dry râles, are usually much affected by deep inspiration, and by coughing by which they may be considerably altered or entirely removed.

SUBCREPITANT RÂLES.—These are moist sounds, which are produced in the very fine bronchial tubes, probably in the ultimate bronchi and those a size larger (Fig. 17, page 67). They are caused by air bubbling through fluid, and may be heard during either portion of the respiratory act alone, or during both inspiration and expiration, but they are most frequently heard with inspiration. They are of comparatively feeble intensity, and vary in pitch according to the condition of the surrounding tissue. These sounds are distinctly moist, and crepitating or crackling in quality.

These râles may be heard most perfectly in *capillary bronchitis* and in the *third stage of pneumonia*. They are often found in *asthma* shortly after the paroxysm. They are present in *congestion of the lung*, purulent *bronchitis*, and *pulmonary œdema*, and are found over a limited portion of the lung in many cases of phthisis. They occur in *brown induration* of the lungs, and are heard after *hemorrhage* into the smaller bronchial tubes, limited to the position of the hemorrhage.

The subcrepitant râle, due to circumscribed capillary bronchitis, is a sign of great value in the early diagnosis of phthisis, in which it may often be found at the apex of the lung before any other signs can be detected.

THE CREPITANT RÂLE is largely like the subcrepitant, but differs from the latter in two respects: viz., it is not so moist or liquid in character, so that it is sometimes classed as a dry râle, and it is never obtained in expiration. Crepitant râles are very well imitated by rubbing together a lock of hair close to the ear. They were compared by Laennec to the sound produced by throwing salt upon the fire.

These râles are produced in the vesicles, intercellular spaces, and ultimate bronchi (Fig. 17, page 67). There are two theories as to their mode of production; one is that they are caused by air bubbling through fluid within the air-vesicle, in the same way that mucous râles are produced in the bronchial tubes; the other, that they are due to the separation of the agglutinated surfaces of the capillary tubes or of the air-vesicles. Which of these is true, or whether both are in part correct, has not been decided. To me they seem to be produced by separation of the sticky surfaces of the air vesicles, and of the capillary bronchi. This view is supported by the fact that in some cases of pneumonia, for instance, when associated with inflammatory rheumatism, no crepitant râle can be obtained; absence of the râle in such cases may be accounted for by difference in viscidity of the inflammatory lymph, for if the sounds were produced by air bubbling through fluid they would occur regardless of the nature of that fluid.

Crepitant râles are much more numerous than the subcrepitant. In listening to subcrepitant râles we seldom seem to hear more than ten or fifteen at once; whereas with the crepitant râle we seem to hear a shower of a hundred or more crackling sounds with each inspiration.

Crepitant râles are obtained in perfection in the *early stage of pneumonia*, of which they are considered diagnostic. This stage lasts for only a few hours; consequently, in many cases of inflammation of the lung, we do not hear crepitant râles, as they have disappeared before we see the patient.

A few crepitant râles are sometimes heard in congestion of the lung, or in pulmonary œdema; and they are frequently found in phthisis, in a small zone beyond the consolidated portion of the lung. In this latter case they seem to result from gradual extension of the pneumonitis, which often precedes tubercular deposit.

Crepitant and subcrepitant râles and friction sounds are sometimes so much alike that it is difficult to distinguish between them. If dry crepitating sounds are numerous, and heard only in inspiration, they are crepitant râles; but if dry crepitating sounds are few in number and are heard in expiration or in both inspiration and expiration, they are likely to be friction sounds. Subcrepitant râles are more moist, and they are not nearly so

numerous as crepitant râles, and they are usually heard both in inspiration and in expiration. The moist character, the number, and the time of occurrence of subcrepitant râles will enable us to distinguish them from the crepitant; and their deeper seat and their constancy will usually enable us to distinguish them from fine friction sounds—which are still fewer in number—even when the latter are moist in character.

Crepitant râles are not much affected by cough or forced respiration, when due to pneumonia, but in other instances, two or three full inspirations will frequently dispel them.

Exceptional.—Both crepitant and subcrepitant râles are sometimes brought out directly after coughing, where they were absent a moment previously. A sound closely resembling the subcrepitant or the crepitant râle may frequently be obtained over the thin border of the healthy lung; in these instances, only a few of the râles are heard, and they disappear after three or four forced inspirations.

GURGLES resemble large mucous râles, but they are generally higher in pitch and possess a hollow metallic quality. They occur during both portions of the respiratory act, but are most frequent in inspiration. They are produced by air bubbling through fluid in cavities which communicate with the bronchial tubes (Fig. 16, page 63). If cavities are completely filled with fluid, or if they are entirely empty, or if the level of the fluid does not reach above the opening of the bronchial tube, no gurgles will be produced. These sounds are large or small, in accordance with the size of the cavity in which they are produced.

This sign is usually indicative of *phthisis*, but it may occur in any of the diseases which cause excavations in the lung.

THE MUCOUS CLICK resembles an isolated subcrepitant râle; it is heard during inspiration only. The sign generally consists of a single click, or, at most, of two or three clicks. It is a sharp crackling, or clicking sound, which is supposed to be produced in the smaller bronchial tubes by sudden separation of their agglutinated surfaces during inspiration: it is not usually affected by cough. When heard over the apex of one lung, it is a sign of considerable value in the early diagnosis of *phthisis*. These sounds are sometimes heard over a considerable portion of the lung in *acute tuberculosis*, in extensive *scrofulous pneumonia*, or in the latter stages of *interstitial or catarrhal pneumonia*.

FRICTION SOUNDS are produced by the rubbing together of the two surfaces of the pleura, which are either dry from diminution of their natural secretions, or roughened by exudation of inflammatory lymph (Fig. 18). These sounds are grazing, rubbing, grating, rasping, or creaking in character; they are sometimes dry, and sometimes moist. They may be simulated by rubbing the back of the hand, while listening with the stethoscope on its palm, or by rubbing the fingers on the integument when auscultating the chest. They are usually few in number, and transitory, being heard for a few respira-

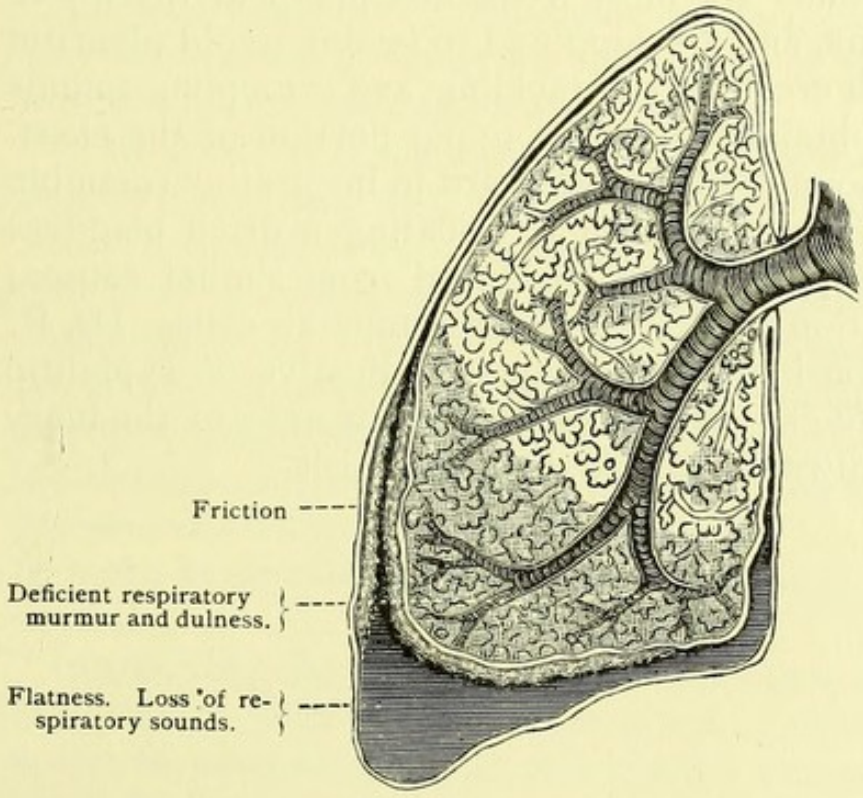


FIG. 18.—Acute Pleurisy.

The upper part of the lung is in a normal condition, or the air-cells are slightly distended. The lower part of the lung is partially collapsed. The upper surface of the fluid is not horizontal, but it conforms itself more or less perfectly to the natural outline of the lung.

tions, and then disappearing to return again in a few minutes; they may be heard just at the end of inspiration, or at the beginning of expiration. This is the characteristic sign of pleurisy. The grazing friction sound is only heard in the beginning of the inflammation, and can be detected most frequently in the circumscribed pleurisy accompanying phthisis. Some one of the other varieties, of which the quality is of no importance, may be heard in the first and third stages of pleu-

risy. Care must always be taken not to mistake for this sign the sounds produced by crackling of the hairs beneath the instrument, or by rubbing of the stethoscope the fingers or the clothing on the surface, or of the clothing or fingers on the instrument. Sounds closely resembling the friction murmur are often heard over the false ribs in a healthy chest. They seem to be produced by slight movements of the skin beneath the rim of the stethoscope.

Creaking or *crumpling* sounds are sometimes obtained over the chest, the signification of which is not fully understood. The creaking sounds are most frequently heard at the lower part of the thorax, and are supposed to be due to old pleuritic adhesions. Both creaking or crackling, and crumpling sounds are sometimes obtained over the upper portion of the chest. The crumpling sounds which are heard in inspiration resemble those which may be produced by inflating a dried bladder; and they are supposed to be produced from similar causes; that is, the inflation of dry emphysematous air-cells. Dr. R. E. Thompson considers these sounds indicative of syphilitic disease of the lungs. When confined to the apex of the lung, they are nearly always associated with phthisis.

LECTURE VIII.

VOCAL AND TUSSIVE SIGNS.

VOCAL SOUNDS.

Considerable information regarding the condition of the lungs can be obtained by studying the sounds of the voice as transmitted through the chest-walls.

If we listen over the healthy chest, while the person is speaking, an indistinct, distant and muffled sound will be heard, which is termed normal vocal resonance. It is due to the fact that sounds produced in the larynx are transmitted not only outward through the mouth, but also downward through every portion of the bronchial tree. Vocal resonance, like most of the other pulmonary sounds, varies greatly in different healthy individuals, and in different portions of the same chest. If a person has a low-pitched intense voice, the vocal resonance will be more forcible than in those who have high-pitched or feeble voices.

In studying the voice-sounds by immediate auscultation, it is desirable to close the ear which is not applied to the chest, in order to exclude sounds coming from the mouth; and it is better to have the patient count, one, two, three, than to ask him questions and listen for the answers. By the latter course, the examiner's attention is distracted from the sounds within the chest in the attempt to catch the patient's reply. The varieties of vocal resonance which may be heard in different regions of the normal chest are named from the parts where they are produced; thus, over the larynx and the trachea we have laryngeal and tracheal resonance; over the bronchial tubes, bronchial resonance; and over air-vesicles, the normal vesicular, or as it is usually termed, normal vocal resonance.

Laryngophony and Tracheophony. — The vocal resonance obtained over the larynx is called laryngophony, and that obtained over the trachea, tracheophony. In these

varieties, the words are imperfectly articulated, but the voice is transmitted to the ear "with a force and intensity almost painful." The sounds are concentrated, or in other words seem to be produced within a small area immediately beneath the stethoscope, and they necessarily vary in pitch with the pitch of the individual's voice.

NORMAL BRONCHOPHONY.—By listening while the person is speaking, over the bronchial tubes, near the border of the sternum from the first to the third rib, or more especially directly over the main bronchi on a level with the second costal cartilages in front, or on a level with the fourth dorsal vertebra in the inter-scapular regions, we obtain normal bronchophony. This occupies a position midway between normal vocal resonance and laryngophony. The sounds thus obtained are transmitted to the ear with considerable intensity, though with much less force than over the larynx; and they appear to be produced immediately beneath the stethoscope, but the words are very imperfectly articulated. Whenever this sign is obtained over any other portion of the chest it indicates consolidation of the pulmonary parenchyma.

NORMAL VOCAL RESONANCE.—Listening to the voice over the vesicular portions of the lung we obtain the normal vocal resonance. This is a distant, diffused sound, having no approach to articulation, which seems to come from the deeper portions of the lung, as though produced two or three inches beneath the surface. As a rule, the vocal resonance is always more intense upon the right side than upon the left, especially in the infra-clavicular regions.

Exceptional.—In a few instances over the right apex, even in health, the resonance very nearly approaches bronchophony. If the sounds have this character upon both sides, as they have in rare instances, they will be found most intense upon the right side, but higher in pitch on the left side—a disparity due to the difference in calibre of the bronchial tubes. The tubes upon the right side being the larger, must necessarily give the more intense and lower pitched sound.

The normal vocal resonance varies in pitch with the pitch of the individual's voice. It is generally obtained over the entire chest in adult males, but only over the upper part of the chest in women and children, in whom it is a sign of little value.

This sign is modified by disease, principally in its intensity, which may be either diminished or increased.

Intensity.
- Diminished. — Vocal sounds feeble or suppressed.
- Increased.
  - Vocal sounds exaggerated.
  - Resonance which is termed bronchophony.
  - " " " ægophony.
  - " " " pectoriloquy.
  - " " " amphoric-voice.

DIMINISHED RESONANCE is due to much the same causes as the diminished respiratory murmur; that is, separation of the pulmonary from the costal pleura by air or fluid, as in pneumothorax or plastic effusion. It occurs in cases of extreme *emphysema*, in *pulmonary œdema*, in *bronchitis* with free secretion, and occasionally when there is *extreme pulmonary consolidation*.

The vocal sounds are mostly suppressed over fluid in the pleural sac; but just above the level of the fluid the air-cells are partially collapsed, so that vocal resonance is increased. For an inch or an inch and a half below the level of the fluid the resonance is diminished in intensity, and a little lower it is entirely suppressed. Thus it will be seen that we are able to ascertain the height of the fluid by means of the vocal resonance as well as by percussion.

This sign is principally of value in the diagnosis of pleuritic effusion, by enabling us to distinguish between it and consolidation of the lower part of the lung.

Exceptional.—In some cases, the vocal resonance may be heard all over the pleuritic effusion, though the sounds are distant and more or less muffled.

INCREASED VOCAL RESONANCE.

EXAGGERATED VOCAL RESONANCE differs from the normal voice-sounds simply in its intensity. This sign denotes more or less consolidation of the lung tissue, of a tubercular or inflammatory character, or due to collapse of the air-vesicles. It is usually associated with broncho-vesicular respiration.

It is a sign of considerable importance in the diagnosis of the early stage of phthisis, and in discriminating between pneumonia and pleurisy.

Exceptional.—In very rare cases, the vocal resonance is exaggerated in pneumothorax and in emphysema.

BRONCHOPHONY consists of more or less intense vocal sounds, usually imperfectly articulated, which have a peculiar degree of concentration, or, in other words, seem to be produced immediately beneath the stethoscope, instead of coming from the deeper portions of the lung. The intensity of this sign, which may be greater or less than that of normal resonance, is an unimportant element; so also is the distinctness of articulation. Its recognition depends chiefly on the characteristic concentration.

The significance of bronchophony depends upon the region where it is obtained. If heard over the main bronchial tubes, it may be simply a healthy sound; but if heard over vesicular portions of the lungs, it is indicative of consolidation. It is usually associated with a tubular respiratory murmur; but as it occurs with a less amount of consolidation than is necessary for true bronchial breathing, it may frequently be obtained with broncho-vesicular respiration.

Exceptional.—Bronchophony usually possesses the characteristic concentration; but when the consolidated lung is separated from the chest-wall by fluid, it may sound distant.

This sign is of special value in the diagnosis of the second stage of pneumonia (Fig. 23, page 121). It is seldom obtained perfectly in phthisis, because in this disease consolidation is not usually complete.

Exceptional.—It is occasionally obtained in carcinoma of the lung, though usually this disease involves the whole tissue, air-vesicles and bronchial tubes alike; or it crowds the pulmonary tissue before it, thus hindering the transmission of the voice. But when the air vesicles alone are filled, and the bronchial tubes remain patent, as occurs in rare cases, bronchophony may be obtained. It is also obtained in hemorrhagic infarctions which fill the air-vesicles, but leave the bronchial tubes open. It may, therefore, be a sign in pulmonary apoplexy.

ÆGOPHONY is a variety of bronchophony. It is a tremulous sound, which has been compared to the bleating of a goat; hence the name. Like bronchophony, it conveys to the listening ear the impression of having been produced within a very limited portion of the lung; unlike the latter, it seems to come up from a considerable depth, and to tremble about the end of the stethoscope. When present, it may be most readily obtained in the inter-scapular or axillary regions. This sound is generally produced in consolidated lung tissue, which is sepa-

rated from the chest-wall by a thin layer of fluid. It is a sign of *pleuro-pneumonia* that is, pneumonia and pleurisy with effusion, but even in this disease, it is present only a short time. It is a sign of little value. Ægophony is most frequently produced when the pleural cavity is about one half filled with fluid.

In ordinary pleuritic effusions, the lung just above the surface of the fluid is more or less solidified by collapse of a portion of the air-vesicles; under such circumstances ægophony may be produced providing the pleura-pulmonalis and the pleura-costalis are agglutinated just above the collapsed lung.

PECTORILOQUY differs from bronchophony in that the articulated speech is more completely transmitted. In bronchophony the voice is heard, but the words are not distinct. In pectoriloquy articulation is nearly perfect. There are two varieties of pectoriloquy: one in which the sounds are concentrated and near the ear like bronchophony, but are heard over a considerable portion of the lung; and another in which the sign is confined to a limited space and has not the degree of concentration found in bronchophony. The first of these, which is high in pitch and clanging or metallic in quality, is frequently produced by simple consolidation of lung tissue. The second, which is low in pitch and softer in quality, is always a trustworthy sign of a pulmonary cavity with smooth walls and a large opening into a bronchial tube. Well defined pectoriloquy is not a frequent sign, but when heard, the first variety is a sign of *phthisis or pneumonia*, and the second is a sign of any of those diseases which cause vomicæ, viz., *phthisis*, *pulmonary abscess or gangrene*, and *bronchiectasis*.

AMPHORIC VOICE.—The amphoric voice is hollow and more or less musical in character. The musical quality follows the voice and is termed the amphoric echo. The words are not articulated, as in pectoriloquy. This sign occurs under the same conditions as amphoric respiration and amphoric percussion resonance; that is, over the pleural sac when containing air and communicating freely with a bronchial tube, and over very large cavities in the lungs.

Exceptional.—There are good reasons for believing that, in rare cases, this sign, as well as amphoric respiration, may be heard over a layer of air in the pleural cavity which does not communicate with the bronchial tubes.

Amphoric voice is a sign of *pneumothorax*, in which disease it is associated with tympanitic resonance over the upper part of the chest, and ordinarily with the succussion sound. If these latter signs are absent, the amphoric voice is probably produced in a phthisical cavity.

WHISPERING VOCAL RESONANCE.

Prof. Austin Flint has described the whisper resonance with considerable minuteness. He considers the signs which it furnishes of equal value with those from a loud voice; I find them of even greater importance. In listening over the upper portion of the chest, when a person is speaking in a sharp whisper, sounds will be heard of a blowing or tubular character, very closely resembling the sound of forced respiration. This is termed the *normal bronchial whisper*. Its modifications by disease are classified as exaggerated bronchial whisper, whispering bronchophony, cavernous whisper, whispering pectoriloquy, and amphoric whisper.

EXAGGERATED BRONCHIAL WHISPER is more intense and higher in pitch than the normal sound. It is produced in lungs which are slightly solidified.

WHISPERING BRONCHOPHONY is higher in pitch and more intense and blowing than the preceding. It has the same characteristic concentration and nearness to the ear as bronchophony with the loud voice. It may be obtained over lungs so slightly solidified as to yield only exaggerated vocal resonance when the patient is speaking aloud, therefore it can be appreciated sooner than bronchophony with the loud voice. This fact renders whispering bronchophony a most important sign in the early stage of phthisis.

THE CAVERNOUS WHISPER is a low-pitched, blowing sound, confined to a limited portion of the chest. It is produced within pulmonary cavities under the same conditions as cavernous respiration. This sign is principally of value in the diagnosis of phthisis.

WHISPERING PECTORILOQUY differs from whispering bronchophony only in its more perfect articulation. When obtained over a small space only, this is a sign of a cavity. It is most frequently found in phthisis.

AMPHORIC WHISPER occurs under the same conditions as the

amphoric voice or amphoric resonance on percussion; that is, over the pleural sac filled with air, or over very large cavities in the lung tissue.

Aphonic Pectoriloquy is a term which has been applied to the voice-sounds when the patient is speaking in a low tone. It has recently been stated that these sounds can be distinctly heard, not only over consolidated or collapsed lung, but also even when the organ in this condition is separated from the thoracic wall by a collection of air or *serum;* however, these vibrations are *not* conducted through *pus*. By studying this variety of vocal resonance it is claimed that we may determine whether pleural effusions are of a serous or of a purulent character. I have been able to verify this statement in a few cases.

METALLIC TINKLING is a clear, silvery tinkling sound, like that produced by dropping a pin into a glass. It seems to be caused by the falling of a drop of fluid from the upper part of a large cavity on the surface of a collection of fluid below. It can sometimes be heard over one entire side, but it is usually most distinct on a level with the nipple. When the proper conditions are present within the chest—that is a large cavity containing air and fluid—it may be produced by any agitation, such, for example, as speaking, coughing, deep inspiration, or occasionally by the act of swallowing. The sign occurs most frequently in the pleural cavity, in the disease known as pneumo-hydrothorax, but in exceptional instances it is produced in very large pulmonary cavities. A sound very similar to this may sometimes be heard over the stomach when it is distended with gas.

TUSSIVE SIGNS.

The resonance of cough may sometimes be studied with advantage, especially in children. The act of coughing is often of special value in dislodging obstructions in the bronchial tubes or pulmonary cavities, and also in causing a subsequent deep inspiration which will freely inflate the air-cells, thus bringing out signs which might otherwise be overlooked. The different varieties of cough are classified as laryngeal, bronchial, cavernous, and amphoric.

THE LARYNGEAL COUGH is usually more or less hacking in character, and often spasmodic. It is indicative of laryngitis.

BRONCHIAL COUGH is quick, harsh, and brassy. It is accompanied with a thrill or fremitus, and if severe is nearly always attended with pain beneath the sternum or along the inferior

ribs, corresponding to the attachment of the diaphragm. It is generally indicative of bronchitis.

CAVERNOUS COUGH is produced under the same circumstances as cavernous respiration, and is generally associated with gurgles. It has a hollow quality and is usually very intense.

AMPHORIC COUGH is more musical and hollow in quality, it is generally lower in pitch, and it seems to penetrate the ear with less force than the cavernous. It is heard over very large pulmonary cavities or over the pleura, when filled with air.

Sometimes large pulmonary cavities are traversed by trabeculæ which yield a peculiar twang when the patient coughs. This is of special value as these strings prevent cavernous or amphoric voice-sounds.

Tussive signs are usually, though not always, transmitted through consolidated lung, but seldom through collections of fluid.

We may obtain considerable information about the condition of the lungs in children who cannot be induced to speak, by studying the cry, which is subject to the same variations, and arises from the same cause as vocal resonance in adults.

This completes the description of the signs which are obtained by physical exploration of the chest in diseases of the lungs and pleuræ.

LECTURE IX.

DIAGNOSIS AND TREATMENT OF PULMONARY DISEASES.

With the last lecture, I completed a description of the physical signs which are found in the various pulmonary affections; and now in order to utilize them for diagnosis, I shall present the groups of signs which occur in individual diseases, beginning with affections of the pleura.

PLEURISY OR PLEURITIS.

Pleurisy consists of an inflammation of the serous membrane covering the lungs and lining the thoracic walls. There are three recognized varieties of this disease: the acute, the subacute, and the chronic or suppurative. The first effect of inflammation on this membrane is to check its normal secretion and cause dryness of the surface. This is soon followed by the exudation of inflammatory lymph, and with this or immediately following it, there is an increased effusion of serum into the pleural sac. After this has remained for a variable length of time, in favorable cases, it is gradually absorbed. The amount of fluid varies in different varieties of the disease. In acute pleurisy, it is not usually great, seldom occupying more than one third, or at most one half of the pleural sac, though in a few instances it may be sufficient to fill the cavity. In subacute pleurisy, the quantity of fluid is greater, and is often sufficient to fill the pleural cavity, and cause great distention of the side. In chronic pleurisy, or empyema, the amount of fluid is seldom greater than in acute pleurisy.

For the sake of convenience of description, pleurisy has been divided into three or four stages. By some authors, it is divided into, first, a dry stage; second, a plastic stage; third, a stage of effusion; and fourth, a stage of absorption. I prefer the division into three stages analogous to the three stages of pneu-

monia. The first of these we will call the dry stage; the second, the stage of effusion; the third, the stage of absorption.

SYMPTOMS.

The usual symptoms of this disease are, a sharp cutting pain in the side, which is aggravated by movements of the body and by respiration; rapid and incomplete inspiration; a short dry cough and a hard, rapid pulse.

SIGNS.

The most important signs of pleurisy are short and catching respiration, friction fremitus, and friction sounds heard on auscultation. There is loss of vocal fremitus and the respiratory murmur, with flatness over the collection of fluid, after effusion has taken place. The upper line of flatness changes with the changes in the position of the patient (Fig. 18, page 71).

Signs of the First Stage.

In the first stage, we have in the beginning simply dryness of the pleura, and shortly afterward an exudation of inflammatory lymph.

INSPECTION.—By inspection, we observe jerking or interrupted and incomplete respiration, with diminution of the expansive movements of the affected side. This catching respiration results from the patient's efforts to limit the inspiratory movement, in order to prevent pain. If the patient is sitting or in a semi-recumbent position, his body will be inclined toward the affected side. If recumbent, he is likely to be lying on the unaffected side.

PALPATION.—On palpation, no signs will be obtained in the early part of this stage; but a little later friction fremitus may frequently be detected, and the vocal fremitus may be found to be diminished. Pressure usually elicits deep-seated tenderness.

MENSURATION yields no additional signs.

PERCUSSION yields no signs at first; but when plastic exudation has taken place, dulness, in proportion to the amount of exudation, will be elicited. The dulness is always less marked at the end of forced expiration than during normal respiration.

AUSCULTATION early in this stage discovers a feeble respira-

tory murmur with jerking or "cog-wheel" respiration; and in some instances, just at the end of inspiration, it reveals a feeble, grazing friction sound. When plastic exudation has taken place, the respiratory sounds are still more feeble, and the friction sound becomes distinct. The latter may have any of the characteristics of friction sounds, of which I spoke in a former lecture, as, rubbing, grazing, creaking, or crackling. At this stage of the disease, the vocal resonance is somewhat diminished.

Signs of the Second Stage.

INSPECTION.—In the second stage of pleurisy, we still observe diminished respiratory movements; but not the interrupted respiration, which was noticed in the first stage.

PALPATION.—The vocal fremitus is found to be absent over the site of the effusion. In a few instances, distinct fluctuation can be obtained. The apex beat of the heart will be found crowded over to the right or to the left, according to the seat and the amount of the effusion. If the pleurisy is upon the left side, the heart is crowded to the right; if upon the right side, it is displaced in the opposite direction.

Exceptional.—In very rare instances of serous effusion, the vocal fremitus is not lost.

PERCUSSION yields flatness over the lower part of the chest, and extending upward to the surface of the fluid. The height of this surface is not altered by deep inspirations or forced expirations. The relations of this surface are changed by alterations in the patient's position, the fluid tending to gravitate to the lower part of the cavity. When the pleural sac is filled with fluid, and when there are complete adhesions above the surface of the liquid, this change will not take place.

Above the fluid, the resonance is exaggerated; and in exceptional cases it may have a vesiculo-tympanitic or amphoric quality.

Investigations by Damoiseau, of Paris, and more recently by Dr. Ellis, of Boston, show that usually when the pleural sac is no more than one fourth or one third filled, the upper surface of the fluid corresponds to a curved lined known as the letter "S" curve, termed by Dr. Ellis the curved line of flatness (Fig. 19).

Dr. G. M. Garland, in his admirable monograph on "Pneumo-Dynamics," describes this curved line as follows: "Its lowest

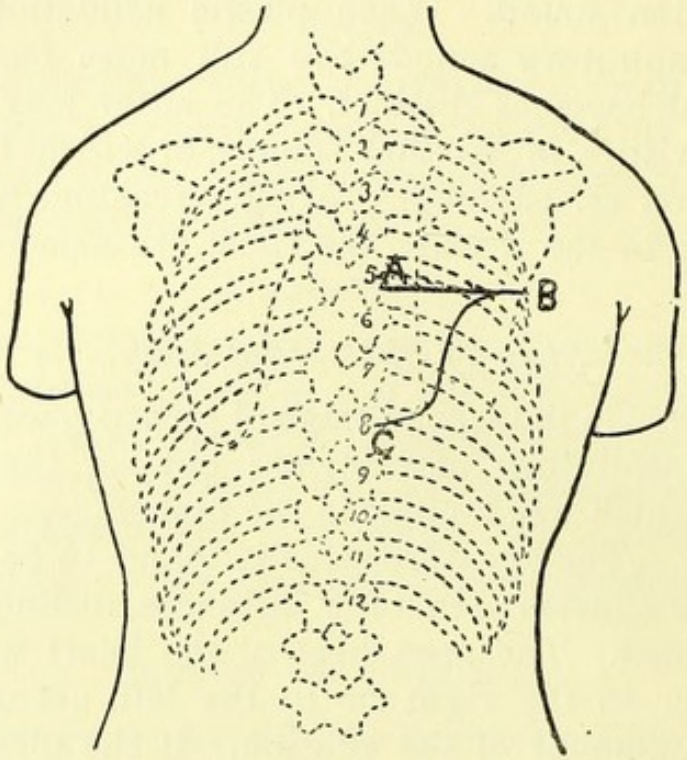


FIG. 19.—Curved Line of Flatness in Pleurisy (Garland).
C, B, letter S curve. A, B, C, triangle of dulness.

point is found behind, near the spinal column. From this point, it curves upward and outward across the lateral region,

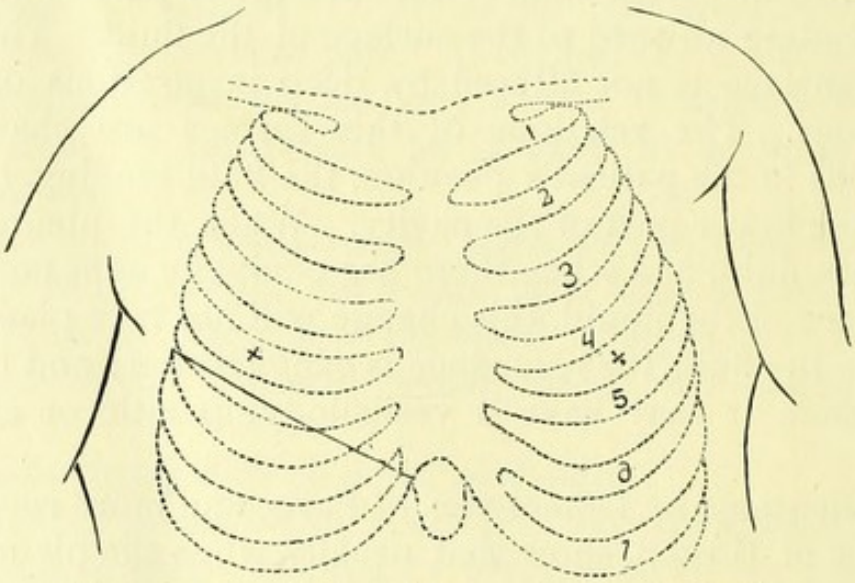


FIG. 20.—Curved Line of Flatness in Pleurisy (Ellis).
Letter S curve, anterior view.

where it is highest, and from this point it proceeds almost horizontally forward to the sternum." The experiments of Dr.

Garland demonstrate that, instead of the fluid gradually rising in the lower portion of the chest, carrying the lung above it, and maintaining a horizontal surface, as is usually supposed; its upper line nearly corresponds to the natural outline of the base of the lung. This is supposed to be due to the elasticity of the lung, which holds the fluid in this unnatural position. I would refer those interested in this matter to Dr. Garland's monograph, for a complete exposition of the subject. If a line be drawn horizontally backward from the highest point of the curved line of flatness in the lateral region to the spinal column, a somewhat triangular space will be left between it and the posterior part of the curved line of flatness. This space is termed by Dr. Garland the triangle of *dulness* (Fig. 19, page 84). It is bounded below and externally by the letter "S" curve, internally by the spinal column, and above by a line drawn backward from the highest point of the curved line in the lateral region. This superior boundary is not necessarily horizontal, but it may be so considered for the sake of illustration. In this triangular space we have no fluid, but the resonance is less than above it. This dulness is due to partial compression of the lung against the spinal column. In order to recognize the curved line throughout its entire extent, we must not compare the affected with the sound side posteriorly, as it is not the distinction between resonance and flatness which we wish to obtain, but the distinction between dulness and flatness. Percussion should be made in perpendicular lines at several places, either from above downward, or from below upward. By this method, we can easily distinguish between the dulness over the compressed lung and the flatness over the fluid, and between the character of the resonance in these positions, and that of the lung above them. Failure to recognize the true character of the percussion note in these different localities has caused authors to describe the upper surface of the fluid as corresponding to a horizontal line. If you recollect that the fluid in the pleural sac conforms itself more or less perfectly to the natural contour of the base of the lung, you will understand why the line does not undergo greater changes with alteration in the position of the patient. Suppose, for instance, that we find the level of the fluid, in front, at the fifth rib, when the patient is in an erect position: upon causing him

to lie on his back, according to the generally accepted opinion, the line of flatness should still remain horizontal, and would then be found running longitudinally along the lateral region. In point of fact, however, this never occurs. On the contrary, the line of flatness is not likely to be depressed in front more than one or two inches by this change in the patient's position, and it will be found running more or less obliquely downward and backward, instead of longitudinally.

When the pleural cavity is nearly filled with fluid, we frequently get tympanitic resonance over its apex, especially if the patient is in a recumbent position. In attempting to explain this phenomenon, we are once more involved in the opposing statements that tympanitic resonance is low-pitched, and that it is high-pitched. Fraentzel—who believes the tympanitic resonance to be low in pitch—in giving the reasons for this sign, quotes from Wintrich and Traube, who claim that the pitch in pulmonary percussion is dependent upon two conditions: first, the volume of air beneath the point percussed; and second, the tension of the lung tissue; and also that the pitch of the percussion sound stands in direct proportion to the tension and in inverse proportion to the volume of the oscillating column of air. In other words, as the lung is diminished in volume the pitch is raised; or as it again approaches the normal size, the pitch is lowered according to the amount of air which it contains, and as the tension of the lung is increased the pitch is elevated. Therefore, if the diminution in volume which raises the pitch, and the diminution in tension which lowers the pitch, be equally balanced, the pitch will remain unaltered. It therefore follows that in moderately large pleuritic effusions, which yield tympanitic resonance in the infraclavicular region, the diminution in tension (*low pitch*) must exceed the diminution in volume (*high pitch*). Doctors Flint and Da Costa, who consider tympanitic resonance to be of high pitch, believe that this sign in pleurisy is due in great part to the conducted resonance from the trachea and the bronchial tubes. Both of these reasons may be in part correct, but as I pointed out in a communication to the *Chicago Med. Jour. and Exam.*, March, 1877, it is more than probable that this sign results mainly from a collection of watery vapor above the fluid in the pleural sac. You will remember that vaporization

of water takes place even at a low temperature, and when we reach a temperature of one hundred and one or two degrees Fahrenheit, under ordinary pressure, vaporization takes place very rapidly. This process must therefore be going on constantly when fluid collects in the pleural cavities, and as soon as the serous surfaces become so altered by inflammation that they are incapable of absorbing the vapor as rapidly as it is formed, it will collect above the fluid until the tension becomes sufficient to prevent its further formation. This being the case, a cavity is formed, filled with watery vapor, which must yield tympanitic resonance. I am convinced of the correctness of this theory by experiments, not only with fluids outside of the body, but also on a patient whose pleural cavity was almost filled with fluid, and in whom tympanitic resonance was plainly discernible, just beneath the clavicle, when he was lying on his back. On inverting this patient, and placing him as nearly as possible upon his head, so that the base of the chest was much the highest, tympanitic resonance was found over a small area at the base of the pleural sac.

Signs of the Third Stage.

During the third stage of pleurisy the signs denote a gradual return to a healthy condition. The distention becomes less, the respiratory movements are freer, and the vocal fremitus gradually returns, appearing first at the upper portion of the chest. The upper limit of the liquid, as ascertained by percussion, slowly falls toward the lower part of the chest until the fluid is entirely absorbed. Sometimes, over the lower part of the chest, more or less dulness remains for a long time, or the resonance may never become normal, owing to the collection of inflammatory lymph or to thickening of the pleura, which may permanently remove the lung a short distance from the chest-wall.

The respiratory sounds gradually return, at first feeble and distant, but growing more and more distinct, until they finally become normal. Occasionally the respiratory sounds remain harsh and tubular in quality, on account of the imperfect expansion of the air-vesicles. Usually, as the two surfaces of the pleura again come in contact, friction sounds are obtained, which may continue for a short time only, or for several months.

The heart and the abdominal organs gradually return to their normal positions, as shown by percussion and auscultation.

In some rare cases, however, when the heart is crowded to the right of the sternum by an effusion into the left pleural sac, adhesions take place which permanently retain the organ in its abnormal situation. Again, the absorption of a large and long-continued effusion in the right sac is sometimes followed by a permanent dislocation of the heart to the right of the sternum, the dislocation being due to the tendency of the surrounding parts to fill the space which should be occupied by the unexpanded lung.

If the air-vesicles do not fully expand, on account of having been compressed so long that the lung tissue is partially disorganized, or if the lung cannot expand by reason of having been bound down by inflammatory adhesions, the chest may never again attain its normal condition. There will be consequent loss of motion and retraction of the affected side, with more or less dulness upon percussion, and feeble or suppressed respiration. In the most protracted cases, the upper portion of the lung becomes only partially expanded, and in this region there will be more or less dulness upon percussion with deficient vesicular murmur and broncho-vesicular respiratory sounds, together with exaggerated vocal resonance.

TREATMENT.

The patient should be kept quiet. Talking should be prohibited and all movement avoided. The movements may be restricted by strapping the side with strips of adhesive plaster running diagonally, from above downward and forward, and downward and backward; and also horizontally: a broad, elastic bandage may be employed for the same purpose. When these are not used, hot poultices may be beneficially employed.

Opiates should be given in sufficient quantity to relieve pain. Saline diuretics are also important and should be given at the same time. Sometimes the pleural sac rapidly fills with serum, and the question of aspiration will be suggested. With regard to this, the following rule is important: never aspirate in acute pleurisy until about the middle of the second week or until all acute symptoms have passed. The only exception to this rule is when we are compelled to aspirate to relieve great dyspnœa. In the latter stage of the disease, tonics and iodide of potassium, with counter-irritation by blisters or iodine are indicated. Absorption of the fluid may also be favored, by

free sweating which may be caused by jaborandi or the hot air bath; and by such diuretics as squills, comp. spts. of juniper, and bitartrate or acetate of potassium.

SUBACUTE PLEURISY.

This is also called chronic pleurisy by some authors. It consists of a low grade of inflammation of the pleura, most frequently, characterized by absence of pain and slight constitutional disturbance, until after extensive effusion has taken place. The effusion consists of serum, and is usually very abundant, often completely filling the pleural cavity.

SYMPTOMS.

The principal symptoms are dyspnœa, and finally loss of appetite, emaciation, vomiting and more or less cough.

It is surprising how great the effusion may become in this affection before the difficulty in breathing becomes noticeable.

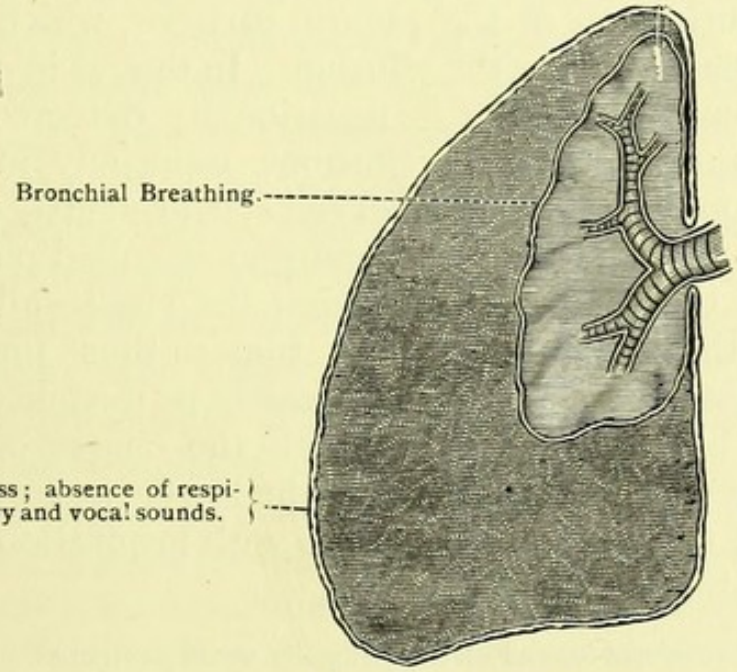


Fig. 21.—Subacute Pleurisy.

SIGNS.

The signs are the same as those of the second and third stages of acute pleurisy with extensive effusion (Fig. 21).

TREATMENT.

The fluid should be removed by the aspirator. Iodide of potassium with other diuretics should be given. Tonics are

also indicated. Counter-irritation is useful. Every effort must be made to improve the patient's general condition.

CHRONIC PLEURISY OR EMPYEMA.

In this affection the inflammation is protracted, and pus instead of serum occupies the pleural sac.

SYMPTOMS.

The symptoms of empyema denote serious constitutional disturbance. The most important are: rapid pulse, high temperature, dry brown tongue, hectic and night sweats, with loss of appetite and rapid emaciation.

SIGNS.

The signs of this disease are much the same as those of subacute pleurisy, but usually the displacement of the heart and of other adjacent organs is greater. Ordinarily, the level of the fluid does not vary with changes in the position of the patient, owing to the agglutination of the pleural surfaces, which has taken place immediately above the effusion. In this, as in other varieties of pleurisy, fluctuation is occasionally detected by palpation. Sometimes with large effusions, especially in the left pleura, pulsation of the side is observed synchronously with the contraction of the heart. This condition is called pulsating empyema. If the pus breaks through the chest-wall and appears beneath the integuments, the tumor thus formed generally pulsates strongly, and it might easily be mistaken for an aneurism if it happened to be located in the course of the aorta instead of occupying a position at the lower part of the chest. Tumors of this kind often enlarge with inspiration and diminish in size with expiration.

Exceptional.—Rarely, empyema instead of occupying its usual position at the base of the chest, may be confined to the upper part of the pleural sac, or to a small space about the root of the lung, or it may occupy two different and widely separated localities.

It is generally considered impossible to differentiate between serum and pus in the pleural sac; but Prof. Guido Bocelli, of Rome, claims that the distinction can be made by attention to the whispering vocal resonance. The whisper resonance he claims may be heard at the base of serous pleuritic effusions, but will not be conducted through pus. In making this distinction, two conditions must be complied with: first, immediate auscultation must be practiced, the ear being pressed firmly against the naked chest and all external sounds excluded by closing the other ear; second, the patient

must be so placed that the vibrations produced by whispering shall proceed from his mouth in a direction diametrically opposed to the listening ear.

DIFFERENTIAL DIAGNOSIS BETWEEN THE VARIOUS FORMS OF PLEURISY AND OTHER DISEASES.

The differential diagnosis of pleurisy is usually easy, yet various diseases have been mistaken for it. The affections most likely to cause an error in diagnosis are pleurodynia, intercostal neuralgia, pericarditis, pneumonia, phthisis, collapse of the lung due to pressure on a main bronchus, cancer of the lung, aneurism of the aorta, and enlargement of the liver or spleen.

Pleurodynia and Intercostal Neuralgia.—Pleurisy is only likely to be mistaken for pleurodynia or intercostal neuralgia in the first stage of the acute variety, when the pain and consequent impairment of the respiratory movements and murmur are the same as in the latter affections. The distinction may be made by remembering that the pain of pleurodynia is likely to be increased by slight pressure and by muscular contractions, and that the pain in intercostal neuralgia is confined to one, two, or three tender points along the course of the intercostal nerves. On the other hand, the pain in pleurisy is deep-seated, and although there is tenderness on pressure, it is not confined to isolated points over the course of a nerve; and by auscultation we detect a friction sound which is not obtained in pleurodynia or in intercostal neuralgia.

Pericarditis is liable to be mistaken for pleurisy affecting the left side. The diagnosis between these two diseases is based upon the locality of the pain and the friction sounds, and the relation of the latter to the respiratory movements.

The pain of pericarditis is located in the præcordial region; that of pleurisy more externally. The friction sound in pericarditis is heard most distinctly at the left border of the sternum near the fourth costal cartilage; that of pleurisy is usually heard farther to the left. The friction sound in pericarditis is independent of the respiratory movements, and does not cease when the patient holds his breath. In pleurisy, these sounds are not heard at all except during respiration.

Exceptional.—The action of the heart may cause a friction sound between the anterior portions of the left pleura which will not disappear when respiration ceases, but this is extremely uncommon.

Pneumonia.—Pleurisy is distinguished from pneumonia by

the signs obtained on palpation, percussion, and auscultation. These are: vocal fremitus feeble or absent, instead of exaggerated, flatness instead of dulness, change in the level of the liquid by altering the position of the patient, and absence of respiratory and vocal sounds instead of bronchial breathing, bronchophony, and râles. See page 124.

Phthisis.—Pleurisy is distinguished from phthisis by the same signs which discriminate it from pneumonia, and by the fact that phthisis, affecting the greater part of the lower lobe of one lung, will also affect the apex of the opposite lung, whereas the signs of pleurisy are usually confined to the lower part of one side. In phthisis the signs usually progress downward; in pleurisy they proceed upward.

Collapse of the Lung.—Collapse of one lung from compression of its main bronchus may present many signs similar to those found in pleurisy with extensive effusion, viz., loss of motion of the side, absence of vocal fremitus, flatness on percussion, and absence of respiratory and vocal signs. When these signs exist, the diagnosis must be based mainly on the position of the heart. Moderate pleuritic effusions, where no adhesion of the pleural surfaces has taken place, would be easily differentiated from the condition under consideration by changes in the level of the fluid. But where the effusion is circumscribed, or when it completely fills the pleural cavity, this sign would not be present. In pleurisy with considerable effusion, the heart is more or less displaced toward the opposite side. This does not occur in collapse of the lung. The essential difference in the signs of these two conditions may be seen at a glance in the following table:*

Pleurisy.	Collapse of Lung from Compression of the Main Bronchus.
Heart usually more or less displaced to opposite side.	Heart not displaced.
Side often distended. Side not retracted excepting in protracted cases.	Side not distended, may be retracted, and would always be retracted except that collapse of the air-vesicles causes diminished pressure on the organ. This favors dilatation of the blood-vessels, and causes congestion with exudation which fills the air-vesicles and distends the lung to its normal size.

* In this, as in other tables, signs common to both diseases have been omitted.

Pulmonary Cancer.—In this affection dulness usually begins near the middle of the lung and progresses irregularly in different directions, leaving here and there patches or islands of normal resonance surrounded by flatness. Observe that in pleurisy flatness begins at the base of the chest and is uniform. The constitutional symptoms of the two diseases are very different.

Aneurism of the Aorta.—The occurrence of empyema with perforation of the chest walls, in the course of the aorta, might cause a tumor which would closely simulate aneurism. It would be distinguished from the latter disease by the presence of signs of empyema in the lower part of the chest. In all probability you will never be called upon to make a diagnosis in such a case.

Enlargement of the Spleen is distinguished from pleurisy of the left side by attention to the following facts. An enlarged spleen seldom encroaches much upon the thorax, and therefore it causes little or no distention of the side, and no bulging of the intercostal spaces, or displacement of the heart. Upon percussion, dulness is found to extend in front higher than behind, and the level of its upper surface does not materially change with changes in the patient's position.

Enlargement of the Liver has frequently been mistaken for pleuritic effusions, even by skilful diagnosticians. The differential signs will be seen in the following table:

Pleuritic Effusions.	Hypertrophy of the Liver.
Inspection.	
Frequently bulging of the intercostal spaces.	There may be bulging of the chest, but the intercostal spaces are not specially prominent.
Palpation.	
Occasionally fluctuation.	No fluctuation.
Percussion.	
Dulness extending higher behind than in front.	Dulness extending in front higher than behind, because the shelving border of the lung posteriorly intervenes between the liver and the thoracic-walls.
The line of absolute flatness usually varies with changes in the position of the patient, and *is not* depressed or elevated during inspiration or expiration.	The line of flatness is not materially affected by changes in the patient's position, but *is* depressed and elevated by inspiration and expiration.

Auscultation.

The respiratory murmur is heard in front, at a lower level than behind, and this level is not materially affected by deep inspiration.	The respiratory murmur is heard behind, at a lower level than in front, and this level is depressed during deep inspiration and elevated in expiration.

TREATMENT OF EMPYEMA.

When pus collects in the pleural sac it should be removed. At first an exploratory operation by means of the aspirator should be made, and as soon as the pus re-collects free drainage should be established. The cavity should be cleansed daily, or twice daily, with a one-per-cent solution of carbolic acid in water at 100° F. If healing does not soon occur, stimulating injections should be used. For this purpose we may employ sulphate of zinc, gr. ij.–iv. to the ounce of water; sulphate of iron, gr. iv.–viij. ad ℥ i.; compound solution of iodine, ʒ ss.–ʒ i. ad ℥ i., and similar substances.

When one of these remedies loses its effects, as it ordinarily will in two or three weeks, another must be tried, and when weak solutions fail to stimulate the healing process, stronger ones must be substituted. Attention should always be given to the patient's general health.

The following forms of pleurisy, though not entitled to be considered as distinct varieties, need some special consideration:

Circumscribed Pleurisy usually occurs during the course of phthisis, and is responsible for many of the acute pains suffered by consumptives. This inflammation is generally limited to the small portion of pleura investing that portion of the lung where the lesions are superficial. The signs indicating this condition are some variety of friction sound, or a dry, creaking sound, probably due to old adhesions.

Pleurisy of the Apex, unassociated with phthisis, is said by Dr. J. Burney Yeo to be a frequent disease, which he believes to be the cause of many coughs, usually called "hysterical" or "stomach coughs." He has observed it principally in women who have been accustomed to wear low-necked dresses.

SYMPTOMS.

A harsh, dry, shallow or incomplete cough, occurring in a person apparently in good health.

SIGNS.

The only physical sign to be detected is friction limited to the supra-clavicular region, or to the upper third of the scapular.

Diaphragmatic Pleurisy.—Inflammation of that portion of the pleura which covers the diaphragm is not easily detected. I wish to direct your special attention to a few symptoms and signs which, according to Dr. Noel Gueneau, render its diagnosis more precise. Besides the pain elicited by pressing over the base of the chest on the affected side, there is a point of hyperæsthesia, due to irritation of the phrenic nerve, which is found at the intersection of two lines, one of which corresponds to the border of the sternum, and the other of which is perpendicular to the first, and follows and prolongs the border of the ribs. At the same time, exaggerated sensibility is found between the sternal attachments of the sterno-cleido-mastoid muscles, and pain is experienced in the shoulder and in the infra-clavicular region of the same side. This is due to reflex action, caused by irritation of the phrenic nerve. Neuralgia of the last intercostal nerve is also frequently present, and there is likely to be increased obliquity of the last rib on the affected side, and immobility of the hypochondrium. If the inflammation is on the right side, the liver is usually slightly depressed.

PERCUSSION gives a high-pitched note over a narrow space, corresponding to the lower margin of the lung contiguous to the effusion.

AUSCULTATION.—On auscultation, the vesicular sound at the level of the collection of liquid is usually feeble, and accompanied with crepitant or mucous râles. Weakness of the inspiratory sound and prolonged expiration may exist over the whole lung, due to compression of the bronchi by enlarged glands, which are said ordinarily to accompany this disease.

Multilocular Pleurisy.—In 1854, Prof. Wintrich wrote that it was impossible to distinguish, in the living subject, between unilocular, bilocular, and multilocular pleurisies, and this proposition is still generally accepted; but recently it has been asserted that the diagnosis is practicable in many instances. In a communication to the Académie de Médicine of Paris in 1879, M. Jaccoud declared the diagnosis possible, when the

following groups of signs are found coincidently with the ordinary symptoms and signs of pleurisy. He had observed two distinct semeiological types of the affection.

In the first, added to the ordinary signs of complete pleuritic effusions, the vocal fremitus, though lost over every other portion of the affected side, is found to be preserved along a line running forward from the spinal column, in a more or less regular semi-circular course, toward the sternum, at a variable height. Vocal resonance and bronchial respiration are heard in the same locality, though wanting everywhere else.

This line indicates the position of the band of pleural adhesion which divides the pleural sac into two cavities. In these cases, he has found in the infra-clavicular region feeble and distant respiratory murmur and voice-sounds, with no tympanitic resonance.

In the second type, vocal fremitus, though more or less enfeebled, is obtained over the whole effusion, excepting, sometimes, a narrow zone, one or two fingers in breadth, at the lower, posterior part of the chest. Marked bronchial respiration and bronchophony are also found over the fluid, with perfect flatness on percussion, and no tympanitic resonance under the clavicle. In two cases he has been able to locate the fundamental partitions, by finding one or two zones where the vibrations were manifestly stronger than in other localities. The value of this diagnosis depends upon the proposition apparently established by M. Jaccoud's observations, that thoracentesis is not well borne in multilocular pleurisy, but that it seems rather to add greatly to the patient's danger. The essential points in the differential diagnosis between extensive pleuritic effusions of the unilocular, bilocular, and multilocular types, are shown in the following table.

Unilocular Pleurisy.	Bilocular Pleurisy.	Multilocular Pleurisy.
	Palpation.	
Loss of vocal fremitus.	Vocal fremitus preserved on a line corresponding with the band of adhesion, though lost above and below this line.	Vocal fremitus, though enfeebled, is present over the whole of the affected side, excepting a small zone at the base. Vocal fremitus is occasionally well marked in one or two limited zones corresponding to bands of adhesion.

Percussion.

Usually tympanitic resonance under the clavicle.	Flatness over the whole chest ; no tympanism.	Flatness over the whole chest ; no tympanism.

Auscultation.

Absence of respiratory murmur and vocal resonance, excepting over the compressed lung in the upper part of the thorax.	Bronchial respiration, and bronchophony heard over a line corresponding to the pleuritic band, but wanting in other places, except over the apex, where they are indistinct.	Bronchial respiration and bronchophony marked over the seat of the whole effusion.

HYDROTHORAX.

This term is properly applied only to dropsical effusions, which will affect both sides alike, causing the same signs as pleuritic effusions of an inflammatory character.

TREATMENT.

The proper remedial measures are those suited to the condition which has caused the dropsy, and aspiration to relieve the lungs from pressure.

LECTURE X.

DISEASES OF THE LUNGS—Continued.

PNEUMOTHORAX.

Pneumothorax consists of a collection of air or gas in the pleural sac, resulting from perforation of the pleura, or from decomposition of pleuritic effusions (Fig. 22).

SYMPTOMS.

The usual symptoms are sudden acute pain in the side, with severe dyspnœa and lividity of the lips and face; great prostration, accompanied with anxiety of countenance; a clammy surface, palpitation of the heart, and accelerated pulse.

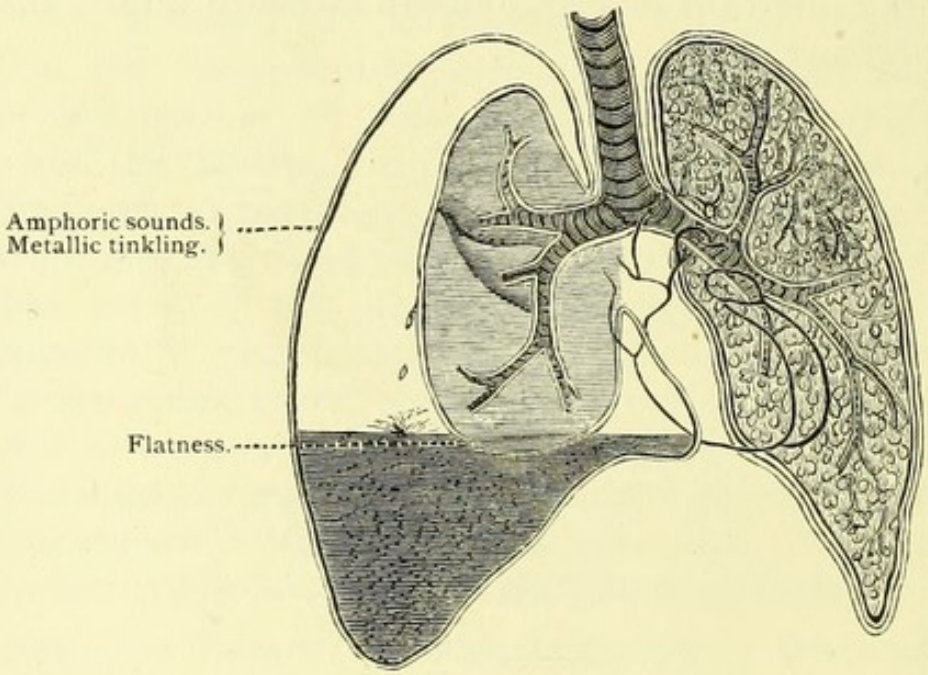


Fig. 22.—Pneumo-hydrothorax.

Right lung compressed by air and fluid. Heart crowded far to the left.

SIGNS.

The most important signs are diminished movement and enlargement of the affected side; tympanitic resonance; respiratory murmur feeble, or amphoric in character, or wanting.

INSPECTION AND MENSURATION reveal distention of the

affected side, diminution or loss of the respiratory movements, with widening, and sometimes bulging of the intercostal spaces.

PALPATION.—The vocal fremitus is feeble or wanting, and the apex beat of the heart is displaced toward the sound side.

PERCUSSION.—Tympanitic or amphoric resonance is obtained over the collection of air. When the distention of the side is extreme, the adjacent organs are displaced, and the tympanitic resonance, somewhat muffled and modified in quality, may be obtained for a considerable distance beyond the normal limits of the pleura.

Exceptional.—Occasionally when the tension is very great, the percussion note is so muffled as to seem almost dull. The bell sound may be obtained by percussion with two coins on one side of the cavity while the ear is placed opposite.

AUSCULTATION.—The respiratory murmur is feeble or absent according to the amount of air. The vocal sounds are altered in like manner. The respiratory murmur on the sound side is exaggerated. The heart sounds are feebly transmitted through the collection of air. Bronchial breathing may be heard over the compressed lung, in the inter-scapular space, and usually over the apex anteriorly. Amphoric respiration and voice are also obtained when a bronchial tube connects freely with the cavity of the pleura. For the differential diagnosis between this and emphysema, the only disease with which it is likely to be confounded, see page 101.

PNEUMO-HYDROTHORAX.

This name signifies a collection of both fluid and air in the pleural sac. As the effusion of fluid is almost sure to follow in a few hours after the admission of air into the pleura, the signs and symptoms of this disease and of pneumothorax are usually considered together. But the presence of both air and fluid in the pleural cavity causes some signs which are not found in pneumothorax. The sound obtained by SUCCUSSION is diagnostic. Metallic tinkling is also found in many instances (Fig. 22).

INSPECTION, PALPATION, AND MENSURATION furnish the same signs as those found in pneumothorax, or in extensive pleuritic effusions. There is absence of vocal fremitus, and there is dis-

placement of the heart and adjacent organs, with distention of the side, and loss of motion.

PERCUSSION.—On percussion, tympanitic resonance is obtained over the air in the upper, and flatness over the fluid in the lower portions of the chest. The line of flatness corresponding to the surface of the fluid changes by alterations in the position of the patient. Tympanitic resonance is not unfrequently transmitted a short distance beyond the limits of the pleura, and even below the surface of the fluid, so that if only a small effusion is present, this sign may be heard over the entire chest, and thus the presence of fluid may escape our notice. Amphoric resonance is sometimes heard over the upper part of the chest.

AUSCULTATION.—Upon auscultation, below the level of the fluid, the respiratory murmur is absent or is very feeble and distant. Above this level it may be the same, or amphoric respiration may be heard. This latter may be limited to a small space near the point of perforation, which is likely to be located just in front of the angle of the fourth or fifth rib. Amphoric respiration may disappear, and reappear again, during the course of the disease in consequence of the variation in the amount of fluid from day to day.

Usually bronchial respiration is heard over the compressed lung, where it lies against the spinal column.

The signs of phthisis, which in nine cases out of ten precede pneumothorax, are frequently found at the apex of the lung on the opposite side. Metallic tinkling, due to dropping of fluid from the upper portion of the cavity into the effusion at its lower part, is one of the signs of this disease; and the splashing sound obtained on succussion is characteristic. Vocal resonance is feeble or wanting, or amphoric, upon the affected side. The percussion resonance and the respiratory murmur upon the sound side are exaggerated.

DIFFERENTIAL DIAGNOSIS.

Pneumothorax and pneumo-hydrothorax are not likely to be mistaken for other diseases, though they are said to be closely simulated when there is complete catarrhal obstruction of the main bronchus on one side. They may possibly be mistaken for emphysema, chronic pleurisy, or diaphragmatic hernia.

Emphysema presents the following distinctive features:

Pneumothorax and Pneumo-hydrothorax.	Emphysema.
Inspection.	
Prominence or bulging of one side with loss of movement, especially at the lower part of the chest, but no falling-in of the inferior ribs or intercostal spaces during inspiration.	Prominence of the anterior superior portion of the chest, usually upon both sides, with a characteristic lifting movement or the upper part and falling-in of the lower ribs and intercostal spaces during inspiration, with frequently permanent contraction of the lower part of the chest.
Percussion.	
Tympanitic resonance over the upper part of the chest with flatness over the fluid, the line of flatness varying with changes in the patient's position. The heart is displaced to the right or to the left, according to the seat of the disease. Nearly always these signs are found on one side only.	Vesiculo-tympanitic resonance over the entire lung, but most marked at the superior portions ; no flatness below. The heart may be covered by lung tissue, but it is not greatly displaced. The signs are usually found on both sides.
Auscultation.	
Respiratory murmur feeble or absent ; if heard, the expiratory murmur is of normal duration, unless prolonged by consolidation of the lung, in which case it will be high-pitched. Amphoric respiration and voice are observed if a bronchial tube connects freely with the pleural cavity. Metallic tinkling.	Respiratory murmur usually feeble and generally associated with bronchial râles. The expiratory sound is prolonged and low-pitched. The respiratory sounds are sometimes harsh and tubular, but never amphoric. No metallic tinkling.
Succussion.	
Splashing sounds if fluid is present.	No splashing sound.

Chronic Pleurisy.—These diseases can be easily distinguished from chronic pleurisy by the physical signs obtained on percussion and auscultation. On inspection, palpation, and mensuration the signs are similar.

Pneumothorax and Pneumo-hydrothorax.	Chronic Pleurisy.
Percussion.	
Tympanitic resonance over the upper portion of the chest, flatness over the fluid.	Tympanitic resonance, if heard at all, is limited to a small space at the apex of the lung, usually immediately beneath the clavicle ; flatness over the remainder of the affected side.
Auscultation.	
Often amphoric respiration and voice.	Never amphoric respiration or voice.

Diaphragmatic Hernia is fortunately a rare disease, otherwise it would frequently be mistaken for pneumothorax, with which

it possesses many symptoms and signs in common. This affection, like pneumothorax, causes distention of one side with diminished motion, tympanitic resonance, and feeble or suppressed respiration with metallic tinkling. The diagnosis depends mainly upon the history and the symptoms, as will be seen from the following table:

Pneumothorax.	Diaphragmatic Hernia.
History and Symptoms.	
Usually follows phthisis or accidental perforation of pleura; the dyspnœa may come on suddenly or gradually.	Often congenital; at times dyspnœa comes on suddenly, and as suddenly disappears.
Auscultation.	
Amphoric respiration and metallic tinkling.	No amphoric respiration, and the metallic tinkling occurs independent of the respiratory movements, and is associated with rumbling of gas in the stomach or intestines; which usually form the contents of the hernia.

TREATMENT.

Pneumothorax and pneumo-hydrothorax call for essentially the same treatment. At first an opiate should be administered to relieve pain. When fluid has collected and dyspnœa is great, free drainage is advisable, especially if the fluid has become purulent: subsequently the case should be treated in the same manner as empyema.

ACUTE BRONCHITIS.

Bronchitis is an inflammation of the membrane lining the bronchial tubes. It affects both sides at the same time, and is therefore called a bilateral disease. Four varieties are recognized, viz., subacute, acute, chronic, and capillary bronchitis. The symptoms and the signs of acute and subacute bronchitis are substantially the same, except that in the latter variety they are less marked.

SYMPTOMS.

The disease is ushered in sometimes with a chill; usually with pain in the back and extremities, attended by tightness or constriction in the chest, soreness beneath the sternum, a harsh cough and frothy expectoration sometimes streaked with blood.

SIGNS.

The most important signs are absence of dulness and the

presence of large and small, dry or moist, râles on both sides of the chest (Fig. 17, page 67).

INSPECTION.—In acute bronchitis the movements of the chest are normal or somewhat accelerated.

PALPATION.—Upon palpation the vocal fremitus is normal. If there is considerable secretion in the tubes, ronchial fremitus will be obtained, especially in children.

Exceptional.—In a few cases the movements are deficient in those parts of the chest which are supplied by bronchi that are partially occluded by a collection of the bronchial secretions.

PERCUSSION.—On percussion the resonance is normal.

Exceptional.—In some cases dulness is found especially over the lower portion of the chest, due to accumulation of the fluid secretions. This dulness, however, is not permanent, as it may be removed by coughing and free expectoration.

AUSCULTATION.—By auscultation in subacute bronchitis we frequently hear simply a harsh and somewhat bronchial sound without any râles. In acute bronchitis, and in many cases of the subacute affection, dry sonorous and sibilant râles (Fig. 17, page 67) are obtained in the early part of the disease, and the vesicular murmur is more or less drowned by these signs. After from twenty-four to forty-eight hours, the secretions from the mucous membrane become abundant, and then the dry râles give place to large and small, moist, mucous râles. The intensity of these râles varies; sometimes they are feeble, at other times they may be heard at quite a distance from the chest. These signs are seldom continuous. Often they are heard during a few respirations, and are then displaced by deep inspiration or by forced expiration or cough. Mucous râles, even when numerous, may sometimes be entirely removed by free expectoration.

Some of the bronchial tubes may become so filled with mucus as greatly to diminish the intensity of the vesicular murmur, or even to suppress it in those portions of the lung which are supplied by the occluded bronchus.

Exceptional.—If the disease affects the smaller tubes, the vesicular murmur may be inaudible over the entire chest.

Vocal resonance is not altered by this disease.

CHRONIC BRONCHITIS.

The prominent *symptoms* are cough, some dyspnœa, muco-purulent expectoration, often without any considerable constitutional disturbance. The *signs* of chronic bronchitis differ from those of the acute affection, principally in the greater abundance of mucous râles, and in the scarcity of dry râles.

DIFFERENTIAL DIAGNOSIS.

The different varieties of bronchitis may be readily distinguished from each other by the history. They are liable to be mistaken for asthma, emphysema, pulmonary hemorrhage, and phthisis.

Asthma.—From asthma they are distinguished by the symptoms and by the history. The spasmodic character of asthma, its sudden appearance, the great dyspnœa, and the history of former attacks are sufficient to establish the diagnosis. The physical signs in these two diseases differ rather in degree than in kind, as shown in the following table:

Bronchitis.	Asthma.
In the early stage there are dry râles, comparatively few in number. Later, during the second or third day, dry râles give place to large and small mucous râles.	During the paroxysm the sonorous and sibilant râles are very abundant. The following day either the respiratory murmur may be normal or an abundance of moist râles, due to the attendant bronchitis, may be present.

Emphysema.—Simple bronchitis can be easily distinguished from well-marked cases of emphysema, but the latter disease is usually associated with more or less inflammation of the bronchial mucous membrane. The distinctive points in the two diseases will be seen below:

Bronchitis.	Emphysema.
Inspection.	
The form and movements of the chest are natural.	Prominence of the upper portions of the chest "barrel-shaped," with more or less constant expansion of the superior ribs, which are elevated in inspiration as though united in a single bone. Depression of the soft parts in inspiration, notably above the clavicles and sternum, and at the lower portions of the chest.

Percussion.

The resonance is normal. In exceptional instances slight dulness, especially over the lower part of the chest.

Vesiculo-tympanitic resonance more or less marked.

Auscultation.

Vesicular murmur sometimes incomplete. The expiratory murmur not prolonged. Numerous râles.

The respiratory sounds feeble, but expiration greatly prolonged. Comparatively few râles.

Hemorrhage into the Bronchi.—Bronchitis is distinguished from hemorrhage into the bronchial tubes by the character of the sputa. The physical signs are identical, except the absence in the latter of dry râles, with the harsh quality of respiration often found in bronchitis.

Phthisis.—Before the days of auscultation and percussion, chronic bronchitis was often mistaken for phthisis, but at present the physical signs render their distinction comparatively easy. They differ in the following particulars:

BRONCHITIS.	PHTHISIS.
Inspection.	
The form and movements of the chest are natural.	Very early in the disease more or less depression over the affected region, with lessened expansion.
Palpation.	
The ronchial fremitus, with normal vocal fremitus.	Vocal fremitus exaggerated.
Percussion.	
The resonance normal.	More or less dulness over the affected regions.
Auscultation.	
The râles found in this disease are equally diffused over both lungs. The expiratory murmur is not notably prolonged. Vocal resonance natural.	The râles, and other signs of consolidation, are localized, being limited to the portion of lung affected. There is broncho-vesicular respiration, and exaggerated vocal resonance.

TREATMENT.

In many cases the acute disease may be aborted, if taken early, by Dover's powder gr. x., or quinine gr. x., or a hot sling at bed time. If this fails, small doses of opium or of aconite are very useful (Form. 1); or morphia, chloride of ammonium, and tartar emetic (Form. 2) may be used until the expectoration becomes free, and subsequently carbonate of ammonium, with small doses of morphia, for cough. If the cough is not very

troublesome, we may give chlorate of potassium ʒ ss. to ʒ i. daily in divided doses. Tonics may be required until resolution is complete.

Chronic bronchitis is often dependent upon some constitutional disease or diathesis, which should receive our first attention.

When it is due to the dartrous diathesis, arsenic, in doses of gr. $\frac{1}{40}$–$\frac{1}{20}$, three times a day, is specially indicated.

When the rheumatic or gouty diathesis is present, one or more of the following remedies may be given from three to five times a day: Acetate of potassium gr. xv., guaiacum gr. x.–xv., or of the ammoniated tincture of guaiacum ʒ ss.–ʒ i., iodide of potassium gr. v.–x., or tincture of colchicum ♏ x.–xx.

If the affection originates in syphilis, iodide of potassium in full doses, with bichloride of mercury, will have the best effect.

When the disease is of simple catarrhal origin, chlorate of potassium ʒ i., daily in divided doses, is one of the best internal remedies. Preparations of squill, senega, yerba santa, and eucalyptus are sometimes beneficial. Vegetable and mineral tonics, cod-liver oil, and maltine are indicated, if the patient is debilitated.

Persistent counter-irritation sometimes aids greatly in promoting a cure.

Locally.—Inhalations similar to those recommended for diseases of the throat (Form. 34–38, and 43–56) are beneficial. Cough may be relieved by small doses of morphia and carbonate of ammonium (Form. 5), by troches of morphia (Form. 21), and often by sedative inhalations (Form. 36–40). Great care should be taken on the part of the patient to avoid damp feet, exposure to night air, cold drafts, overheated atmospheres, and the inhalation of irritating substances.

CAPILLARY BRONCHITIS.

This disease consists of an inflammation of the mucous membrane lining the capillary bronchial tubes. It usually results from extension of the inflammation affecting the larger bronchi, and it affects both lungs at the same time.

SYMPTOMS.

The principal symptoms, in addition to those found in acute

bronchitis, are severe dyspnœa with lividity of the surface and great prostration.

SIGNS.

The principal signs are: absence of dulness, with occasionally exaggerated resonance on both sides, and sibilant or subcrepitant râles (Fig. 17, page 67).

INSPECTION.—The respiratory movements are rapid, and the countenance shows the effects of imperfect aëration of the blood.

PALPATION occasionally yields a ronchial fremitus, due to disease in the larger bronchial tubes.

PERCUSSION.—The resonance is normal or slightly exaggerated over the lower portions of the chest. This exaggeration is due to emphysema of a portion of the air-vesicles, which results from complete occlusion of some of the smaller tubes, with collapse of their terminal vesicles, and consequent dilatation of the surrounding air-cells.

AUSCULTATION usually furnishes signs of general bronchitis, and in addition to these, early in the course of the affection, sibilant râles are found in great abundance, which a little later are replaced by subcrepitant râles. These subcrepitant râles, when numerous, may be taken as a positive sign of capillary bronchitis, but a few are frequently heard over the lower portion of the chest, simply from gravitation of fluids, or of the products of inflammation from the larger bronchial tubes.

Occasionally a few subcrepitant râles are heard, near the borders of the lung, even in health.

Subcrepitant râles, when confined to the base or to the apex of one lung, usually indicate that the capillary bronchitis producing them is either of tuberculous or of emphysematous origin.

DIFFERENTIAL DIAGNOSIS.

Capillary bronchitis is attended by signs similar to some of those found in asthma, pneumonia, or pulmonary œdema.

Asthma.—This disease may be distinguished from asthma by the history.

Pneumonia.—Capillary bronchitis cannot be mistaken for the first or second stage of lobar pneumonia if we bear in mind that neither of these stages causes many sibilant or subcrepitant râles, which are abundant in bronchitis; and that both stages

are attended by marked dulness, while in bronchitis the resonance is either unaltered or exaggerated. From the third stage of lobar pneumonia this disease is distinguished by the signs obtained by palpation, percussion, and auscultation, as follows:*

Capillary Bronchitis.	Pneumonia.
Palpation.	
No increase in the vocal fremitus.	Vocal fremitus increased.
Percussion.	
No dulness; occasionally exaggerated resonance.	More or less dulness.
Auscultation.	
Subcrepitant râles obtained over both lungs; these râles are of low pitch.	Subcrepitant râles confined to one side, over the affected lung; these râles are high in pitch.

Lobular Pneumonia.—It is difficult to distinguish between capillary bronchitis and lobular pneumonia, with which it often co-exists; but the diagnosis may be made fairly certain by attention to the following points:

Capillary Bronchitis.	Lobular Pneumonia.
Symptoms.	
Moderate fever. Moderately accelerated respiration.	High fever. Very rapid respiration.
Percussion.	
No dulness, but possibly exaggerated resonance.	Limited unchanging spots of dulness may sometimes be detected, though as the disease usually occurs in children, in whom dulness is difficult to detect, this sign is liable to escape observation.
Auscultation.	
Multitudes of fine, dry, and moist râles over every part of the chest.	The râles are limited in area, unless the two diseases co-exist. Bronchial breathing can seldom be detected.

Pulmonary Œdema.—Capillary bronchitis is distinguished from pulmonary œdema by the following symptoms and signs:

Capillary Bronchitis.	Pulmonary Œdema.
History.	
Usually shows an antecedent acute bronchitis several days in duration.	This affection usually follows some protracted disease, as typhoid fever, or affections of the heart or kidneys.
Percussion.	
Resonance normal or exaggerated.	Dulness over the lower part of both lungs.

* Signs common to both diseases are omitted in all the tables.

Auscultation.

Usually numerous râles in the larger tubes.	Signs of general bornchitis areabsent.

Phthisis.—This disease is distinguished from phthisis by the history of the case, and by the fact that the subcrepitant râles of the latter affection are limited to a smaller portion of the chest, which is usually over the apex of one lung.

TREATMENT.

Opiates should *not* be used in this disease excepting in very small doses. Early in the disease, muriate of ammonium with syrup of ipecac will prove beneficial; but after two or three days, more benefit will be derived from carbonate of ammonium. Inhalations of steam, or steam impregnated with sedative remedies, will have a soothing effect on the inflamed bronchi (Form. 36–40). Iodide of ammonium in small and often-repeated doses is sometimes a most efficient remedy. Strychnia gr. $\frac{1}{30}$–$\frac{1}{20}$ is a valuable remedy in this affection, as soon as symptoms of exhaustion supervene. Alcoholics should be used to sustain the strength, if the carbonate of ammonium does not seem sufficient. Cough and any spasmodic tendency should be relieved by camphor or by small doses of hydrocyanic acid.

The most efficient remedies are carbonate of ammonium and strychnia, with large jacket poultices kept constantly warm and moist and covering the whole chest. The diet must be nourishing.

PLASTIC BRÓNCHITIS.

Synonyms.—Diphtheritic, croupous, or exudative bronchitis.

Bronchitis is sometimes complicated by exudation of fibrinous matter, with the formation of false membrane or plastic casts in the smaller air-tubes and their ramifications. The exudation rarely reaches the larger bronchi, and it is said never to involve the upper air-passages. This affection may be acute or chronic.

SYMPTOMS.

The prominent symptoms are: hacking cough with scanty expectoration, followed, after a varying interval of from a few hours to several days, by a sense of constriction of the chest, and dyspnœa which may be very severe. The cough gradu-

ally increases in severity, the expectoration becomes more abundant, and perhaps tinged with blood, and finally small fragments of the fibrinous matter or—after severe paroxysm of cough—complete casts of the bronchi, of greater or less extent, are brought up.

SIGNS.

The physical signs are those of ordinary bronchitis, superadded to which we have the signs due to partial or complete obstruction of some portion of the bronchial tree, viz., weakness or absence of the respiratory murmur, with dulness where portions of the lung are collapsed. These signs may lead us into an erroneous diagnosis of pleurisy or of pneumonia. From the former plastic bronchitis is distinguished by absence of catching respiration, pains, and friction sounds; by the speedy occurrence of dulness with loss of the respiratory murmur and vocal signs, and by the presence of signs of bronchitis in other parts of the chest.

We distinguish it from pneumonia by the absence of bronchial breathing and when collapse of the lung occurs, by the sudden accession of the signs of consolidation. The differentiation from ordinary bronchitis rests entirely upon the presence of fibrinous casts in the sputa.

TREATMENT.

During the acute attack or during exacerbations of the chronic disease, the treatment should be essentially the same as that for membranous croup. At other times, the iodide of potassium will afford some relief. The general health must be maintained and all causes of cold avoided.

LECTURE XI.

DISEASES OF THE LUNGS.—Continued.

DILATATION OF THE BRONCHIAL TUBES.

Synonyms.—Bronchiectasis, or bronchicatasis, "Knife-grinder's rot," "Filer's phthisis," Cirrhosis of the lungs. It is sometimes termed fibroid phthisis.

This disease is usually associated with fibrous induration of the lungs, or with vesicular emphysema. It is generally found over the middle or the lower portion of the lung, and more frequently on the right than on the left side.

SYMPTOMS.

Patients affected with this disease often have the general appearance of phthisical subjects. The principal distinctive symptom is the expectoration of an opaque, purulent, and extremely offensive sputum, which is very abundant, measuring sometimes from one to three pints in twenty-four hours.

SIGNS.

The principal signs are: more or less dulness, and a harsh inspiratory murmur with numerous râles, all of which signs may rapidly change.

INSPECTION shows imperfect expansion of the chest, and prolonged, labored expiration, with more or less fixity of the chest-walls, and depression of the intercostal spaces.

The signs obtained by palpation, percussion, and auscultation vary greatly at different times, according to the amount of fluid in the tubes or cavities. This variation in the signs is of itself almost diagnostic of the disease.

PALPATION.—The ronchial fremitus may or may not be obtained. The vocal fremitus may be normal, but it is sometimes increased, at other times diminished.

PERCUSSION.—Some dulness is usually obtained over the affected lung. This is sometimes removed by free expectoration, and it may then be followed by vesiculo-tympanitic reso-

nance. It is apt to be located at the middle or the lower part of the lung, and it is most common on the right side. Light percussion sometimes elicits dulness, when a more forcible stroke would produce a somewhat tympanitic sound.

AUSCULTATION.—We sometimes find the respiratory murmur suppressed over a considerable portion of the lung, while in surrounding portions the sounds may be harsh and loud. A few moments later, free expectoration having emptied the bronchial tubes and the cavities communicating with them, the respiration may become broncho-vesicular and intense, where at first it could not be heard. The respiratory murmur is often associated with numerous adventitious sounds of every variety, from the dry, sibilant râle to gurgles.

The vocal resonance is subject to similar changes, and from the same causes; that is, alterations in the amount of fluid in the bronchial tubes, and in cavities communicating with them.

DIFFERENTIAL DIAGNOSIS.

Bronchiectasis is most likely to be mistaken for *phthisis*, from which it can only be distinguished by attention to the expectoration, and to the mutability of the physical signs. The distinctive features between the two may be seen below.

BRONCHIECTASIS.	PHTHISIS.
Palpation.	
Fremitus is changeable.	Exaggerated vocal fremitus not universal, but when it does occur the sign is usually constant.
Percussion.	
Dulness, or vesiculo-tympanitic resonance, often changing from one to the other during the examination.	More or less dulness, which remains constant.
Auscultation.	
The sounds are usually found over the lower or middle portions of one or both lungs, and they change rapidly as the result of deep inspiration or cough.	The signs for several months are usual confined to the upper portion of one lung. They are not materially altered by cough or by deep inspiration. They are confined to a more limited space than the signs of dilatation of the bronchi.

TREATMENT.

In this affection, cod-liver oil, chloride of calcium, and vegetable tonics are generally demanded. Some of the preparations of eucalyptus globulus or grindelia robusta are often beneficial, as are also copaiba, turpentine, senega, and squills.

Iodide of potassium or ammonium, and arsenic are often useful. Inhalations of turpentine, camphor, iodine, and carbolic acid are frequently useful in checking or altering the secretions. Counter-irritation should be tried.

ASTHMA.

Asthma is a spasmodic affection which, by causing contraction of the annular muscular fibres of the bronchial tubes, diminishes the calibre of these tubes, and thus obstructs the entrance of air to the air-cells. This disease is characterized by sudden paroxysms of dyspnœa, with stridulous respiration. The attack usually comes on during the latter part of the night, and lasts from two to four hours. It is often followed by the signs of bronchitis; these in simple cases usually disappear in from twelve to eighteen hours. Only one paroxysm may occur, or the attacks may succeed each other night after night for several days, or even for months together.

Many cases of spasmodic night-cough are doubtless due to undeveloped asthma.

SYMPTOMS.

As already intimated, paroxysmal dyspnœa, occurring at night, is the leading symptom.

SIGNS.

The principal signs are labored and wheezing respiration, attended with numerous sonorous and sibilant râles, which may be heard, and often may be felt, over the whole chest.

INSPECTION.—Respiration is labored, especially during inspiration.

PALPATION, MENSURATION, and PERCUSSION yield no distinctive signs. The resonance may be normal or slightly exaggerated.

AUSCULTATION.—By auscultation, we obtain jerking or cog-wheel respiration, with a great variety of sonorous and sibilant râles. The respiratory murmur is usually harsh and more or less tubular, the vesicular element being suppressed. Vocal resonance is normal.

DIFFERENTIAL DIAGNOSIS.

During the paroxysm, asthma may be mistaken for cardiac dyspnœa or capillary bronchitis. From the former it may be

distinguished by the history, by the absence of cardiac signs, and by the presence of a great number of sonorous and sibilant râles.

Capillary bronchitis differs from asthma in its history, and in some of the signs obtained by inspection and by auscultation, as shown in the following table:

Asthma.	Capillary Bronchitis.
History.	
A sudden attack, with usually a history of former paroxysms. Febrile symptoms not marked.	Dyspnœa comes on gradually, usually preceded by acute or subacute bronchitis. Febrile symptoms pronounced.
Inspection.	
Respiration labored, but not greatly accelerated.	Respiration not only labored, but also rapid.
Auscultation.	
Sonorous and sibilant râles, usually followed by large and small mucous râles.	Mucous râles likely to precede the sibilant râles, and the sibilant to be followed by the subcrepitant.

After the paroxysm, the signs of asthma are the same as those of bronchitis; but they last only a few hours. Asthmatic symptoms often occur during the progress of pulmonary emphysema; but these two diseases may be easily distinguished from each other by the history. *In emphysema*, as in cardiac disease, the dyspnœa is permanent, and it is aggravated by exercise; while in asthma the dyspnœa usually comes on during the hours of rest.

TREATMENT.

During the paroxysm, the most effectual internal treatment consists of morphia and chloral (Form. 3) repeated every half-hour or every hour until relief is obtained. This may be combined with half a drachm of fl. ext. of quebracho or with the fl. ext. of grindelia robusta, either of which is sometimes beneficial. Two or three cups of strong hot coffee will frequently ward off an attack, if taken when the first symptoms are noticed. The severity of the paroxysms may be greatly modified by small doses of belladonna, hyoscyamus, bromide of potassium, or camphor. Fuming inhalations of arsenic or nitrate of potassium, alone or combined with other antispasmodics, such as stramonium, hyoscyamus or tobacco give speedy relief in some cases (Form. 85). Galvanizing the pneumogastric nerve, with the positive pole beneath the mastoid process, and the

negative pole on the epigastrium, will promptly relieve some cases.

If bronchitis or pneumonia supervenes, it should receive similar treatment to that recommended when it occurs as a primary disease. The general treatment of asthmatic patients should be supporting. Between the paroxysms an effort should be made to prevent their recurrence. The most efficacious remedy for this purpose is iodide of potassium, but in some cases iodide of ammonium, grindelia, eucalyptus, arsenic, or guaiacum will be found useful. It should be remembered that asthma may result from the rheumatic or dartrous diathesis and that it is often caused by bronchitis or emphysema, as well as by purely nervous affections. The treatment must therefore vary according to the conditions of each case.

All medicines may fail, and then a change of climate should be tried. The climate of Colorado is perhaps the most frequently beneficial to these patients, but very slight changes may be sufficient to prevent a recurrence of the attacks; therefore "each patient must be a law unto himself" in this regard. By repeated trials, the majority of cases will find some locality where they will be free from asthmatic attacks.

PULMONARY EMPHYSEMA.

Emphysema consists of dilatation of the air-vesicles, with occasionally uniform dilatation of the bronchial tubes. In the hypertrophous form, which is most common, the volume of the lungs is increased. In a rarer variety of the affection occurring only in old people, known as *senile* or *atrophous* emphysema, some of the air-cells are distended and others are destroyed, without any increase in the volume of the lung.

Emphysema is one of the bilateral diseases. In exceptional instances, however, it may be confined to one lung or to a single lobe of one lung.

SYMPTOMS.

The prominent symptoms are constant dyspnœa, associated often with the symptoms of bronchitis, or asthma, or of both.

SIGNS.

The prominent signs are: lifting of the sternum in inspiration; "barrel-shaped" chest; vesiculo-tympanitic resonance, and prolonged expiration.

INSPECTION.—In well marked cases, the countenance is dusky, the eyes prominent, the nostrils dilated, and the sterno-cleido-mastoid muscles stand out like whip-cords in their efforts to aid in respiration. The shoulders are elevated and drawn forward; the neck is apparently shortened and the individual seems to stoop, which gives him the appearance of old age. The margins of the scapulæ sometimes stand out like wings, and there is an increase in the antero-posterior diameter of the chest, giving the rounded appearance termed barrel-shaped. During inspiration, there is no expansive movement of the upper ribs, but they are elevated as if the chest-walls were composed of a single bone. In marked cases of this disease, with inspiration, there is falling-in of the soft parts of the chest above the clavicles and sternum; the intercostal spaces at the upper part of the chest are wider and more distinct than usual; and there is retraction instead of dilatation of the false ribs during inspiration. Early in the disease, these signs are not present.

In a few instances among old people, in cases known as atrophous emphysema, the intercellular septa are destroyed by atrophy and the vesicles coalesce. The volume of the lung is thereby more or less diminished, so that the disease causes no distention of the chest. In such cases, no signs would be obtained on inspection, except perhaps retraction and an increased obliquity of the lower ribs, with considerable diminution of the space between them and the crest of the ilium

PALPATION.—The apex beat of the heart is frequently found below its normal position, and nearer the median line.

The vocal fremitus may be exaggerated, diminished, or normal.

MENSURATION shows us the exact increase in the antero-posterior diameter of the chest, and the deficient expansive movement of inspiration.

PERCUSSION yields vesiculo-tympanitic resonance, which is usually most marked over the upper portion of the left lung. This is more intense, and according to Dr. Flint, it is higher in pitch than the normal resonance. Percussion over the præcordia may show the area of superficial cardiac dulness to be diminished, or the entire region may yield pulmonary resonance, due to the expansion of the border of the left lung, so that it completely covers the heart.

Deep inspiration or forced expiration will not materially affect the pulmonary resonance, as it would in health.

AUSCULTATION.—The vesicular murmur is impaired, the inspiratory sound being deferred, and consequently shortened, and the expiratory sound being prolonged, so that the ratio between the two may be reversed, making the expiratory sound equal in length to the inspiratory, or even three or four times as long. Both sounds are low in pitch. A peculiar dry, crackling sound, closely resembling fine pleuritic friction, is often heard just at the end of inspiration or at the beginning of expiration. It is produced in the walls of the air-vesicles. Harsh, blowing sounds from the bronchial tubes are often present.

Exceptional.—In rare cases, especially in the aged, the inspiratory and the expiratory sounds are of equal duration, exaggerated in intensity, harsh and tubular in quality, and high in pitch. This is probably due to atrophy of a portion of the lung tissue.

The vocal resonance may be either increased or diminished.

The heart-sounds are usually feeble, and displaced downward and inward, in consequence of the intervention of the emphysematous lung between this organ and the surface of the chest. The cardiac sounds and impulse are often abnormally distinct in the epigastric region, due to displacement of the heart and to dilatation of the right ventricle. Dilatation of the ventricle may cause tricuspid regurgitation with a valvular murmur.

DIFFERENTIAL DIAGNOSIS.

The diseases likely to be mistaken for emphysema are: dilatation of the lung from acute tuberculosis; and pneumothorax. When confined to one lung, emphysema may be mistaken for any of the diseases which usually cause feeble respiration. In such cases, the normal murmur of the sound side is liable to be mistaken for exaggerated respiration, and the feeble murmur of the emphysematous lung for the normal sounds. Error may be avoided by remembering that the feeble respiratory murmur of emphysema is characterized by *prolonged* expiration, and that the resonance over the affected lung is more marked than that of the sound side; while in nearly all diseases causing feeble respiration, from obstruction in the air-passages or from interference with the free expansion of the lung, the expiratory sound is *shorter* than the inspiratory, and the resonance is less intense than on the sound side. Emphysema of one lung, or of

a single lobe of one lung, is a rare affection; but when it does occur, great care is necessary to avoid errors in diagnosis.

Pneumothorax.—This disease, when bilateral, is differentiated from pneumothorax by the signs furnished upon inspection, percussion, and auscultation, as seen in the following table:*

Emphysema.	Pneumothorax.
Inspection.	
Prominence of both sides, especially of the antero-superior portion of the chest, with falling-in of the soft parts during inspiration.	Uniform distention of one side, no sinking-in of the soft parts during inspiration.
Percussion.	
Vesiculo-tympanitic resonance on both sides.	Tympanitic resonance on one side only.
Auscultation.	
The respiratory murmur is vesicular in quality, and expiration is prolonged.	The respiratory murmur is feeble or suppressed, or it may be amphoric.

Emphysema of a single lung is distinguished from pneumothorax by the following signs:

Emphysema of One Lung.	Pneumothorax.
Percussion.	
Vesiculo-tympanitic resonance.	Tympanitic resonance more or less intense, with absence of the vesicular quality.
Auscultation.	
The inspiratory murmur is delayed, the expiratory sound prolonged.	The vesicular murmur feeble or absent; but, if heard, regular in rhythm. The respiration may be amphoric.

Acute Tuberculosis.—Dr. Thompson states that in acute tuberculosis as numbers of the air-vesicles become filled with the tubercular deposit, the adjoining cells become distended so as to cause physical signs, especially in front, almost identical with those of emphysema. The distinctive features of the two diseases may be seen in the following table:

Emphysema.	Acute Tuberculosis.
History.	
Affection gradually developed.	Comparatively rapid accession.
Symptoms.	
Constitutional symptoms often slight.	Constitutional symptoms similar to those of typhoid fever.
Inspection.	
Cyanosis; labored expiration; chest enlarged.	Pallor; respirations rapid but not labored; chest not enlarged.

* In this, as in other tables, only the differential signs are given, those which are alike being omitted.

Percussion.

Vesiculo-tympanitic resonance more or less marked over whole chest.

Vesiculo-tympanitic resonance in front, but actual dulness behind.

Auscultation.

Expiratory murmur prolonged and low in pitch.

Expiratory murmur not much prolonged and higher in pitch than normal.

Fibrosis or Fibroid Disease of both lungs, produces some signs which are liable to cause it to be mistaken for emphysema. The distinction may be readily made from the following signs:

Emphysema.	Fibroid Disease of Both Lungs.
Inspection.	
Fixity of the chest with bulging, except in the atrophous form.	Fixity of the chest with flattening.
Palpation.	
Vocal fremitus usually diminished.	Vocal fremitus markedly increased.
Percussion.	
Vesiculo-tympanitic resonance.	Usually dulness, but occasionally resonance approaching tympanitic in quality.
Heart covered by lung tissue, as shown by resonance.	Heart uncovered, causing increased area of superficial dulness.
Auscultation.	
Low-pitched respiratory sounds, though sometimes considerable harshness from affection of the bronchi.	Absence of respiratory murmur at times. In other instances, rude respiration.

TREATMENT.

As the changes in the lung tissue in this disease are due rather to general malnutrition than to local causes, our first aim in treatment must be to improve the general condition. The remedies of most service for this purpose are tincture of iron, cod-liver oil, and occasionally small doses of quinine.

Chronic bronchitis usually co-exists, and should receive treatment similar to that mentioned when considering the latter disease. Iodide of potassium is the most serviceable single remedy in this disease. It should be given in doses of gr. v.–xx., three or four times a day for a long time. Arsenic long continued has been found beneficial. Asthmatic symptoms are to be treated as spasmodic asthma. Cough may require anodynes. Expiration into rarefied air has benefited some cases.

The patient must avoid all causes of cold or asthmatic attacks, and should live if possible in a climate where he will be most free from dyspnœa. High altitudes are not to be recommended for these cases.

LECTURE XII.

DISEASES OF THE LUNGS.—Continued.

PNEUMONIA.

Synonyms.—Peripneumonia, Peripneumonia Vera. Popularly known as lung fever or inflammation of the lungs.

There are two recognized varieties of this disease, one known as *lobar pneumonia*, in which the greater part or the whole of one lobe, or the whole lung, is affected; and the other as *lobular pneumonia*, in which the inflammation is confined to smaller portions of the lungs, consisting of a single lobule, or of groups of lobules, scattered through the lungs. According to the origin and character of the disease, its various manifestations have also been termed primary or secondary pneumonia; or bilious, gastric, typhoid, latent or walking, intermittent, hypostatic, tubercular, scrofulous, rheumatic, gouty, puerperal, or metastatic pneumonia; but these varieties, if they may be so called, require no special description. Though different cases vary more or less in their origin and in their anatomical characters, as well as in a few of their clinical features, it would only confuse us to attempt to differentiate between them by their physical signs. I shall therefore describe only lobar and lobular pneumonia, the signs of which include those of the other, so-called varieties. But I will mention, under their respective headings, special forms of the disease, and the signs which are believed to be of value in enabling us to distinguish between them.

LOBAR PNEUMONIA.

Synonyms.—Acute pneumonia; Croupous pneumonia; Acute sthenic pneumonia.

Lobar pneumonia consists of an inflammation of the vesicular structure of the lungs with accumulation of inflammatory exudation in the air-cells, whereby they are filled and rendered impervious to air.

SYMPTOMS.

The affection comes on suddenly with rigors, and fever which attains great intensity in a few hours and as suddenly subsides between the fifth and the tenth days. It is attended with pain in the side, dyspnœa, cough, clear tenacious and subsequently rusty sputa; with great prostration and often with delirium.

SIGNS.

The essential signs in the order of their occurrence are; diminished movement of the side, some dulness and crepitant râles, followed by marked dulness, bronchial breathing and

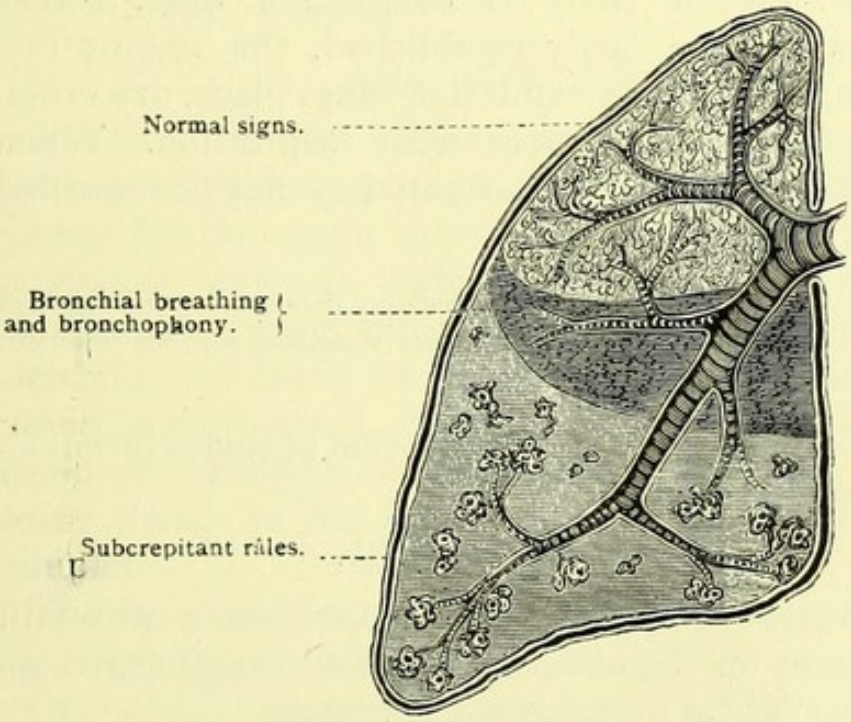


Fig. 23.

The upper lobe indicates healthy lung tissue. The middle lobe represents the second stage of pneumonia (red hepatization) and the lower lobe illustrates the third stage (gray hepatization).

bronchophony. These signs are succeeded in favorable cases by subcrepitant râles and a gradual return of the healthy signs (Fig. 23).

For the sake of convenience in description, the disease is divided into three stages, each possessing signs more or less characteristic. The *first* stage begins with the inception of the disease, and continues until the air-vesicles are completely filled. At this point the *second* stage begins, and it continues

throughout the period of consolidation, which is also known, as the stage of red hepatization. The *third* stage, or the stage of gray hepatization commences with the beginning of resolution and continues until convalescence is complete.

Signs of the First Stage.

INSPECTION.—The movements of the chest are somewhat diminished over the affected organ.

PALPATION in the early part of this stage yields only negative results; later, the vocal fremitus is increased.

PERCUSSION early in this stage elicits slight dulness, which gradually increases as the stage advances.

AUSCULTATION.—While there is congestion only, before inflammation has become fairly established, the respiratory murmur is feeble; but soon as exudation takes place, dry crepitant râles occur in great numbers with inspiration. When these râles are well marked and persistent, they may be regarded as pathognomonic.

When the inflammation is associated with inflammatory rheumatism, the crepitant râle does *not* occur. Subcrepitant râles are sometimes associated with the crepitant, but the latter greatly predominate.

As consolidation progresses, the respiration becomes broncho-vesicular and finally bronchial.

Signs of the Second Stage.

INSPECTION AND PALPATION.—The movements are still found to be deficient on the affected side, and exaggerated on the opposite side. Vocal fremitus exaggerated.

Exceptional.—Consolidation in rare instances diminishes the vocal fremitus, in consequence of complete occlusion of the bronchial tubes.

PERCUSSION.—There is perfect dulness over the affected lobe, with exaggerated resonance over the healthy portions of the lung. The line separating dulness from vesicular resonance usually corresponds to the position of the interlobular fissure, and it is not altered by changes in the position of the patient.

Exceptional.—In rare cases the density of the lung is so great that the percussion sound caused by vibration of air in the bronchial tubes is transmitted to the surface with such peculiar distinctness as to justify the appellation of tubular resonance.

In some instances of extreme consolidation, the resonance seems almost amphoric.

In such cases the solid sounds would of necessity be mistaken for hollow sounds, were it not for their pitch, which is always high instead of being low, like the proper resonance of cavities. In rare cases, flatness is found instead of dulness.

AUSCULTATION.—There are no crepitant râles, but in their place, we find bronchial or broncho-vesicular respiration, varying in degree with the amount of consolidation. There is also co-existing bronchophony and whispering bronchophony. A few moist and dry bronchial râles are liable to be heard in this stage.

Exceptional.—In rare cases a few crepitant râles may be heard in this stage. In other instances, the bronchial tubes of larger size may be filled by the inflammatory lymph so that the vocal resonance is diminished instead of being intensified, and all respiratory sounds may be suppressed.

Signs of the Third Stage.

In the early part of the third stage, the signs are the same as in the second stage, with the addition of a few subcrepitant râles. As the stage advances, the vocal fremitus becomes gradually lessened, dulness diminishes over the inflamed portion of the lung, and, upon auscultation, bronchial breathing slowly gives place to broncho-vesicular breathing, and this finally to the normal respiratory murmur. Subcrepitant râles appear early in this stage, and continue, often associated with mucous râles in the larger bronchi, until resolution is nearly complete.

The crepitant râle also occasionally reappears; it is then known as the "crepitant râle redux."

Bronchophony, which was present in the second stage, gradually gives place to exaggerated vocal resonance, and this, in turn, to the normal sounds of the voice.

DIFFERENTIAL DIAGNOSIS.

This disease is to be diagnosticated from pleurodynia, intercostal neuralgia, pleurisy, pulmonary œdema, collapse of the air-vesicles, hydrothorax, phthisis, and bronchitis.

It is not likely to be mistaken for *pleurodynia* or *intercostal neuralgia* by any one familiar with physical diagnosis, as the latter diseases yield no signs excepting those due to the pain.

Pleurisy.—From pleurisy it is distinguished by the following features:

PNEUMONIA.	PLEURISY.
First Stage.	*First Stage.*
Moderate dulness with feeble respiration. Numerous crepitant râles and exaggerated vocal resonance.	Resonance normal. Respiratory murmur feeble or absent. Ordinarily grazing or creaking friction sounds, but occasionally transitory crepitating friction murmurs, few in numbers as compared with crepitant râles. These are usually heard during three or four inspirations, and then disappear to return again in a few moments.
Second Stage.	*Second Stage.*
The vocal fremitus exaggerated. Dulness marked with no change of the upper limit by changes in the position of the patient. Bronchial respiration and bronchophony.	Vocal fremitus absent. Flatness instead of dulness. The line of flatness changes with changes in the patient's position. Usually absence of all respiratory and vocal sounds.
Third Stage.	*Third Stage.*
Subcrepitant râles are found in addition to the harsh respiration, exaggerated respiratory and vocal signs, and dulness, of the second stage.	Friction fremitus and murmur; absence of râles. Respiratory and vocal signs nearly or quite normal. More or less dulness.

Pulmonary Œdema is only liable to be mistaken for the first and third stages of pneumonia. The diagnosis is generally easily made if we recollect that œdema is a bilateral disease and that pneumonia is usually unilateral. In œdema the dulness is slight, and it occurs on both sides. In pneumonia it is marked in the third stage, and is found only on one side.

Crepitant râles are few in œdema and are nearly always associated with moist râles. In the first stage of pneumonia crepitant râles are very abundant, and they are seldom associated with moist sounds.

Subcrepitant râles in œdema are heard upon both sides and are not high in pitch or metallic in quality. In pneumonia they are found only on one side, and they are high in pitch and are usually metallic.

Œdema usually follows some protracted disease, as, for example, typhoid fever. Pneumonia is generally a primary affection.

Pulmonary Collapse or Atelectasis, is distinguished from pneumonia by the history and by the *ensemble* of the physical signs,

rather than by any pathognomonic characteristics. The points of distinction are shown in the following table:

Pneumonia.	Pulmonary Collapse.
History.	
Usually a primary affection involving only one lung.	Generally a sequel of bronchitis, often involving both lungs.
Percussion.	
Marked dulness.	Moderate dulness, frequently vesiculo-tympanitic resonance in the vicinity.
Auscultation.	
In the first and third stages crepitant and subcrepitant râles.	Few, if any crepitant or subcrepitant râles.
Second stage bronchial breathing, with exaggerated respiration over healthy lung.	Bronchial breathing over collapsed lung; prolonged emphysematous expiration near it.
Râles and other abnormal signs usually confined to one lung or one lobe of that lung.	Râles due to bronchitis over both lungs. Other signs due to collapse more apt to affect both lungs and not likely to involve an entire lobe of either.

Hydrothorax.—The distinction between pneumonia and hydrothorax is shown below:

Pneumonia.	Hydrothorax.
Unilateral dulness, and the respiratory and vocal signs of consolidation.	Bilateral flatness, with absence of respiratory and vocal signs.

Phthisis.—To distinguish pneumonia from phthisis, a knowledge of the history and the symptoms is frequently essential. Many physicians consider a case in which the signs of pneumonia have continued for more than four or five weeks to be consumption; but this rule will not always hold good. The distinctive features between these two diseases, as they ordinarily present themselves, may be seen in the following table:

Pneumonia.	Phthisis.
An acute affection usually involving the greater portion of the lower lobe of one lung and giving rise to the signs of consolidation.	A protracted disease coming on insidiously, nearly always beginning at the apex of the lung, and at first involving only a limited amount of tissue; giving rise, first, to the signs of slight and subsequently to those of greater consolidation.

Phthisis, following upon pneumonia, will be distinguished from prolonged cases of the simple inflammation by the history and by the physical signs obtained on repeated examinations.

Bronchitis cannot be mistaken for the early stages of pneu-

monia by any one familiar with physical diagnosis. The râles of the resolving stage of pneumonia might be mistaken for those of bronchitis; but there is no danger of error if we remember that the latter is a bilateral disease and causes little or no dulness on percussion, and that, when dulness does occur, it disappears after cough and free expectoration.

TREATMENT.

Within the first ten or fifteen hours from the inception of the attack, a blister will sometimes prevent further development of the inflammatory process; but patients are seldom seen by a physician early enough to allow of the use of this agent.

For the first two or three days, small doses of aconite or veratrum viride are very useful. They should be given often, in just sufficient doses to keep the pulse nearly down to its natural rate; but they must not be continued after the third day. During the same period fluid ext. of ergot should be given in doses of ʒ ss. every three or four hours.

After the second day of the disease, quinine in doses of three to five grains every three to five hours is the best anti-pyretic.

During the active stage of inflammation, large, hot, jacket poultices, enveloping the whole side, are beneficial if they can be kept constantly and thoroughly applied; otherwise they do harm. When poultices cannot be managed satisfactorily, an oil-silk jacket should be employed with warm clothing. From the very first, the patient should keep perfectly quiet, neither moving nor speaking excepting when absolutely necessary.

Very small doses of opium or moderate doses of chloral are useful to relieve pain and restlessness. After four or five days, in all cases where there is much prostration, strychnia gr. $\frac{1}{30}$–$\frac{1}{20}$ should be added to the quinine, and tincture of digitalis ♏ x., should be given three or four times a day to stimulate the heart. Alcoholics or carbonate of ammonium are required when there is much prostration. The latter is evanescent in its effects, but acts promptly. Iodide of ammonium, carbonate of ammonium, chloride of ammonium, liquor potassæ, or acetate of potassium are useful in the latter stages to favor resolution and prevent caseation. Late in the disease counter-irritation is beneficial. Cathartics and blood-letting should not be employed excepting in rare instances, in robust patients.

When patients are much prostrated and delirious, great care should be taken to prevent them from sitting up or getting out of bed, for this will sometimes cause immediate death.

LOBULAR PNEUMONIA.

Synonyms.—Catarrhal pneumonia; Broncho-pneumonia; Disseminated pneumonia. Chronic or interstitial or interlobular pneumonia is often included in this term.

This is usually a disease of childhood or of old age. It is preceded by bronchitis affecting the smaller tubes, and the inflammation is confined to small portions of the parenchyma, involving only a single lobule or group of lobules which are scattered through the lung. The nodules thus formed vary from the size of a mustard-seed to that of a walnut. They are often surrounded by emphysematous air-cells. One lung or both lungs may be involved, and either the upper or lower lobe may be affected.

SYMPTOMS.

The essential symptoms are rapidity of the pulse and of respiration; with usually great elevation of temperature, a troublesome cough and rapid emaciation.

SIGNS.

The most important signs are deficient respiratory move ments, slight and occasionally "patchy" dulness, with deficient vesicular murmur and on forced inspiration, numerous poorly defined mucous clicks. When only a limited number of lobules are affected, a diagnosis cannot be accurately made; but if several lobules are involved, the signs become quite distinct.

INSPECTION.—We will usually observe imperfect respiratory movements, with very slight expansion of the ribs, but considerable elevation of the chest-walls, especially at the upper part during inspiration; and at the same time falling-in of the soft parts of the chest and of the lower ribs, as in pulmonary emphysema. The respiratory movements are rapid; the inspiration is often shortened and the expiration prolonged.

PALPATION.—When several inflamed nodules exist, especially if they are located near the surface of the lung, palpation will discover exaggerated vocal fremitus.

PERCUSSION.—Upon percussion, dulness will be found varying in degree with the amount of consolidation. This is nearly always limited to the inferior and posterior portions of the chest, and usually occurs on both sides; but the disease may be confined to one lung or to the upper lobes of the lungs.

AUSCULTATION.—More or less broncho-vesicular or bronchial respiration with exaggerated vocal resonance and moist high-pitched râles will be found over the lower part of the lungs. At the same time, over the upper and anterior portions of the chest, we ordinarily find the signs of pulmonary emphysema, viz., vesiculo-tympanitic resonance with a prolonged and low-pitched expiratory murmur.

After protracted or repeated colds, the occurrence of a feeble vesicular murmur, with several illy-defined mucous clicks on forced inspiration, should cause us to suspect lobular pneumonia. The mucous clicks in these cases are due to retention of the catarrhal products in the air-cells.

High-pitched bronchial râles are also significant of consolidation. In children the alveoli are often completely choked, so that no râles are produced. In adults, the inflammatory products are more fluid, and consequently râles are more abundant.

The diagnosis of this disease is very difficult, unless a considerable number of lobules are affected. Even then, the disease cannot always be detected by the physical signs alone, but, as in some cases in other affections of the lungs, the history and symptoms must be weighed with the signs, before a positive opinion can be formed. For example, in a child suffering from bronchitis, if the respiration suddenly becomes accelerated, the temperature elevated, and the cough, which may previously have been loose and easy, becomes dry, paroxysmal, hacking, and painful, we have good reason to think that the vesicular portion of the lung has become involved in the inflammatory process. If in addition to these symptoms, we find the signs of consolidation which have just been enumerated, the diagnosis may be considered certain.

Lobular pneumonia is often preceded and accompanied by collapse or atelectasis, of many of the air-vesicles; for this reason the signs of the two diseases are usually considered identical. If any considerable amount of tissue is involved,

and the two conditions are not combined, a differential diagnosis can be made by attention to the following symptoms and signs.

Lobular Pneumonia.	Pulmonary Collapse.
Symptoms.	
Temperature suddenly increased; cough becomes dry and paroxysmal.	The elevation of temperature, and the cough, which are incidental to the associated bronchitis, are not materially affected by collapse of the air-vesicles.
Inspection.	
Falling-in of the lower portions of the chest which may have been noticed in bronchitis partially disappears.	The inverted action of the inferior ribs is increased in proportion to the extent of atelectasis.
Palpation.	
Vocal fremitus is increased.	The vocal fremitus is not likely to be increased, but, on the contrary, it may be diminished.
Percussion.	
Uniform dulness, or distinct patches of dulness, usually marked over the lower portions of the chest.	The dulness is not so distinct, and there is occasionally vesiculo-tympanitic resonance. The dulness usually occurs first at the border of the left lung, where it overlaps the heart; and shortly afterwards at the base of the lungs. From the latter position it has a tendency to spread upward in an elongated, somewhat pyramidal form along the lines of the intervertebral grooves, in which position it may reach as high as the apex of the lung.
Auscultation.	
The respiratory sounds are generally harsh or broncho-vesicular in quality, but they are never wholly tubular. The mucous râles of bronchitis are usually heard over the entire chest; but, in many instances, finer moist râles are obtained, limited to a small space immediately over the inflamed lobules. When the finer bronchi are dilated, as sometimes happens in this disease, the râles become coarse and somewhat metallic, if the dilatations are surrounded by consolidated lung.	The respiratory sounds usually feeble. The râles of bronchitis are less likely to be present than in lobular pneumonia, and they are seldom heard over the collapsed lobules. Sometimes deep inspirations may bring out a few crepitant râles, which are heard with three or four inspiratory acts, and then disappear.

TREATMENT.

This disease is nearly always a secondary affection, due to extension of the inflammatory process from the bronchial

mucous membrane in consequence of debility. Bearing this in mind, we will avoid all depressing remedies such as antimony, aconite, or veratrum viride, and will very early commence the use of stimulants.

Quinine is the best remedy to moderate the fever. Alcohol should be given according to the amount of depression. The rule is to give as much as can be borne without causing head symptoms. Carbonate of ammonium or iodide of ammonium are very useful, not only for the stimulation which they afford, but also for their beneficial effects in removing the products of inflammation.

Sedative inhalations are useful early in the attack, and at a later period stimulant inhalations and counter-irritation are beneficial. If the patient emaciate, chloride of calcium, tincture of iron, and cod-liver oil are indicated. A change of climate is advisable if recovery does not take place within eight or ten weeks.

PECULIAR FORMS OF PNEUMONIA.

Several somewhat peculiar forms of pneumonia merit passing consideration, though they cannot be considered as distinct varieties of the disease. These are: interstitial pneumonia, typhoid pneumonia, pneumonia secondary to typhoid fever, pneumonia due to cardiac disease, and pneumonia from Bright's disease.

The treatment of these varieties is essentially the same as that for the diseases with which they are associated, combined, as occasion may seem to require, with the resolvents and expectorants mentioned in speaking of lobular pneumonia.

CHRONIC OR INTERSTITIAL PNEUMONIA

(sometimes termed catarrhal pneumonia) will be described under the head of fibroid phthisis.

TYPHOID PNEUMONIA.

Synonyms.—Infective or pathogenic pneumonia.

This is a somewhat peculiar inflammation of the lung arising from blood-poisoning.

The symptoms are similar to those of typhoid fever or septi-

cæmia, and are occasionally prolonged for several months, with repeated remissions and exacerbations.

The only peculiar signs are: irregular subcrepitant râles, few in number, heard sometimes at the base, and sometimes at the apex of the lung. They occur during both portions of the respiratory act, and have a peculiar viscid quality.

PNEUMONIA, SECONDARY TO TYPHOID FEVER,

usually commences during the later stages of the febrile affection. It is indicated by increased rapidity of the pulse, and by accelerated respirations with signs of consolidation.

Cough and sanguinolent sputa are rarely present.

PNEUMONIA ARISING FROM DISEASE OF THE HEART,

especially when mitral lesions are marked, presents many features similar to those of lobular pneumonia. The invasion is usually slow, being seldom preceded by rigors. There is a chronic cough, with bronchial sputa, which seldom becomes rusty or tenacious. The signs may appear in scattered patches, which change their seat from day to day, but they are usually found over the lower lobes of both lungs.

There is some exaggeration of the vocal fremitus, slight dulness, and blowing though not strictly bronchial respiration, with exaggerated vocal resonance.

PNEUMONIA FROM BRIGHT'S DISEASE

may not differ materially from ordinary acute pneumonia, or it may begin in collapse of portions of the vesicular structure, and present characteristics similar to those of lobular pneumonia.

PULMONARY CONGESTION.

This consists of an engorgement of the capillaries within the lungs, and affects both sides. It possesses no distinctive physical signs unless associated with pulmonary œdema or bronchial hemorrhage.

In the congestion of the lung which immediately precedes pneumonia, physical examination reveals very slight dulness, with feebleness of the respiratory murmur and, possibly here and there, a crepitant or subcrepitant râle. This condition,

however, is not usually included under the head of pulmonary congestion.

SYMPTOMS AND SIGNS.

In the condition which is usually termed pulmonary congestion, we can only judge of the nature of the case by its history and its symptoms, taken in connection with the physical signs. For example, if a patient is attacked with sudden dyspnœa after extreme physical exertion or exposure to the influence of a rarefied atmosphere, as in high altitudes, pulmonary congestion should be suspected; and if the dyspnœa is attended with a profuse watery and blood-stained expectoration and the signs of œdema, we may be positive of our diagnosis.

PERCUSSION.—In such cases percussion reveals slight dulness over the lower portions of the chest.

AUSCULTATION enables us to hear a feeble respiratory murmur with crepitant râles, attended usually by an abundance of large and small mucous râles due to secretions in the bronchial tubes.

Accentuation of the *second* sound of the heart, at the pulmonary orifice, has been considered by some authors to be diagnostic of this affection; but this sign cannot be relied on, as it may be only relative, due to feebleness of the aortic sound; and again this accentuation is a common sign in cardiac disease.

TREATMENT.

When the congestion comes on suddenly, full doses of ergot should be given. Bleeding will be found useful in cases of extreme plethora. Dry or wet cupping is sometimes beneficial. A blister will occasionally prevent the supervention of inflammation. If the heart is weak, it should be stimulated, and if pulmonary œdema co-exist, a hydragogue cathartic should be administered.

LECTURE XIII.

DISEASES OF THE LUNGS—Continued.

PULMONARY HEMORRHAGE.

Hemorrhage into the bronchial tubes obstructs the entrance of air, and causes more or less quickening of the respiratory movements. It produces mucous râles similar to those found in bronchitis. The diagnosis must rest upon the bloody and frothy character of the expectoration, and the presence of mucous râles over that portion of the lung where the hemorrhage has taken place.

TREATMENT.

The patient should be kept perfectly quiet until all bleeding ceases.

The most efficient remedies for checking the hemorrhage are full doses of ergot, gallic acid, or acetate of lead and opium.

The hemorrhage may often be checked by the inhalation of a spray from a weak solution of liquor ferri subsulphatis—℥ x., aqua *ad* ℥ i.

PULMONARY APOPLEXY.

Pulmonary apoplexy, or hemorrhagic infarctus, is a rare affection, consisting of extravasations of blood into the lung tissue. It usually occurs in the lower lobes.

SYMPTOMS.

This accident is usually, though not invariably, attended with dyspnœa and hæmoptysis.

SIGNS.

The principal signs are: more or less dulness, feeble or bronchial respiration, and mucous râles.

PERCUSSION.—When the coagula are few in number, and small or deep-seated, percussion yields no signs; but if they are numerous, or lie superficially, dulness will be more or less marked.

AUSCULTATION.—Upon auscultation, mucous, subcrepitant, and possibly well-marked crepitant râles will be detected in and about the extravasations, until coagulation of blood has taken place. Afterwards, the respiration will be feeble or suppressed over the extravasations; or bronchial breathing and exaggerated vocal resonance may be obtained, if a large clot lies in apposition with a patent bronchial tube.

DIAGNOSIS.

The diagnosis of this affection must be based upon the history and the character of the sputa, taken in connection with the signs found upon percussion and auscultation. This condition is not likely to be mistaken for any other disease except pneumonia, from which it can easily be distinguished by the history and by the expectoration.

TREATMENT.

The treatment should be mainly directed to the cause of the hemorrhage. Removal of the blood-clot is probably hastened by the administration of iodide of potassium, or liquor potassæ or other alkalies. Counter-irritation is useful in some cases a few days after the accident. Quiet must be maintained for two or three weeks to prevent a recurrence of the attack. If pneumonia or pleurisy supervene, they should be treated essentially the same as when they occur alone.

PULMONARY THROMBOSIS AND EMBOLISM.

The first of these conditions consists of plugging of the blood-vessels, by a coagulum, resulting from some neighboring irritation. The second consists of plugging of the blood-vessels, usually by fragments, of a coagulum, or of vegetations on the surface of the mitral or aortic valves. In the former case, the pulmonary artery, or some of its branches is likely to be occluded by a clot carried from the veins in the lower part of abdomen, or of the inferior extremities; in the latter case, some of the bronchial arteries are obstructed by fragments washed from the vegetations on the mitral or aortic valves.

SYMPTOMS AND SIGNS.

The principal symptoms are sudden, severe, and sometimes paroxysmal dyspnœa, turbulent action of the heart, and pulsation of the jugular veins, from yielding of the tricuspid valve.

Exaggerated resonance is sometimes detected, owing to cutting off of the blood supply to some of the pulmonary lobules, and consequent distention of the air-cells. In the same locality, the respiratory murmur will be feeble or suppressed.

DIAGNOSIS.

Neither the symptoms nor the signs of these conditions are sufficiently well understood to enable us to make a positive diagnosis in every instance. Most reliance must be placed on the symptoms.

TREATMENT.

The treatment must be expectant.

PULMONARY COLLAPSE.

Synonyms.—Apneumatosis and Atelectasis. The latter term, though referring to the same anatomical condition, is more properly applied to air-cells which remain in the fœtal condition after birth, never becoming distended with air.

Formerly this affection was described by different authors as lobular pneumonia, carnification of the lung, catarrhal pneumonia, and so on. Lobular (catarrhal) pneumonia I have already spoken of. The term carnification should be restricted to the hardened condition in which the lung is found after having been subjected to compression by pleuritic effusions.

Pulmonary collapse or apneumatosis is a condition of the lungs in which portions of the air-cells, which have formerly been inflated, have collapsed, and returned to a quasi-fœtal state. As a result of this change, adjacent air-cells become more or less emphysematous. The affection is most frequent in early childhood. It is always preceded by inflammation of the bronchial mucous membrane, the secretions from which collect in some of the smaller bronchial tubes, where, acting as a ball valve, they obstruct the entrance of air during inspiration, but permit its escape in expiration. Ultimately the air-cells to which the obstructed bronchus is distributed, become in this manner completely emptied of air and collapsed. This may affect only a few lobules; or a great number of lobules may be implicated, and sometimes an entire lobe is involved. Usually all the lobes of both lungs are more or less affected.

Certain portions of the lung are affected most frequently.

These are: first the lower margins of the lower lobes of both lungs; then, the tongue-like prolongation of the upper left lobe, and the middle lobe of the right lung; next in order come the posterior surfaces near the spinal column, of the lower and upper lobes of both lungs.

SYMPTOMS.

The essential symptoms are: great prostration, pallor, or duskiness of the skin, which hangs in loose folds on the emaciated limbs; rapid feeble pulse and coldness of the extremities; a feeble insufficient cough; great dyspnœa, without the lividity which usually attends this symptom, and rapid respiration, rising, in young children, from sixty to eighty per minute, with an altered rhythm in the respiratory acts. In this alteration of rhythm the pause follows inspiration, and precedes expiration, instead of occurring between expiration and inspiration, as in health.

SIGNS.

The essential signs are: retraction of the intercostal spaces and lower ribs during inspiration, dulness over the collapsed lung when the apneumatosis is considerable, and feeble or absent vesicular murmur, usually with harsh or bronchial respiration over the affected parts.

INSPECTION.—By inspection we notice the rapidity of the respiration and its changed rhythm—the interval occurring between inspiration and expiration, instead of between expiration and inspiration—and retraction of the intercostal spaces and lower ribs during inspiration. This latter is a very important sign, but it must not be forgotten that it occurs in other diseases.

PERCUSSION.—In children the signs of percussion are not so reliable as in adults, but when the disease is well marked, more or less dulness will be found over the affected portions, usually first at the base of the lungs, then at their anterior borders, and finally along the spinal column. If a whole lobe is involved, dulness like that of pneumonia will be present. Not infrequently the collapsed cells are so scattered through the lungs, and the adjacent cells are so distended, that the affection may be quite extensive without giving any signs on percussion.

AUSCULTATION.—The vesicular murmur is absent over the collapsed cells, and in its stead we hear harsh or bronchial respiration.

Usually portions of the lung immediately surrounding the affected lobules remain pervious to air, so that the vesicular murmur is not entirely lost. As a result the sounds from the air-vesicles are mingled with those from the bronchi, causing broncho-vesicular respiration. Ordinarily numerous bronchial râles are present, which may completely mask the vesicular murmur.

DIFFERENTIAL DIAGNOSIS.

The diagnosis in many cases must depend mainly on the symptoms, as the signs are by no means distinctive. Whenever dulness occurs, its rapid appearance, within twenty-four or thirty-six hours succeeding the signs of bronchitis, is an element of great value in diagnosis.

Pulmonary collapse is most likely to be mistaken for pneumonia or pleuritic effusions.

Pneumonia.—In pulmonary collapse we find few if any crepitant râles which are considered pathognomonic of pneumonia. In the latter disease there is not the retraction of the chest noticed in collapse, and dulness is usually greater and the bronchial breathing more marked than in the disease under consideration (see page 125).

Pleurisy.—The distinctive features that characterize pleurisy and pulmonary collapse were considered in speaking of the former (see page 92).

TREATMENT.

In the treatment of this condition it must not be forgotten that debility is the chief factor in its production. Our treatment must therefore be supporting from the first. We must also attempt to remove the secretions from the bronchi, so as to prevent implication of other air-cells. With this in view a non-depressing emetic may be given when the debility is not very great, but it is generally unsafe to repeat it. In mild cases expectorant doses of ipecac are useful. In severe cases carbonate of ammonium or iodide of ammonium with alcoholic stimulants are indicated. Counter-irritation of the surface by means of vigorous friction or sinapisms is useful in most cases. The diet should be nourishing, but not too concentrated. Concentrated nourishment often deranges the digestive organs, and thus does more harm than good.

PULMONARY ŒDEMA.

This consists of an effusion of serum into the vesicular portion of the lungs, which renders the cells impervious to air. It is frequently associated with general dropsy. It may result from the adynamic condition following protracted fever, or it may be caused by renal or by cardiac disease, and it occasionally follows bronchitis or pneumonia.

SYMPTOMS.

The symptoms are not distinctive.

SIGNS.

The principal signs are very moist subcrepitant râles, with more or less dulness over the base of the lungs.

INSPECTION, PALPATION, AND MENSURATION yield no characteristic signs. The respirations are increased in frequency.

PERCUSSION.—Dulness is obtained on both sides over the most dependent portions of the lungs.

AUSCULTATION.—There is a feeble respiratory murmur which may be slightly broncho-vesicular, with abundant moist and crackling subcrepitant râles. These sometimes resemble the crepitant râles of pneumonia, but they are more moist, not so numerous, and usually they are heard in expiration as well as in inspiration. The vocal resonance may be increased.

DIFFERENTIAL DIAGNOSIS.

Pulmonary œdema is liable to be mistaken for the first and the third stages of pneumonia, for hydrothorax, and for capillary bronchitis. The distinctive signs between these diseases are as follows.*

PULMONARY ŒDEMA.	PNEUMONIA, FIRST AND THIRD STAGES.
Percussion.	
Slight dulness upon both sides.	Dulness more or less marked, usually confined to one side.
Auscultation.	
Mucous and subcrepitant râles on both sides.	Crepitant and subcrepitant râles on one side.
PULMONARY ŒDEMA.	HYDROTHORAX.
Palpation.	
Vocal fremitus may or may not be increased.	Vocal fremitus absent.

* Signs common to both are omitted.

Percussion.

Moderate dulness, the upper level of which does not vary with changes in the patient's position.	Flatness, the upper line of which varies with the changes in the patient's position.

Auscultation.

Subcrepitant râles.	Absence of the respiratory murmur and râles.

Pulmonary œdema is distinguished from *capillary bronchitis* by the history, by the presence of considerable dulness on percussion, and by absence of the signs of general bronchitis (see page 103).

TREATMENT.

The treatment of this condition will depend upon the disease with which it is associated. If it results from Bright's disease, sudorifics and cathartics will be necessary to stimulate the other emunctories. Diuretics will also be useful in some cases; but we must not forget that the kidneys are crippled and will not respond readily to our efforts to increase their functional activity.

If the condition is dependent upon disease of the heart, digitalis will be specially useful. If it results from debility, induced by low forms of disease, general stimulation is very essential, and diuretics and sudorifics are indicated.

If it results from pulmonary congestion, active counter-irritation by sinapisms or dry cups should be made, and diuretics, sudorifics, and cathartics should be simultaneously employed, care being taken not to exhaust the patient.

Digitalis, scoparius, acetate of potassium, and acetate of ammonium are the best diuretics. Jaborandi and the hot-air or vapor bath are the most suitable means to cause sweating.

The saline cathartics, elaterium or euonymus, may be employed when it is desired to act on the bowels.

When patients are greatly depressed from protracted disease, care should be taken to prevent pulmonary œdema by frequently changing their position from the back to the sides, and *vice versa*.

PULMONARY GANGRENE.

Pulmonary gangrene is a putrefactive necrosis of lung tissue, resulting from pneumonia, septicæmia, or local injuries. It usually occurs at the lower part of the lung, and according to Prof. Flint, on the posterior aspect of the upper portion of the lower lobe. The affection is usually confined to a few lobules, but sometimes it is diffused throughout a large portion, or even throughout the whole of a lobe.

SYMPTOMS.

The principal symptoms are great prostration, pallor, emaciation, rapid pulse, rapid and oppressed respiration, hæmoptysis, and cough with abundant greenish or brownish purulent sputa of a sickening gangrenous odor, and containing fragments of the decomposing lung. The odor is not perceived in the breath constantly, but mainly after coughing.

SIGNS.

The most prominent signs are: dulness on percussion, with large and small mucous râles; bronchial breathing or absence of the respiratory murmur, and, when the slough has been thrown off, gurgles and respiratory sounds indicative of a cavity. The disease at first presents the signs of consolidation, which are soon followed by breaking-down of the lung tissue, and the production of vomicæ.

DIFFERENTIAL DIAGNOSIS.

Most of the symptoms and physical signs are not distinctive, as the same may be found in phthisis, bronchitis, or dilatation of the bronchial tubes. The diagnosis must therefore rest upon the character and the odor of the expectoration, which may be considered pathognomonic.

Bronchitis.—Small circumscribed patches of gangrene, which occasionally occur in bronchitis, or around tubercular deposits, cause fetid breath and fetid expectoration. The odor in these cases is only temporary, whereas, in diffuse gangrene, the fetor is persistent, though most marked after each act of cough and expectoration.

Bronchiectasis.—In bronchial dilatation the sputum is abundant

and fetid, but not brownish in color, and the breath has not that peculiar, sickening odor of gangrene, which, once impressed on the olfactory sense, can never be forgotten.

TREATMENT.

Quinine, tincture of iron, alcoholics, and nourishing diet are the chief remedies in this affection. Inhalations of carbolic acid or turpentine may be useful in modifying the offensive odor and in limiting the amount of discharge. Anodynes should be used to soothe pain.

TUMORS OF THE LUNGS.

Morbid growths in the lungs result from enlargement of glands, syphilis, hydatids, abscesses, and malignant disease. These will be considered under their respective headings.

PULMONARY CANCER.

Pulmonary cancer is fortunately a rare disease; the medullary variety is the one most frequently found in the lungs. Indeed, by Boyle and Laennec, it was thought to be the *only* variety ever found in these organs.

Cancer may occur, in miliary bodies scattered throughout the entire lung, or in nodules ranging from two to ten or twelve pounds in weight; or the lung tissue may be entirely supplanted by the malignant deposit. When the disease is primary, it is very difficult to detect it. When secondary to cancer in other portions of the body, the occurrence and persistence of bronchial or other pulmonary signs should lead us to suspect its true nature.

SYMPTOMS.

The most marked symptoms are pain and emaciation, with some dyspnœa and cough, and often bloody expectoration.

SIGNS.

If only the bronchial mucous membrane is affected by the cancerous deposit, we obtain simply the signs of bronchitis. If the air-vesicles are filled, we obtain the signs of pulmonary consolidation, as in pneumonia. When softening and ulceration have occurred, cavernous signs are sometimes obtained. If

part of the air-vesicles are filled, and others remain open, we will obtain broncho-vesicular respiration and other signs similar to those of phthisis.

The occurrence of the nodular variety of cancer in the lung gives rise to signs which are often distinctive, viz., dulness or flatness on percussion over the upper or middle portions of the lung, usually with feeble or suppressed respiration, though sometimes with harsh, respiratory sounds. If the pleura is involved by the cancerous deposit, there will be an exudation of serum into its cavity, which will yield the signs of chronic or of subacute pleurisy. In the nodular variety of pulmonary cancer, we generally notice the following signs:

INSPECTION.—Upon inspection, we observe more or less loss of motion, and retraction of the thoracic walls on the affected side.

PALPATION.—The vocal fremitus will be feeble or suppressed, according to the proximity of the tumor to the chest-walls.

PERCUSSION.—There will be dulness or flatness over the tumor, according to its nearness to the chest-walls. In many instances, one or more places may be found where the resonance remains normal, surrounded by areas of flatness. This is due to the presence of a small portion of healthy lung surrounded by a cancerous mass. It is most frequently found near the middle or the upper part of the chest.

AUSCULTATION.—The respiratory sounds will be feeble or entirely suppressed over the tumor. Occasionally, the cancer rests upon a large bronchial tube, in such a position that the sounds from the latter are transmitted to the surface, giving rise to bronchial breathing and bronchophony.

DIFFERENTIAL DIAGNOSIS.

Pulmonary cancer is most likely to be mistaken for chronic or subacute pleurisy with effusion. It bears some resemblance to phthisis, and some resemblance to aortic aneurisms.

Pleurisy.—If the cancer is attended with effusions into the pleural sac, an accurate diagnosis cannot be made by the ordinary methods, but the character of the fluid obtained by aspiration will usually enable us to make a correct diagnosis.

The differential diagnosis between the nodular variety of cancer in the lungs and *chronic pleurisy* will be seen in the following table:

Pulmonary Cancer.	Chronic Pleurisy.
Symptoms.	
Nearly constant pain, and often currant-jelly expectoration.	Little, if any, pain ; the expectoration, if any, is only purulent.
Percussion.	
Dulness does not begin at the base of the lung, and there are usually one or more isolated spots of resonance within the area of dulness or flatness.	Flatness begins at the base of the lung, and is uniform until its upper limit is reached.
Auscultation.	
Usually some respiratory signs, due to isolated portions of normal lung, or to only partial consolidation of the pulmonary parenchyma.	Absence of the respiratory murmur, and usually of the bronchial sounds; the latter when heard are diffused and distant.
Aspiration.	
Sometimes a sanguinolent fluid. The fluid, when serous, coagulates much more slowly than in pleurisy.	Serous or purulent fluid is obtained.

Phthisis.—Cancer of the lung is not likely to be mistaken for phthisis, though such an error might be made. The cancerous growth does not often begin in the apex of the lung, and it may become very extensive without causing bronchial râles. The reverse is true in phthisis.

Aortic Aneurism.—The history of this affection is different, as intrathoracic cancer is nearly always secondary to external manifestations. The symptoms due to pressure, viz., pain, dyspnœa, dysphagia, and venous congestion and pulsation, are less persistent in aneurisms than in cancer.

Aneurisms usually have a distinct expansile pulsation, and when they cause a murmur, it is likely to be double, that is, systolic and diastolic. Cancers have no pulsation excepting that communicated from the aorta, and this is feeble and simply lifting. If a cancerous growth, by pressure on the artery, causes a murmur, it is always systolic, no second sound being produced.

TREATMENT.

Anodynes to relieve pain are the only remedies that can be recommended. None of the remedies which have from time to time been recommended for the cure of cancer have borne the test of experience.

ENLARGED BRONCHIAL GLANDS.

As an independent affection, this is of rare occurrence, but more or less enlargement of these glands is often found in phthisis, with which this condition has many symptoms and signs in common. This is generally a disease of childhood.

SYMPTOMS.

The prominent symptoms are: a dry, ringing and paroxysmal cough like that of pertussis, but without the whoop, with dyspnœa, and more or less pain and tenderness on pressure near the fourth or the fifth vertebra; associated with emaciation, hectic and night-sweats.

SIGNS.

The essential signs are: some tenderness on pressure in the region of the main bronchi, with dulness in the upper sternal region, and in the interscapular region in advanced cases. In some cases pressure of the enlarged glands upon the blood-vessels, causes distention of the cervical veins, and murmurs in the arteries. Pressure upon the bronchial tubes is indicated by permanent large bronchial râles; by harsh or deficient respiratory murmur; or by absence of the vesicular sound.

INSPECTION.—Frequently we find distention of the cervical veins and sometimes, though rarely, deficiency or absence of respiratory movements of one side, if the main bronchus is occluded.

PALPATION AND PERCUSSION.—Tenderness may usually be detected over the bronchial glands in the interscapular region near the fourth and fifth dorsal vertebræ. Circumscribed dulness over the enlarged glands is sometimes found. Compression of a bronchus may cause collapse of the lung with consequent uniform dulness.

AUSCULTATION.—We usually observe numerous râles and feeble or harsh respiration, or in other words the signs of consumption. Sometimes arterial murmurs may be detected. Again pressure on a bronchus may cause localized râles and feeble respiration; or it may prevent respiratory sounds in the portion of lung supplied by that bronchus. In these cases a

deep breath will frequently bring out the respiratory sound, where it could not be heard in ordinary respiration.

DIFFERENTIAL DIAGNOSIS.

This affection cannot usually be distinguished from phthisis, but in some instances, a reasonably certain differentiation can be made by remembering that the disease under consideration occurs at an earlier age than phthisis, and that the pain, tenderness and dulness which it induces are first found in the region of the bronchial glands, instead of over the apex of one lung.

TREATMENT.

Treatment is usually of little avail in this disease, but the remedies which are most beneficial in scrofulous enlargement of the superficial glands should be tried. Iodine, iodide of potassium, chloride of calcium, and cod-liver oil may be used; with quinine to relieve fever, or iron when fever is not present.

The diet should be plain but nutritious, and all the patient's surroundings should be made as healthful as possible.

PERTUSSIS OR WHOOPING COUGH.

This is a spasmodic affection, the result of contagion or of epidemic influence, and mostly confined to children. The affection is characterized by frequent paroxysms of convulsive cough which is followed by a peculiar stridulous inspiration or *whoop*. The paroxysms recur with varying frequency—during the height of the attack from fifteen minutes to two hours apart. The cough is attended with vomiting in most cases. The matter expectorated consists of clear tenacious mucus. Similar matter is usually expelled by the acts of vomiting. Blood is sometimes expectorated or vomited.

This peculiar cough is usually preceded by a nasal or a bronchial catarrh of eight or ten days' duration. Ordinarily a mild form of bronchitis attends the affection throughout its entire course, and it is likely to outlast the paroxysmal attacks.

Not infrequently, acute bronchitis or broncho-pneumonia is developed in the course of the disease.

The peculiar cough usually continues for several weeks, when the whoop ceases. In rare cases, it may continue much

longer. In exceptional instances, the attack is followed by the development of tubercles in the lungs.

DIAGNOSIS.

The diagnosis rests upon the peculiar character of the cough. Affections of the bronchial mucous membrane, or of the pulmonary parenchyma, which are frequently developed during the course of pertussis, yield the same signs as when they occur independently.

TREATMENT.

Many "specifics" have been recommended for this disease, but they have generally been found of very little service.

Morphia and chloral given in doses suited to the age of the patient seem to me the most potent remedies in alleviating the suffering and moderating the severity of the paroxysms.

In many cases a few doses of these will prevent further recurrence of the paroxysms. The prescription recommended for asthma represents the proper dose for an adult (Form. 3).

Sulphate of quinia in large doses, given in solution so as to make the strongest possible impression on the sense of taste, has been highly recommended, and, according to reports in the current medical literature, will cure the majority of cases in a few days; but my own experience with it has been unsatisfactory.

My experience with the preparations of Anemone Pratensis and Œnothera Biennis has been very limited but never satisfactory.

LECTURE XIV.

DISEASES OF THE LUNGS—Continued.

PULMONARY PHTHISIS.

Under this head may be grouped several affections, differing somewhat in their anatomical characteristics, but closely resembling each other in their physical signs. From this latter fact, these affections are often treated of as one and the same disease. This renders it especially appropriate for us, in the matter of diagnosis, to consider them together. Therefore, when I speak of phthisis, I include within the scope of that term, all those chronic, wasting affections which are attended with exudation or infiltration into the pulmonary parenchyma, causing consolidation, and attended or followed by more or less induration and contraction; and subsequently by breaking down of lung-tissue. This I do whether these diseases be the result of a simple inflammatory affection, or be the cause or the result of tubercular infiltration. The term pulmonary phthisis will therefore include fibroid phthisis and the ordinary acute and chronic forms of phthisis, or of pulmonary consumption. Any special symptoms or signs which are of value in differentiating between these various conditions will be separately considered.

Fibroid phthisis is also known as cirrhosis, induration, or fibroid degeneration of the lung; sometimes as chronic catarrhal pneumonia, and occasionally as bronchiectasis. This latter term relates to dilatation of the bronchial tubes, the signs of which we have already considered.

The ordinary forms of phthisis have also been variously named, as chronic croupous pneumonia; chronic catarrhal pneumonia; cheesy or tuberculous infiltration of the lung; chronic tuberculosis; and pneumonic phthisis.

Clinically, these disease cannot usually be differentiated, and their pathology does not properly fall within our consider-

ation. The views entertained on the pathology of the various forms of phthisis, to-day, by a portion of the profession are not those which were generally accepted a few years since, and they are themselves likely to be supplanted by others within the next decade; therefore, we may well avoid this difficult subject until pathologists can more nearly agree. As has been aptly said, "This disease must not be looked upon as a single disease, beginning invariably in the same way, and continuing in one uniform course, but must rather be looked upon as the terminus to which any pulmonary disease may converge, and the vortex in which all may end."*

SYMPTOMS.

The ordinary symptoms of this disease are only too well known, even by the laity. Few there are who have not noticed among their immediate friends, the bright and suffused eye, hacking cough, progressive emaciation, hæmoptysis or purulent sputa, the hectic flush and the night-sweats, of this dread disease.

SIGNS.

The signs differ in various stages of the affection, the most important being: diminished movement and sinking in of the chest-walls in the infra-clavicular region, with dulness on percussion; and at an early stage, feeble respiration, or subcrepitant râles confined to one apex; followed by broncho-vesicular respiration, exaggerated vocal resonance, metallic râles, and the signs of cavities.

Phthisis is generally described as having three stages, but these run imperceptibly into each other, so that the signs of two or of all of them are likely to be combined at one time in the same individual. The stages, therefore, cannot be sharply delineated, and I think an attempt to describe the signs of each separately would only lead to confusion.

The stages of phthisis consist of, first, the incipient stage; second, the stage of more complete deposition, occasioning consolidation and retraction; and third, the stage of softening with breaking down of lung-tissue and the formation of cavities. The pulmonary lesions occur with about equal fre-

* R. E. Thompson, Physical Examination of the Chest.

quency on the right and on the left side of the chest, and almost always they are to be found at the apex of the lung.

INSPECTION AND MENSURATION yield no signs in the early stage of this disease, except increased rapidity of the respiratory movements; but after a few weeks, in the second stage, in addition to the rapid respirations, we observe more or less loss of motion, with sinking in of the chest-wall over the affected organ, especially during deep inspiration. Later on, in the last stage of the disease, there is marked emaciation, with prominence of the clavicles due to the sinking in of the tissues above and below them; loss of motion becomes more distinct, and there is depression of the chest-walls, usually in the infra-clavicular region.

Exceptional.—In exceptional cases, cavities may exist in the apices of the lungs without any considerable depression of the chest-walls or diminution in their movements.

PALPATION.—Early, this method furnishes no signs. As soon as any considerable amount of consolidation has taken place, the vocal fremitus is likely to be increased, but this sign is variable, and therefore not reliable. Sometimes gurgling fremitus is detected, over superficial cavities.

Exceptional.—Shrinking of the affected lung may drag the heart a short distance from its normal position, as indicated by the site of its apex beat. The formation of a large cavity occasionally causes bulging of the portion of the chest which was formerly depressed.

PERCUSSION.—In the first stage of this disease, there is slight dulness, if the superficial portions of the lung be affected; but if only the deeper structures are involved, this sign may not be obtained.

Dulness, when slight, is best obtained with the patient's mouth open, and the difference in the resonance of the two sides can be most easily recognized at the end of a full inspiration.* In this connection, it must be constantly borne in mind that moderate dulness is frequently a normal sign over the right apex, and that other diseases than phthisis, as, for example, bronchitis and circumscribed pneumonia, not infrequently cause temporary dulness in the infra-clavicular region.

* Prof. H. A. Johnson, of this city, informs me that he has sometimes obtained excellent results, in obscure cases, by listening with the ordinary binaural stethoscope, the chest-piece of which is held by the patient about two inches in front of his open mouth, while percussion is being made on the chest.

Dulness over the left apex, even though slight, is always abnormal, and when persistent, it is nearly always a sign of phthisis. Marked dulness, if persistent, has the same significance when found over the right apex. This sign is sometimes found behind, when it cannot be detected in front. It is frequently present in the supra-clavicular or in the clavicular region, when it cannot be obtained below the clavicle.

Exceptional.—In the first stage of phthisis the resonance is sometimes vesiculo-tympanitic, on account of secondary circumscribed emphysema.

Consolidation of the deeper portions of the lung may cause no dulness upon ordinary percussion, if healthy lung tissue intervene between it and the surface. In forcible percussion a small amount of consolidation at the surface of the lung may be overlooked, in consequence of the intense resonance from the deeper tissues.

It should be remembered in estimating the amount of phthisical consolidation that the degree of dulness and its area may be due to the consolidation of circumscribed pneumonia, which is temporary. The extent of phthisical consolidation in such cases can only be ascertained after the inflammatory product has been absorbed.

In the second stage of phthisis dulness becomes very marked, and gradually extends over a wider area, owing to progressive consolidation in the lung. Up to this time, dulness is almost universally confined to one side. At the same time, tubular—or according to Prof. Flint "tympanitic"—resonance may be caused by the bronchial tubes or the trachea, especially when percussion is made near the borders of the upper part of the sternum.

Exceptional.—In this, as in the first stage, vesiculo-tympanitic resonance may be obtained in rare instances.

In the *third stage*, dulness is obtained over the affected lung, unless cavities of considerable size exist near the surface. In this case, the resonance over a limited portion, surrounded by dulness and corresponding to the cavity, may be tympanitic, amphoric, or "cracked pot" in character. Sometimes early in the morning dulness or flatness may be obtained over a cavity, owing to its being filled with secretions, which will give place, after free expectoration, to the signs of a vomica. In this stage, or in the latter part of the second stage, dulness nearly always appears at the apex of the opposite lung, where

it can be detected by comparing the resonance over the diseased structure with that below the second or third rib.

AUSCULTATION.—Among the first signs of this disease to be detected by this method are feeble, or "cog-wheel" respiration, with subcrepitant râles, limited to a small portion of the apex of one lung. Occasionally the mucous click or a few crepitant or sibilant râles, or crumpling or friction sounds, may be heard in the same locality. Broncho-vesicular respiration is obtained a little later. The heart-sounds are heard with abnormal intensity over the affected lung; if the consolidation be upon the right side, the first sound of the heart will be most distinct; if upon the left, the second sound is more intense than the first.

In the first stage, the exaggerated bronchial whisper is a sign of considerable value, and exaggerated vocal resonance can usually be obtained.

At a later period, in the second stage, broncho-vesicular respiration becomes distinct, the respiratory sounds are harsh and tubular in quality, and the expiratory murmur is prolonged and high-pitched. There are also large and small, moist, crackling, or metallic râles, which are often sticky in character, and not affected by coughing. Friction sounds are often present, due to circumscribed pleuritis, caused by the tubercular deposit in the pleura. In a few cases, subcrepitant or sibilant, and occasionally sonorous râles, may still be heard in the second stage, limited to a small space over the affected tissue. Râles are generally most abundant in the morning, before free expectoration has taken place. Vocal resonance, with the whispered or the loud voice, is now exaggerated or bronchophonic. In some cases, when the consolidated lung immediately surrounds a large bronchial tube, pectoriloquy may be obtained.

During the latter part of this stage, the signs of incipient phthisis usually appear at the apex of the opposite lung.

In the third stage, when cavities have formed in the lungs, if they are empty and are connected with a bronchial tube, cavernous or broncho-cavernous respiration will be detected. True cavernous respiration, of a soft blowing or puffing character, and of low pitch, is one of the very rare signs of phthisis. Broncho-cavernous respiration, having much of the bronchial element, still with a hollow quality strongly suggestive of a cavity, is heard in nearly every case. Amphoric respiration is

found in exceptional instances only. Associated with these signs we usually hear numerous râles and gurgles with bronchophony, pectoriloquy, or cavernous voice, and occasionally metallic tinkling and amphoric voice. The signs of the second stage also are generally present.

If cavities are filled with fluid, none of the ordinary signs of the third stage may be obtained. Small cavities located in the deeper portions of the lungs are not easily detected.

In advanced phthisis, we may reasonably conclude that a cavity exists whenever the respiratory and vocal sounds over a small space, and limited to it, are peculiarly intense and bronchial in character, and associated with metallic râles.

FIBROID PHTHISIS.

Synonyms.—Fibroid degeneration of the lungs; Fibrosis; Chronic pneumonia; Interstitial pneumonia; Cirrhosis or Scirrhus of the lung; Induration of the lung.

This disease usually results from the extension of chronic inflammation from the bronchial mucous membrane, which causes hyperplasia of the intercellular and interlobular connective tissues, with increase in the substance of the lung and corresponding diminution of its air cavities. In this form of phthisis, there is no exudation into the air-cells such as occurs in croupous pneumonia. The new-formed tissue at length consolidates and contracts, forming an indurated or callous tissue, less in bulk than the original healthy lung substance. In the mean time the bronchial tubes often become dilated, and ultimately the tissue breaks down, with or without the deposition of tubercle, and cavities are formed. The progress of this affection is not so rapid as that of the more common form of consumption, but its symptoms and its signs are usually much the same, except that the symptoms do not appear commensurate to the pulmonary lesions, as indicated by the physical signs. However, in well-marked cases the signs are tolerably distinctive, as I shall presently point out.

INSPECTION.—Flattening of the chest-wall, over the affected part, and depression of the shoulder are observed.

PALPATION.—Vocal fremitus is exaggerated. The heart is dislocated more or less toward the affected side, as shown by the position of the apex-beat.

PERCUSSION gives dulness over the affected side. Exaggerated resonance is found on the sound side, and it sometimes extends, in consequence of the distention of the healthy lung, from two to four inches beyond the median line upon the affected side.

AUSCULTATION.—We obtain bronchial breathing and bronchophony, with or without bronchial râles. The vesicular murmur is feeble or absent.

MILIARY OR ACUTE TUBERCULOSIS.

This disease is attended by no physical signs unless the mucous membrane lining the air passages is involved, and then there are no signs except those of bronchitis. The diagnosis in such cases must rest upon the history and symptoms, and the exclusion of other pulmonary affections.

DIFFERENTIAL DIAGNOSIS.

Discrimination between the various forms of phthisis is often impossible, and is always attended with more or less uncertainty. The principal features which are supposed to be of value in distinguishing between them may be seen in the following table:

FIBROID AND OTHER VARIETIES OF SIMPLE INFLAMMATORY PHTHISIS.	CHRONIC TUBERCULOSIS OR THE ORDINARY FORM OF PHTHISIS.	ACUTE MILIARY TUBERCULOSIS.
	History.	
The constitutional symptoms come on slowly, and are less severe than would naturally be expected from the condition of the lung, as indicated by physical signs.	The constitutional symptoms come on more rapidly, and are graver than would be expected from the physical signs.	The disease is ushered in with chills and fever without complete remissions, and there is rapid accession of grave constitutional symptoms, which cannot be accounted for by the signs of bronchitis, which are the only physical signs to be obtained.
	Symptoms.	
The fever is intermittent, with an afternoon or evening elevation in temperature of from one to two degrees.	The fever continues with constant elevation of temperature, but no marked exacerbations.	Fever remittent, temperature often highest in the morning, but seldom rising above 103½° F.
Diarrhœa is not common.	Diarrhœa usual.	

Physical Signs.

Rapid respiration, and signs of consolidation upon palpation, percussion, and auscultation, usually extending over a large part of the lung.	Rapid respiration, physical signs of consolidation less marked and limited to a smaller area than in the preceding variety.	Rapid respiration, with usually the signs of bronchitis, and ordinarily no signs of consolidation, but occasionally slight dulness.

INFECTIVE PHTHISIS.

This name has been proposed for that form of phthisis which not infrequently affects those who have been for a long time exposed to the exhalations of phthisical patients. According to Dr. Thompson, this is a peculiar condition, simulating chronic blood poisoning, in which the general disturbance is out of all proportion to the pulmonary affection, which is not established until some months afterward.

SYMPTOMS.

There are usually present depression, loss of appetite, intermittent chills, emaciation, night-sweats, diarrhœa, and often vomiting, and late in the disease, cough.

SIGNS.

The signs are said to differ from those of ordinary phthisis in being entirely insufficient to account for the constitutional disturbance, and in often occurring early in both lungs. The distinctive signs, if there be any, are slight instead of marked dulness, and *viscid* sub-crepitant râles.

DIAGNOSIS.

The diagnosis will rest on the history and the presence of grave symptoms, which cannot be adequately accounted for by the physical signs.

TREATMENT OF PHTHISIS.

Pulmonary phthisis, whether of the simple inflammatory types, catarrhal, or fibrous; or whether of the chronic tuberculous form, or of the acute tuberculous or infective varieties, requires essentially the same treatment. However, slight modifications of the general plan are advisable when the lesions are simply of an inflammatory character, and the treatment of acute tuberculosis can seldom or never be more than palliative.

The most important remedies in the treatment of this disease

are alcohol, cod-liver oil, chloride of calcium, quinine, and iron, with proper climate.

Alcohol should be used in large quantities, as much as can be borne without being felt in the head, providing it does not derange digestion or cause elevation of temperature.

Cod-liver oil should be given to those patients who can take it without disturbing their digestion, in doses of a teaspoonful to a tablespoonful, three times a day. They should always commence with small doses. Whenever cod-liver oil cannot be borne it may be substituted by cream or maltine. The latter is usually preferable to oil during warm weather.

Chloride of calcium is a remedy of undoubted value in many cases. I have found it more serviceable than the hypophosphites of calcium or sodium. The dose is from ten to twenty, or even thirty grains, three times a day. I usually dissolve it in a small quantity of water, and combine it with the cod-liver oil. By shaking the bottle before the medicine is poured out, the two can be thoroughly mixed. It may be added to an emulsion of cod-liver oil prepared as directed in Form. 4.

Quinine is the best remedy for relieving hectic fever. It will usually prove efficient when given in the same manner as for intermittent fever. It acts most promptly when given in one or two large doses, a couple of hours before the fever is expected. It should be continued in this manner until the temperature falls or cinchonism appears. The cases in which this remedy fails to check the fever are generally considerably benefited by it.

Iron is a valuable remedy in this disease, but it must not be given when there is much fever, for it aggravates this symptom.

Belladonna is the best remedy for checking the night-sweats. Six minims of the tincture of belladonna, or the one hundred and twentieth of a grain of atropia, at bed time, is sufficient in the majority of cases, but the dose may be increased to twice this amount, and repeated two or three times daily if necessary.

Tonic doses of the bichloride of mercury—gr. $\frac{1}{24}$—$\frac{1}{16}$,—will be found beneficial in some cases, especially those of a chronic catarrhal or fibroid character. The same may be said of arsenic, but this must not be given when there is much fever.

When there is a suspicion of syphilitic origin of the disease, iodide of potassium should be tried.

Sedative troches (Form. 21–24) and sedative inhalations of benzoin, opium, or chloroform are useful in allaying the cough (Form. 34–40).

Stimulant inhalations are frequently serviceable in the early stages of the inflammatory varieties of the disease, but they are likely to do harm when there are tubercular deposits. For this purpose, iodine, carbolic acid, creasote, or oil of white pine, are most frequently used (Form. 43, 49, 50, 57, 80).

Cough mixtures are necessary especially late in the disease, but they should be given as sparingly as possible. Of these perhaps the most serviceable consists of morphia and carbonate of ammonium (Form. 5). Sedative troches and inhalations are preferable to cough mixtures when they will answer the purpose.

The neuralgic pains which often trouble phthisical patients are best prevented by regular and vigorous frictions of the surface with a coarse towel. When severe, they are usually promptly relieved by hot applications to the surface. These applications should be as hot as can be borne and should be frequently repeated until pain subsides.

Counter-irritation is useful especially in cases of an inflammatory character, that is, those cases growing out of pneumonia, bronchitis, or pleuritis, before tubercles have been deposited.

I frequently employ for this purpose an ointment composed of tartar emetic, croton oil, cantharides, stramonium, and camphor (Form. 6). It is an effectual and almost painless counter-irritant. Burgundy pitch plasters, croton oil, iodine or blisters may be used for the same purpose.

The digestive functions must receive careful attention. Nutritious and easily digestible diet of varied character should be ordered.

Climate.—Change of climate is often the most efficient remedy in these cases, especially in the early stage of the disease. As a rule, a warm dry atmosphere should be selected, but this will not be best for all patients. Those whose former experience shows that they have felt best in cold weather should be sent to northern regions. Those who feel best in warm weather will do best in southern latitudes. A few persons feel best in a damp atmosphere, but this must be con-

sidered as an exception to the rule. A few questions will generally enable the physician, in individual cases, to decide upon the climate to be recommended.

A high altitude is generally most beneficial in the early stages of the disease, but later, moderate elevations are better.

For a cool, dry climate with moderate elevation, patients may be sent into the northern part of Minnesota or of Dakota. For a warm dry climate, with moderate elevation, inland portions of Southern California, the Western portion of Texas or certain parts of Kansas, Tennessee, Georgia and South Carolina will be found beneficial. Colorado and Wyoming Territory afford the most suitable places of abode for those who require a dry or mild climate with high altitude. Mild moist atmospheres at low or moderate elevations are found in Cuba, the Bahama or Bermuda islands or on the Eastern Coast of Florida. Long sea-voyages are sometimes useful in the first stage of the disease. Whatever climate is sought, it is of the highest importance for patients to be able to take daily outdoor exercise, to breathe a pure atmosphere night and day, to be protected from all causes of colds and to be supplied with nutritious diet. Patients in the later stages of the disease usually live most comfortably in warm climates at low altitudes, but they should not be sent away from friends and the comforts of a home to die among strangers and the gloomy surroundings of a health resort.

BROWN INDURATION OF THE LUNG.

This affection, which seems to arise from a varicose condition of the pulmonary veins, is generally dependent on disease of the mitral valves. It consists of induration of considerable portions of the lungs, usually radiating from the main bronchi. The blood-vessels are swollen and tortuous, the alveolar walls are swollen, and the air-vesicles are partially filled with cells and blood pigment.

SYMPTOMS.

The symptoms are those of cardiac disease, with cough and hæmoptysis.

SIGNS.

The principal sign is dulness, limited mostly to the second intercostal space near the sternum.

INSPECTION and MENSURATION yield no signs.

PALPATION.—Exaggerated vocal resonance is almost always obtained.

PERCUSSION gives dulness, especially in the regions near the main bronchi.

AUSCULTATION reveals broncho-vesicular or bronchial respiration, and bronchophony, with occasionally pectoriloquy.

DIFFERENTIAL DIAGNOSIS.

This affection may be distinguished from other pulmonary diseases causing consolidation by the position of the dulness and by the presence of the signs of cardiac disease.

TREATMENT.

The principal treatment consists of such measures as will most effectually relieve the heart disease which causes this affection. Carbonate or chloride of ammonium and moderate doses of digitalis are specially indicated. Alcoholic stimulants may also be found useful. Counter-irritants, such as cupping and iodine, are sometimes beneficial.

SYPHILITIC DISEASES OF THE LUNGS.

It is a well-recognized fact that syphilis causes tubercular disease of the lungs, the signs of which in no way differ from those of ordinary phthisis. Cases are occasionally observed in which a specific form of bronchitis, or gummata occur as a result of the venereal taint.

The signs of syphilitic bronchitis are the same as those of the non-specific affection. A distinction between the two can only be made by attention to the history and the attendant symptoms.

DIFFERENTIAL DIAGNOSIS.

The differential diagnosis between syphilitic disease of the pulmonary parenchyma and phthisis is extremely difficult, and often impossible. But when uncomplicated, pulmonary syphilis usually differs from phthisis, as shown in the following table:

SYPHILITIC DISEASE OF THE LUNGS.	PHTHISIS.
History and Symptoms.	
The history of syphilis; thickening of the periosteum and perichondrium over the inner end of the clavicles, and one or	No history of syphilis; no thickening of the periosteum or perichondrium over the clavicles or cartilages of the upper ribs,

more of the cartilages of the upper ribs, with sub-sternal tenderness on pressure over the upper part of the sternum. Usually neither fever nor decided emaciation, and no hæmoptysis.

and no sub-sternal tenderness. Hectic fever and marked emaciation always present, with usually hæmoptysis.

Physical Signs.

Dulness over the nodules, usually confined to one lung, and found at its base or at the lower part of the upper lobe. The dulness remaining circumscribed for a long time. Viscid subcrepitant râles, or several mucous clicks, diffused over a considerable portion of the lung, are believed to be one of the earliest indications of the syphilitic affection; later the auscultatory signs are the same as those of phthisis.

Dulness usually at the apex, and gradually extending over the surrounding lung.

TREATMENT.

Antisyphilitic constitutional remedies, such as iodine, iodide of potassium, or small doses of the bichloride of mercury, are indicated. We should also employ tonic and supporting measures, similar to those recommended in pulmonary phthisis.

HYDATIDS OF THE LUNGS.

This is a rare affection, which presents symptoms and signs similar to those of phthisis. The cyst most frequently occupies the right lung. Commencing within the lung it gradually enlarges, and compresses the pulmonary tissues about it.

SYMPTOMS.

The symptoms are like those of phthisis, viz., emaciation, night-sweats, cough, dyspnœa, and expectoration of bloody and purulent sputa. Finally, hydatid cysts, or portions of them, and the hooklets of the echinococci are thrown off.

SIGNS.

The principal signs are: bulging and loss of motion of the side, nodular prominences in the intercostal spaces, and when the cysts approach the surface of the lung, dulness or flatness on percussion, and suppressed respiration or tubular breathing. A positive diagnosis can seldom be made until the hooklets of the "echinococcus hominis" are discovered in the sputum. This does not occur until late in the disease, when, after death of the *entozoon*, it begins to be ejected from the body.

According to Dr. Bird, the diagnosis may be made with a fair degree of certainty early in the disease, if the cyst is of any considerable size and impinges against the chest-wall. In such cases the following signs have been noticed:

INSPECTION AND MENSURATION.—Decubitus is always on the sound side. The respiratory movements of the affected side are deficient, and there may be slight bulging in one or more places, forming irregular nodular swellings in the intercostal spaces, over the cysts; which are usually found in the axillary or infra-clavicular regions.

PALPATION.—Vocal fremitus may be absent, and fluctuation can sometimes be detected over the cyst.

PERCUSSION.—Flatness is found over a limited area corresponding to the cyst. In order to be of value in diagnosis this area of flatness should not be less than three or four inches in diameter. It should have a rounded outline, and it must be clearly separated by a line of demarcation from the surrounding resonance.

AUSCULTATION.—There is absence of the respiratory murmur over the area of flatness, and normal respiration around it, immediately beyond the line of demarcation. The compressed lung close about the cyst may cause a more or less tubular sound.

DIFFERENTIAL DIAGNOSIS.

This affection is liable to be mistaken for phthisis or circumscribed pleurisy; and, as already stated, a positive diagnosis cannot often be made until the hooklets of the echinococci are found. Attention to the differential characters noted in the following table will aid in making the diagnosis.

HYDATIDS OF THE LUNGS.	PHTHISIS.
Inspection.	
Prominence of the intercostal spaces.	No prominence of the intercostal spaces.
Palpation.	
Absence of fremitus, and perhaps fluctuation over the cyst.	Exaggerated vocal fremitus; no fluctuation over the consolidated lung.
Percussion.	
Flatness over the cyst sharply defined by a line of demarcation from the resonance of the surrounding healthy structure.	Dulness over consolidated lung, gradually fading off into normal resonance.

Auscultation.

Absence of respiratory murmur over cyst (flat area).

Broncho-vesicular respiration, or cavernous signs over dull area.

The distinctive features between this disease and pleurisy are as follows:

Hydatids of the Lungs.	Circumscribed Pleurisy.
History.	
Usually located in the infra-clavicular or axillary regions.	Usually located at the base of the chest.
Symptoms and Signs.	
Gradual accession of the local and constitutional symptoms.	Usually ushered in with acute febrile symptoms.
Inspection.	
Nodular prominence of intercostal spaces.	Uniform prominence of intercostal spaces.
Percussion and Auscultation.	
Signs usually in the upper part of the chest.	Signs generally in the lower part of the chest.

TREATMENT.

As the disease can seldom be distinguished from phthisis, the treatment must generally be the same as for the latter. In those cases where the disease can be positively diagnosticated, aspiration of the cyst and injection with iodine is the most rational treatment (Form. 7).

THE HEART AND AORTA.

LECTURE XV.

ANATOMY, RELATIONS, AND PHYSIOLOGY.

A knowledge of the anatomy and physiology of the heart is so essential in making a correct diagnosis, that before proceeding to the consideration of the means for detecting its diseases I will direct your attention briefly to the normal conditions of the organ.

The heart is a hollow muscle of a conical form, which may be termed the centre of the circulatory system. Its function is to distribute blood throughout the entire body.

The heart is held in position by means of the large blood-vessels springing from its base, and it is enclosed in a fibro-serous sac which is so attached to the diaphragm and great vessels as to prevent the organ from rolling about in the chest.

The heart is located near the central portion of the chest, sheltered in front by the sternum; posteriorly it is protected by the thick chest-walls, and by the spinal column; and laterally it is guarded from all shocks by those soft air-cushions, the lungs. It is placed with its long axis obliquely to the perpendicular axis of the chest, so that the base is directed upward, outward, and backward, toward the right shoulder; and the apex downward and forward.

The pericardium which envelops this organ is a fibro-serous sac, the external layer of which is fibrous and the internal serous. The external layer encloses the arteries for about two inches from the base of the heart, and is continuous with their external covering. From this point it passes downward about the sides of the heart to be attached to the diaphragm. The serous portion of the pericardium envelops the heart completely, and covers the blood-vessels springing from its base for about two inches. It is then reflected upon the inner surface

of the fibrous layer, and passing downward it finally covers the upper surface of the diaphragm, beneath the heart, thus forming a closed sac similar to that surrounding the lung. The two surfaces of the pericardium are constantly in apposition during health. They are moistened by thin serum, which prevents any friction during the action of the heart. The pericardium extends from the level of the second to that of the seventh left costal cartilage. It is farther from the chest-walls superiorly than inferiorly.

The heart, with its overlying pericardium, is in relation: anteriorly, with the anterior border of the lungs and with a small portion of the thoracic walls, from which it is separated by a small amount of areolar tissue; laterally, with the lungs covered by the pleuræ; and posteriorly, upon each side, with the lungs and pleuræ. In the middle line posteriorly this organ lies near the spinal column, from which it is separated by cellular tissue and the aorta and œsophagus.

The heart is about the size of its owner's fist, averaging in weight about ten ounces. In females it ranges from eight to ten ounces, in males from ten to twelve. The anterior surface of the organ is convex; the posterior surface is flattened; the right border is long, thin, and sharp, and the left border, short, thick, and rounded. Running longitudinally about the heart is a well-defined fissure, which is found upon the anterior surface, within half or three quarters of an inch of the left border of the organ, and on the posterior surface, a similar distance from the right border. This fissure lodges the coronary arteries, which supply the heart with blood; and it indicates the position of the septum, which divides the right side of the heart from the left. Near the base of the heart is found a transverse fissure, which, however, is deficient in front on account of the origin of the pulmonary artery in that position. This fissure indicates the position of the septum between the cavities at the base and the cavities at the apex of the heart.

Cavities of the Heart.—By these septa, the heart is divided into four cavities. Those at the base are known as the auricles, one of which belongs to the right and the other to the left side of the heart. Those at the apex are known as the right and left ventricles. These cavities are of nearly equal size, each being capable of containing about two ounces. The

walls of the cavities upon the right side are thinner than those upon the left, because their work is easier; and the walls of the auricles are much thinner than those of the ventricles.

The right auricle receives the blood from the venous system, through the ascending and descending venæ cavæ; and transmits it through the auriculo-ventricular opening, into the right ventricle, which contracting forces the blood onward through the pulmonary artery into the lungs. The left auricle receives the blood from the pulmonary veins, and transmits it to the left ventricle, whence it is distributed, by the aorta and its branches, throughout the entire body.

VALVES.—The internal surface of the heart is lined by a glistening membrane, known as the endocardium, folds of which at the various orifices constitute the valves. At the orifice between the right auricle and the right ventricle, we find three valves which are named the tricuspid. At the orifice of the pulmonary artery are three valves known as the pulmonary semilunar valves. At the aorta we have a similar number, called the aortic semi-lunar valves. At the orifice between the left auricle and ventricle are two folds known as the mitral valves.

RELATIONS OF THE HEART TO THE SURFACE.

The greater portion of the heart lies beneath the lower part of the sternum, but the right auricle, and a small part of the right ventricle, extend from one half to three fourths of an inch to the right of the sternum; and the ventricles extend about two inches to the left of this bone (Fig. 1, page 3).

The auricles are on a line with the third ribs, the right auricle extending considerably beyond the sternum into the third interspace upon the right side, and the left being located beneath the third left costal cartilage and intercostal space. The left ventricle lies mainly beneath the right; that part of it which is superficial is found entirely to the left of the sternum. The greater portion of the right ventricle lies beneath the lower part of the sternum; but a small part of it, at the base, extends to the right of the sternum, and its apex is found to the left of this bone, in the triangular space existing between the sternum and the margin of the left lung. The base of the

heart extends to the upper margin of the third rib, and its apex to the space between the fifth and sixth ribs, about half an inch within the mammillary line, and two or two and a half inches to the left of the sternum. The position of the apex is not exactly constant, as it changes more or less with the respiratory movements and the position of the patient. It is said that the apex may move as much as an inch and a half from left to right, or *vice versa*, when the patient lies on the right or the left side; and a few cases have been reported in which prolonged decubitus on one side seems to have caused permanent dislocation of the heart.

From the base to the apex of the heart, in a vertical line, the distance is about five inches. Measuring from the mesosternal line to the left, the heart extends over the third rib from two and one half to three inches, over the fourth rib three and one half to four inches, and in the fifth interspace from three to three and one half inches. Posteriorly, the base of the heart corresponds to the sixth and seventh dorsal vertebræ.

Position of the Valves.—The relation of the valves to the surface of the chest may be ascertained by passing needles through the chest-walls of the cadaver before the thorax is opened. In this manner it has been ascertained that the pulmonary valves lie beneath the junction of the third costal cartilage of the left side with the sternum. The mitral valves lie close to the left border of the sternum in the third intercostal space. The tricuspid valves lie in front of the mitral, near the middle of the sternum, on a line with the fourth ribs. The aortic valves lie beneath the sternum, just below the level of the third ribs, and a little to the left of the median line (Fig. 1, page 3). It will be seen from this that a circle of not more than an inch in diameter, with its centre at the left edge of the sternum in the third intercostal space, will include the greater portion of all of these valves.

The discrepancy noticeable in the description, by different authors, of the position of the valves is doubtless due, in the main, to their being located after the thorax has been opened, when the collapse of the lungs will have more or less displaced the heart.

Aorta.—The aorta springs from the base of the left ventricle, and passes upward, forward, and to the right, to the

second intercostal space, where it is more superficial than in any other part of its course. In this situation, it is within the pericardial sac. From this point, it passes backward, upward, and to the left; and it finally passes downward, bending completely upon itself, so as to rest along the left side of the fifth and sixth dorsal vertebræ. The highest portion of the arch is on a line with the first costo-sternal articulation.

PULMONARY ARTERY.—The pulmonary artery rises from the base of the right ventricle, beneath the third costal cartilage at its junction with the sternum, and passes upward and outward, about two inches, to the second costal cartilage, where it bifurcates; one of the branches going to each lung. It will be seen that the aorta may be found close to the margin of the sternum in the second intercostal space upon the right side, and the pulmonary artery in a similar position on the left.

PHYSIOLOGICAL ACTION OF THE HEART.

In health, the heart performs the part of a perfect automatic engine, the strokes of which follow each other in regular succession, without stopping, from fœtal life until the moment of death.

The pulsations of the heart consist, first, of contraction, then dilatation of its walls; which acts are followed by a short period of rest. These pulsations occur in the adult, from seventy to eighty times per minute. While they are taking place, the blood is flowing from the auricles into the ventricles, and from these on into the arteries, and the valves guarding the orifices of the heart are opening and closing synchronously with its contraction and dilatation (Figs. 28 and 29, pages 196, 197).

HEART-SOUNDS.—With the closure of the mitral and tricuspid valves, a sound is heard, which is known as the first sound of the heart. With the closure of the semilunar valves, a shorter and sharper sound is obtained, which is termed the second sound. The contraction of the heart is known as its *systole;* the dilatation, as its *diastole.*

The cardiac pulsation begins with contraction of the auricles, which occupies about one eighth of the period of a complete pulsation. While this is taking place, the blood is flowing in a full stream through the auriculo-ventricular openings

into the ventricles, and the mitral and tricuspid valves float out upon the current, causing no obstruction (Fig. 28, page 196).

The systole of the auricles is followed immediately by their diastole, which is a purely passive movement, continuing from the end of the systole to the beginning of the next pulsation, thus occupying seven eighths of the time of a complete cardiac pulsation. During the diastole of the auricles, the blood is again filling them from the venæ cavæ and pulmonary veins. The contraction of the cardiac muscular fibres passes with a wavy motion from the auricles to the ventricles, so that the ventricular systole immediately follows that of the auricles.

During the systole of the ventricles, the vertical diameter of the heart is shortened; the apex approximates more nearly to the base; and at the same time it describes a spiral motion from left to right and from behind forward, striking against the chest-wall between the fifth and sixth ribs, where its impulse may usually be seen and felt.

With this contraction there is sudden closure of the mitral and the tricuspid valves. The semilunar valves being thrown open by the current, the blood is carried onward into the aorta and the pulmonary artery (Fig. 29, page 197). The time occupied by the systole of the ventricles is about three eighths of a complete pulsation. With the closure of the mitral and tricuspid valves, we may hear the first sound of the heart.

The ventricular diastole follows immediately after their systole. The elastic tissue of the arteries contracts, and a portion of the blood is forced backward toward the heart, which it is prevented from entering by the abrupt closure of the semilunar valves that guard the aortic and pulmonary orifices.

With the diastole of the ventricles, the heart assumes its former shape and position; the auriculo-ventricular valves open, and blood flows passively into the ventricles. This occupies about two eighths of the period of a complete cardiac pulsation.

Closure of the semilunar valves produces the second sound of the heart, which is, therefore, caused by the contraction of the arteries.

The diastole of the ventricles is followed by a period of rest, which occupies about two eighths of the time for a complete pulsation.

During this period, the blood continues to flow from the auricles into the ventricles, so that, at the instant just preceding another pulsation, all of the cavities of the heart are full, but not distended. With the contraction of the auricles, the ventricles are distended by an additional amount of blood, but probably the auricles are not completely emptied. The distention of the ventricles, caused by the systole of the auricles, excites their contraction, and thus the blood is forced onward into the arteries. If the cycle of time taken up by a cardiac pulsation were divided into five equal parts, about one fifth would be occupied by the systole of the auricles, two fifths by the systole of the ventricles, and two fifths by the diastole of the ventricles and the period of repose. The physiological action of the heart is graphically represented by a modification of Dr. Gairdner's diagram (Fig. 24).

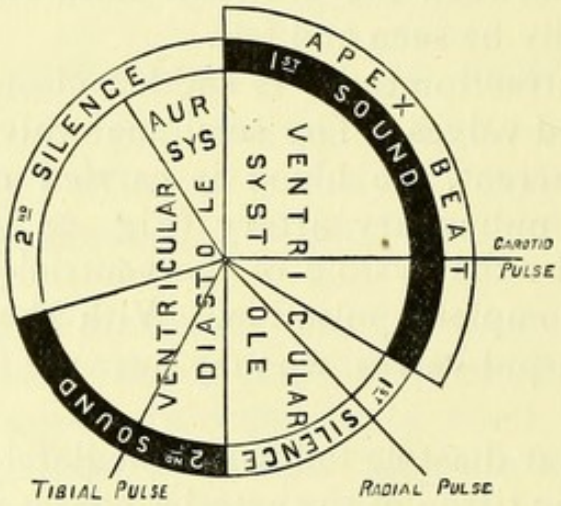


FIG. 24.—Physiological Action of the Heart (altered slightly from Balfour).

In this diagram, the inner circle represents the physiological action of the heart, apart from any manifest signs.

The outer circle represents the external manifestations of the heart's action; the ring between the circles illustrates the sounds and periods of silence, and outside of the outer circle, the arc of a third circle represents the impulse of the apex against the chest-wall. Lines radiating from the centre represent the pulse in the neck, wrist, and ankle.

As seen by the diagram, the systole of the auricles gives rise to no external manifestations, but with the beginning of the ventricular systole we appreciate the first sound of the heart, as indicated by the shading of the ring between the two circles;

and at the same time occurs the beat of the apex against the chest-wall. During this time the carotid pulse may be felt.

The long, first sound, as indicated in the diagram, is followed by a short period of silence, known as the first silence, during which the radial pulse may usually be felt.

Immediately following the first silence the ventricular diastole begins, and with it occurs the second sound of the heart, which, as indicated in the diagram, is shorter than the first. Following the second sound we notice the second or long silence, extending through the period of rest and the time occupied by the auricular systole.

In some cases only one sound of the heart can be heard, either at the apex or at the base. In such instances, in order to determine which is the first and which the second, it is absolutely necessary to associate the sound with the arterial pulsation. This can only be done, in the majority of cases, by feeling for the carotid pulse, which occurs with the first sound of the heart. If the heart were beating slowly, it might be easy to recognize the position of the radial pulse between the first and second sounds; but as the length of the first silence, during which this may be felt, does not usually exceed the tenth of a second, it is difficult to be certain whether it accompanies the latter part of the first or the first part of the second sound. Knowledge of the instant when the carotid pulsation takes place is indispensable in ascertaining whether an abnormal sound precedes or accompanies the systole of the ventricles.

The regular contraction, dilatation, and rest of the heart constitute what is known as its rhythm. In health the cardiac pulsations follow each other in regular succession, about seventy or eighty times per minute, and each pulsation is similar in every respect to those which precede or follow it. In disease of the heart, alterations in the rhythm are among the most constant signs; and in all the affections giving rise to abnormal sounds produced at the valvular orifices, the signs occur with either the contraction or dilatation of the organ. It therefore becomes necessary in the physical diagnosis of cardiac disease to ascertain the rhythm of the heart. When the pulsations are of normal frequency this is an easy matter, if we recollect that the first sound is dull, heavy, and prolonged, while the second sound is comparatively short and clacking;

and that the period of rest, or long silence, follows the second and precedes the first sound; also that the first sound is coincident with the carotid pulse, and the impulse of the apex-beat against the chest-wall. But if the heart is beating rapidly, *e. g.*, more than a hundred times per minute, it is always difficult, and frequently it is impossible, by auscultation alone to distinguish between the two sounds.

If we divide the entire period of the cardiac pulsations into two parts, one of motion and the other of rest, it at once becomes evident that the more rapid the pulsations the shorter must be the period of repose, and consequently the shorter will be the silence between the two sounds of the heart. This is well illustrated by a series of circles of increasing size (Fig. 25).

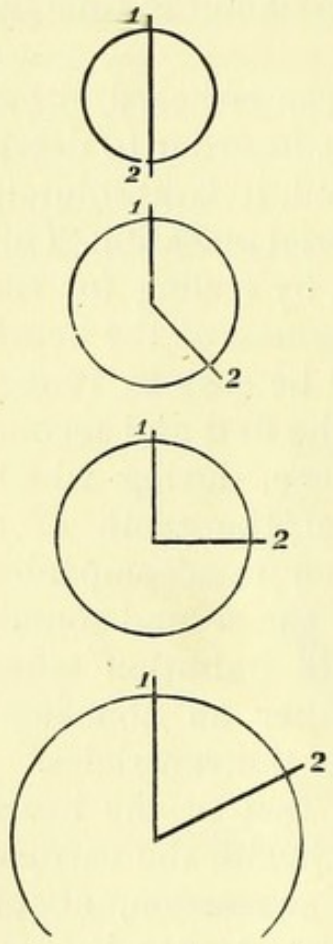


FIG. 25.—(Loomis.)

In the first or smallest circle, which indicates the most rapid pulsation of the heart, the intervals between the first and second, and the second and first sounds are equal; whereas in the largest circle, in which the interval between the first and second sound is represented by the same distance upon the circumference as in the smaller circle, the time between the second and the first sound is greatly increased, as indicated by the greater distance on the circumference. In the smaller circle the time between the first and the second sounds is equal to that between the second and the first, while in the larger the time between the first and the second, which corresponds to the period of motion, is only about one fourth as great as that which includes the period of rest between the second and the first.

LECTURE XVI.

PHYSICAL EXAMINATION OF THE HEART.

METHODS OF CARDIAC EXPLORATION.

The methods employed in examination of the heart are five in number, namely, *inspection, palpation, mensuration, percussion, and auscultation.*

INSPECTION.—Upon inspecting a patient suffering from cardiac disease, we will nearly always observe a peculiar sodden expression, with puffiness of the lower eyelids. In many instances there is marked pulsation of the veins and arteries at the base of the neck; but slight pulsation of the jugular vein is not a sign of cardiac disease. Presystolic, jugular pulsation, when slight, may be caused normally by the auricular contraction; but distinct systolic pulsation in this position is always associated with more or less dilatation of the right side of the heart, which may result from protracted emphysema, mitral disease, or obstruction of the pulmonary artery by embolism or thrombosis. Marked systolic pulsation in the jugular veins, especially on the right side of the neck, is always associated with dilatation of the right ventricle, and regurgitation of blood through the tricuspid valves, by which the impulse is transmitted directly to the jugular veins, as there are no valves guarding the opening of the descending vena cava into the right auricle. Pulsation in the veins is always most distinct when the patient is lying down, and it may be rendered still more noticeable by pressing the blood upward in the vein with the finger, and allowing the vessel to refill from below.

Visible pulsation in the superficial arteries is not uncommon in conditions of health; but when this is excessive and symmetrical in the carotid, subclavian, and brachial arteries, it is always due to hypertrophy and dilatation of the left ventricle, with regurgitation through the aortic valves. Marked pulsation confined to one subclavian or carotid artery usually indicates dilatation of the vessel, and the commencement of an aneurism.

By inspecting the chest, we obtain information regarding the form of the cardiac region and the position and character of the apex-beat.

Form of the Præcordia.—Enlargement or bulging of the præcordial region may be normal, but it is frequently due to enlargement of the heart, or effusion into the pericardial sac. In this latter instance, the intercostal spaces are more prominent than in the former. The unusually distinct pulsations, which are often seen in children and emaciated persons, have been mistaken for bulging; but such errors may be easily avoided by care in inspection, and by palpation.

Rachitis may cause bulging of the præcordial region, but in such instances a corresponding depression is usually found on the posterior aspect of the chest, immediately to the left of the spine, and the spine itself is generally curved.

Prominences caused by aneurisms of the aorta are found only above the fourth rib.

Depression in the præcordial region, of a permanent character, usually indicates previous pericarditis with adhesion of the two surfaces of the pericardium to each other, and of the pericardium to the costal pleura. Care must be taken not to confound with this condition those rhythmical depressions which may occur independent of adhesions, as the result of atmospheric pressure. These take place when the heart is enlarged, and the left lung contracted, provided the person has thin and elastic chest-walls.

Apex-Beat.—Alterations in the position, character, and force of the apex-beat may also be detected by inspection. The apex is crowded upward and outward by hypertrophy of the left lobe of the liver or by abdominal tumors. It may be carried directly upward to a point above the fifth rib by pericardial effusions; and it is raised by contraction of the left lung, as in fibroid phthisis. It is crowded downward and to the right, when the left lung is enlarged by emphysema; or it may be drawn in the same direction by contraction of the right lung. It is crowded to the right by collections of fluid or of air in the left pleural sac, or by large tumors occupying that side of the chest; and to the left, by corresponding conditions upon the right side. It is carried downward by aneurisms or by other mediastinal tumors; and downward and somewhat

inward by hypertrophy of the right ventricle. It is carried downward and to the left by hypertrophy of both ventricles; but in uncomplicated hypertrophy the apex seldom extends more than an inch to the left of its normal position. It is also carried downward, and often far to the left, by enlargement of the heart, whether the result of dilatation or of dilatation and hypertrophy combined. The significance of alterations in the position of the apex-beat is shown at a glance in the following table:

Displacements of the Apex.

Apex raised.	Pericardial effusions.—Contraction of left lung.
Apex more or less upward and outward (to the left).	Hypertrophy of the left lobe of the liver.—Abdominal tumors.
Apex depressed.	Aneurisms or other mediastinal tumors.
Apex more or less downward and to the right.	Pulmonary emphysema.—Contraction of the right lung, or hypertrophy of the right ventricle.
Apex more or less downward and to the left.	Hypertrophy of the left or both ventricles.—Dilatation of the heart.—Hypertrophy with dilatation.
Apex crowded to the right or left.	Fluid, air, or tumors in opposite side of chest.

Area of Cardiac Impulse.—The area over which the impulse can be seen is increased in all those diseases which cause enlargement of the heart.

Feeble pulsations above the fourth rib are usually due to auricular contraction, but they may be caused by an aneurism of the aorta. These two conditions can be distinguished from each other by noting the time of their occurrence. Pulsation of the auricles always precedes the apex-beat, while that of an aneurism must necessarily follow or accompany it. If the heart is acting slowly, this distinction can be made easily by ordinary inspection, but this is not the case if it is beating rapidly. Under such circumstances the differentiation is facilitated by attaching by means of wax, two bristles each carrying a paper flag, to the two pulsating points, one over the apex and the other above the fourth rib. By watching the movements of the little flags it will be easy to determine which is first and which second.

Character and Force of Impulse.—In dilatation of the ventricles, and when agglutination of the two surfaces of the pericardium has taken place, the character of the impulse is wavy or undulating; and it may sometimes be seen over the entire præcordial region.

Alterations in the force of the impulse may ordinarily be recognized upon inspection, but can be better appreciated by palpation.

PALPATION.—Before examining the chest by palpation it is always desirable to ascertain the condition of the pulse, the signs furnished by which are frequently sufficient to establish the diagnosis.

Pulse.—If the radial pulse is of unequal force upon the two sides it is probably caused by an aneurism, though it may depend upon an abnormal distribution of the arteries. In the latter case pulsations in the brachial arteries would be found alike on the two sides; whereas, in case of aortic aneurism, they would vary in force.

If the pulse is small and weak, when the arm is hanging in the natural position, and if it disappears upon raising the arm, anæmia is present, and it may be the only cause for this sign. When the arm is in the natural position, if the pulse is small and weak, and if it maintains the same characteristics when the arm is elevated, there is likely to be disease at the mitral valves; if the pulse is also very irregular, it is probably caused by mitral stenosis.

If the pulse is small and irregular, but distinct, and upon elevation of the arm becomes still more distinct, two lesions are present, one at the mitral valves, and the other at the aortic.

If the pulse is full and distinct, with the arm in its natural position, and becomes much more distinct, and assumes the characteristics known as "hammer" pulse, when the arm is elevated there is regurgitation through the aortic valves, with more or less hypertrophy and dilatation of the left ventricle.

The conditions of the pulse, as shown by the sphygmograph, though very interesting, cannot as yet be considered of much importance clinically. The tracings will be illustrated in another lesson.

Upon examining the chest by palpation, we obtain evidence

concerning the force, frequency, and regularity of the heart's action, and we may detect abnormal pulsations or thrills.

By pressing firmly upon the sternum with one hand, while the other is pressed upon the back, we are sometimes able to detect pulsations, in a slightly dilated aorta, which could not be found in the ordinary manner.

Position of impulse.—Forcible pulsation above the fourth rib may be due to an aneurism; but if observed to the left of the sternum, it is ordinarily caused by hypertrophy and dilatation of the left auricle. The two conditions may be differentiated by observing whether the pulsation precedes or follows the apex-beat.

When the left lung is retracted from the base of the heart, pulsation of the pulmonary artery may be frequently seen in the second intercostal space. It can be distinguished from pulsations of the auricle by the time of its occurrence.

Abnormal pulsations along the course of the aorta are nearly always aneurismal; but in very rare instances they are caused by displacement of the artery, as in rachitis. If the pulsations are feeble, they can be most distinctly felt during expiration.

Pulsation beneath the lower portion of the sternum, and in the epigastric region, with disappearance of the apex-beat, is a sign of enlargement of the right ventricle.

Force increased.—The force of the heart may be increased or diminished.

It is increased in simple hypertrophy, and in hypertrophy with dilatation, whenever the former more than compensates for the latter. It is slightly increased in the early stages of endocarditis, and of pericarditis; and it is increased by simple irritability of the heart, as in palpitation due to hysteria.

Occasionally a double shock is felt in case of extensive hypertrophy and dilatation, due to the rebound of the heart after its systole.

The force is diminished: whenever the chest-walls are very thick, in consequence of a large amount of adipose tissue; when the heart is abnormally separated from the chest-walls, as in pulmonary emphysema; and when there is effusion into the pericardial sac. It is also diminished when the heart is feeble from any cause, whether it be atrophy, fatty degeneration and

softening, or general muscular debility resulting from protracted or low forms of fever, or other disease.

The position of the apex-beat can often be detected by palpation, when it is not perceptible upon inspection. It is altered by the diseases which I mentioned, in speaking of inspection.

Frequency.—The frequency of the heart's action is increased in such a great variety of diseases that it is not a sign of much importance in the diagnosis of cardiac affections.

Irregularity of the heart's action is ordinarily a sign of disease in this organ.

Friction fremitus.—When the pericardial surfaces are roughened by exudation, friction fremitus may be obtained. This is usually most distinct in the fourth intercostal space, near the left margin of the sternum.

Purring tremor.—Regurgitation through the valvular orifices gives rise to a peculiar vibration known as the purring tremor or thrill, which may be felt by the fingers. This is sometimes detected by simply touching the surface, but in other instances firm pressure must be made.

Exceptional.—The same sensation is occasionally communicated from the larger arteries.

Epigastric pulsation.—Feeble epigastric pulsation is frequently found in perfectly healthy individuals; but pulsation in this locality, associated with absence of the apex-beat from its normal position, is generally the result of dilatation of the right ventricle, with or without hypertrophy. This is a common sign of dilatation of the right side of the heart caused by pulmonary emphysema. Epigastric pulsation may be due to the impulse of the abdominal aorta, especially in emaciated people who have formerly been of full habit. It occurs also when a tumor rests upon the aorta in such a manner as to be lifted with each pulsation; and it is one of the signs of aneurism of this artery.

Exceptional.—Sometimes epigastric pulsation is due to the action of the heart upon the left lobe of the liver.

Hepatic pulsation in a few rare instances is caused by venous regurgitation from a dilated right ventricle, through the tricuspid valves and the right auricle, into the ascending vena cava. It sometimes extends over the entire hypochondriac region of the right side, but in other instances it is limited to a portion of the liver.

Similar pulsations are observed in very rare cases, as the result of an aneurism, the pulsations of which are transmitted through the liver.

Sometimes a peculiar pulsation is communicated to the epigastric region by the systole of the heart, the apex of which draws the diaphragm upward in contraction, instead of crowding it downward, in consequence of agglutination of the two surfaces of the pericardium. This pulsation is the reverse of that ordinarily observed, the expansion taking place with the dilatation instead of with the contraction of the heart.

PERCUSSION.—By percussion, we learn the size of the heart, or detect collections of fluid or air in the pericardium. It is generally considered very difficult to map out this organ by percussion, but if attention is paid to the following rules, you will find it comparatively easy. In the first place the patient should be in the recumbent posture, when the examination is made, and the force of the blow should be proportionate to the depth of the part to be examined. If we wish to learn the extent of the area where the heart is not covered by lung, we must percuss lightly; and if we wish to learn the deeper outlines of the organ, a harder stroke must be made.

For clinical purposes, it is not necessary to find the exact limits of the heart in every direction, for our results will be equally good if we ascertain simply the upper, lower, and lateral lines of dulness, over its greater diameters.

To find the base of the heart, percussion should be performed on a line about an inch to the left of the sternum, so as to avoid the dulness occasioned by the aorta and the pulmonary artery, which in no way differs from that of the heart itself. On this line percussion should be made from above downwards, until we reach the upper limit of cardiac dulness; which will ordinarily be found at the third rib.

To locate the lateral boundaries, percussion should be made in the fourth intercostal spaces. Beginning in the right mammary region, where there is perfect resonance, the examination should be carried gradually toward the sternum, until the cardiac dulness is reached; which will usually be about half an inch to the right of this bone.

Upon the left side, the examination should be commenced near the left of the nipple, and carried gradually toward the sternum, until cardiac dulness is obtained; which is usually about half an inch to the right of the mammillary line.

It is a difficult matter, by simple percussion, to find the lower border of the heart, for the reason that it lies immediately

above the left lobe of the liver, and a distinction between the dull, or flat, sounds produced by these two organs is hardly practicable. If you will find the apex of the heart either by palpation or by auscultation, and then the upper surface of the liver, in the right mammary region, by forcible percussion, you may draw a straight line between these two points and it will correspond almost exactly with the inferior border of the heart.

LECTURE XVII.

PHYSICAL EXAMINATION OF THE HEART, ETC.

Superficial cardiac dulness.—In a small triangular space at the inner side of the left mammary region, and at the lower part of the sternum, the heart lies close to the chest-wall, not being covered by the anterior border of the lungs (Fig. 1, page 3). This area, which is about two and one half inches in width, and nearly the same in altitude, is known as the area of superficial cardiac dulness. It might appropriately be called the area of cardiac flatness. The apex of this triangle is at the centre of the sternum, nearly on a line with the fourth rib; the base corresponds to the costal cartilage of the sixth rib.

This space is altered in extent by various diseases of the heart and the lungs. Its area is usually increased by all those affections which cause enlargement of the heart, as hypertrophy and dilatation, or simple hypertrophy.

In some cases of hypertrophy, an emphysematous condition of the lung more than counterbalances the enlargement of the heart, and thus the space, instead of being increased, will be diminished.

This area is also increased by effusions of fluid into the pericardial sac.

In the normal condition, the area is increased by forced expiration, and it is diminished by deep inspiration.

The area of superficial cardiac dulness is diminished: by emphysema, which crowds the anterior border of the left lung over the heart; by pneumothorax; and it is obliterated in the rare disease known as pneumopericardium, in which air or gas collects in the pericardial sac, and the normal dulness is supplanted by tympanitic resonance.

Deep cardiac dulness.—The area of deep-seated cardiac dulness corresponds to the borders of the heart. It extends usually from the third rib above, to the resonance of the stomach, below; and laterally from about three fourths of an

inch to the right of the sternum, to within half an inch of the left nipple. This area of dulness is increased in those affections which cause enlargement of the heart, as hypertrophy and dilatation; and by pericardial effusions.

When the dulness is first increased in the upper portion of the præcordial space above the third ribs, you may be almost certain that there is pericardial effusion, for an increase in the vertical diameter of this area is seldom found in disease of the heart itself.

In the beginning of pericardial effusions, the fluid collects

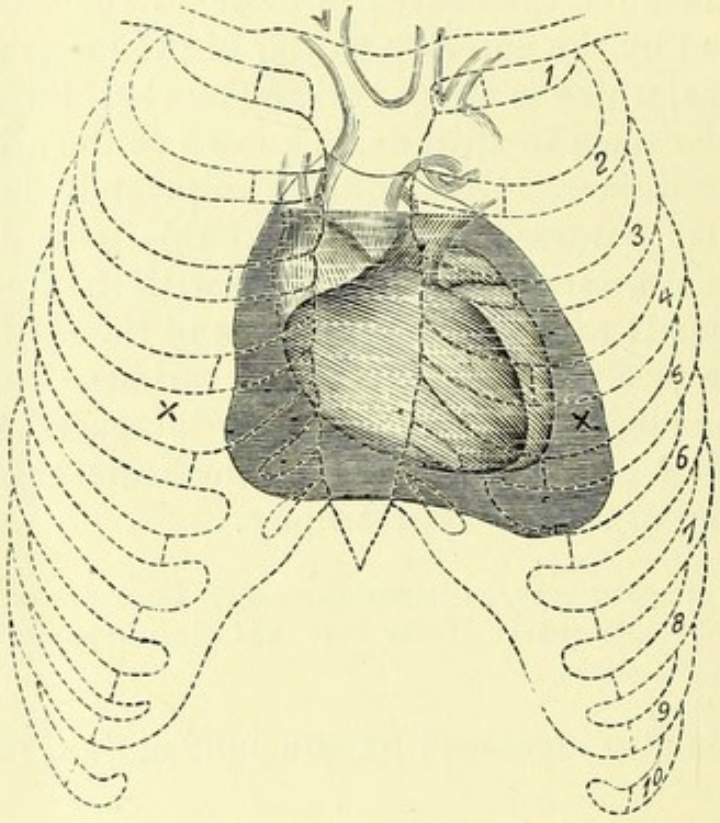


FIG. 26.—Pericarditis.

about the arteries at the base of the heart, where it causes dulness. Very soon, the weight of the fluid overcomes the tension of the pericardium and surrounding lungs, and dulness occurs in the lower portion of the præcordial space, causing an increase in the lateral diameter of the deep-seated area of dulness.

As soon as any considerable amount of effusion has taken place, you can recognize a dull space more or less triangular in shape, like the pericardial sac, with the apex upward and the base downward (Fig. 26).

Where the effusion is very great, this dulness may extend

laterally from near the right nipple to a point an inch or more to the left of the left nipple. In this condition the dulness will be found extending considerably to the left of the apex of the heart, which may be located by auscultation. This fact will enable us to distinguish between effusions into the pericardium and enlargement of the heart. The area of dulness in pericardial effusions is greater when the patient is sitting or standing, than when lying upon the back. In the latter position, the fluid gravitates toward the posterior part of the pericardium, and the anterior border of the lung insinuates itself further between the pericardium and the thoracic walls.

The area of cardiac dulness is apparently increased by consolidation of the left lung.

The outlines of the heart may be traced a little more easily by auscultatory percussion than by the ordinary method of percussing. In practicing this method, you may employ either the solid stethoscope made for this purpose, or the ordinary binaural stethoscope with the small chest-piece. Whichever you use, the chest piece should be placed over the most superficial part of the heart, and percussion should be made from the resonant portion of the lungs toward the central portion of the organ; from above downward, and laterally from without inward. By this method, as soon as the outermost limits of the pericardium are reached, the change in the percussion note is at once perceptible to the listener.

Cardiac Auscultation.—In auscultation over the heart, accurate information cannot usually be obtained by the unaided ear; but by mediate auscultation, especially if the small chest-piece of the stethoscope be used, most satisfactory results can be secured.

For cardiac auscultation, the patient should be in the recumbent position during at least a portion of the examination.

The examination should be commenced while the individual is breathing naturally. Subsequently, the patient should be directed to take three or four deep inspirations, which will enable us more clearly to detect sounds that are produced by the lungs. Then he should hold his breath for a few seconds, which will enable us to eliminate pulmonary sounds, and will render the heart-signs more distinct.

The examination must not stop with the præcordial space, but should be carried over the entire chest, and the various points must be localized at which the heart-sounds, both normal and abnormal, may be heard most distinctly.

It is not the point at which the sound may be heard which is of diagnostic importance, but the point at which it is loudest.

CAUSE OF HEART-SOUNDS.—Considerable difference of opinion exists regarding the cause of the heart-sounds. All concede that the second sound is usually produced by closure of the semilunar valves; and it is generally admitted that several elements enter into the production of the first sound, though the importance of each of these is variously estimated by different authors.

The main factors in the production of the first sound are: first, the closure of the mitral and of the tricuspid valves; second, the contraction of the muscular fibres of the heart; third, the impulse of the apex against the chest-walls. Besides these elements, friction of the blood against the inner surface of the heart, and of the heart against the surrounding tissues, doubtless plays some part in forming this sound. I believe that the part taken in the production of the first sound by the contraction of the muscular fibres is much greater than is generally supposed, as may be shown by the following simple experiment. Place the end of your stethoscope over the body of a muscle which can be contracted or relaxed without moving the integuments, as, for example, upon the ball of the thumb; now flex and extend the terminal phalanx regularly about seventy times a minute and you will hear, what almost seems, the heart beating immediately beneath your instrument. Skoda states that the heart-sounds may be produced by the arteries. "It appears to follow with tolerable certainty that both ventricles, the pulmonary artery and aorta are capable, each separately, of producing both the first and second sound perceptible in the region of the heart."

In health, the *first sound* of the heart is dull, soft, and prolonged, compared with the second, and it is synchronous with the systole of the heart, and therefore with the apex-beat and carotid pulse. Its point of maximum intensity corresponds to the apex-beat.

The *second sound*, which is dependent upon closure of the semilunar valves caused by resilience of the arteries, is shorter, sharper, and more superficial than the first sound, and possesses none of that muscular element which we observe in the latter. It coincides with the diastole of the heart and follows the

arterial pulse and apex-beat. It is heard with the greatest intensity at the articulation of the third left costal cartilage with the sternum. Immediately following the second sound is the period of silence, which varies in duration with the rapidity of the heart's action.

The intensity of the heart's sounds varies in different individuals with the changing force of the impulse and the conformation of the chest-walls, and with peculiar idiosyncrasies, which we cannot well understand. As a rule, the heart-sounds are louder in children and in those with thin chest-walls than in adults or in those with the parietes very muscular or thickened by adipose tissue.

The extent of the area over which the cardiac sounds may be heard will vary with the adaptability of the surrounding organs for transmitting sounds. If the lungs are solidified the sounds may be heard much farther than in the normal condition; but if the lungs are emphysematous the sounds are not heard as far as in health.

Usually the sounds produced upon the right side are heard loudest over the corresponding portion of the heart, and toward the right side of the sternum; while those produced upon the left are heard loudest over the left side of the heart and nearer the left nipple.

Since the normal heart-sounds vary considerably in different individuals, you will recognize the necessity for studying a large number of healthy hearts, for no one individual can be taken as a standard.

MODIFICATIONS OF THE HEART-SOUNDS BY DISEASE.

The heart-sounds are modified by disease in their intensity, pitch, quality, seat, and rhythm. They may be preceded, accompanied, or followed by abnormal sounds known as murmurs; or murmurs may entirely supplant the natural sounds.

INTENSITY INCREASED.—The intensity of the heart-sounds is increased by hypertrophy of the ventricles, by nervous irritability, by palpitation of the heart, by consolidation of adjacent lung tissue, and exceptionally, by dilatation of the heart.

INTENSITY DIMINISHED.—The intensity of these sounds is diminished by simple dilatation of the ventricles, by fatty de-

generation of the muscular fibres of the heart, or by deposition of fat between them, or on the surface of the organ; by softening or debility of the muscular fibres as the result of protracted disease—for example, typhus or typhoid fever; and by pericardial effusions. It is also diminished by emphysema of the lungs. The heart-sounds are sometimes masked by bronchial râles.

Quality Modified.—The quality of the heart-sounds is considerably altered in a great variety of diseases. The sounds, instead of being clear and distinct, as in typical healthy cases, may be slightly muffled, or they may be associated with an indistinct and transient sound which closely resembles a murmur. This impurity of the heart-sounds, unless associated with other signs of cardiac disease, is of no diagnostic importance, because it very frequently occurs as the result of pulmonary disease when the heart is in no way involved, and it is often noticed in healthy individuals.

Pitch and Quality.—The first sound of the heart is rendered duller and lower in pitch than natural, by hypertrophy of the ventricles, with thickening of the tricuspid and mitral valves. The second sound is modified in the same way by thickening of the semilunar valves without regurgitation, and by loss of elasticity in the arterial walls.

The first sound of the heart is sharper and higher pitched than normal in dilatation of the ventricles without alteration of the auriculo-ventricular valves.

The second sound of the heart may be higher pitched than natural, or in other words, accentuated, at either the aortic or the pulmonary orifice.

At the aortic orifice, this sound is somewhat intensified by hypertrophy of the left ventricle, due to obstruction in the artery. A ventricle thus hypertrophied propels the blood with increased force into the aorta, unduly distends this vessel, and thus causes sudden and more forcible contraction of the artery, and consequently a sharper sound from the semilunar valves. Well marked accentuation of the second sound in this position results from setting back, on the valves, of an increased volume of blood, and it is always caused by dilatation of the aorta.

Accentuation of the second sound at the pulmonary orifice

occurs in a great variety of diseases. It is the most persistent of all the signs of cardiac disease, but it is also found in nearly every case of pulmonary congestion from whatever cause. Whenever there is obstruction or regurgitation at the mitral orifice there must be increased tension of the blood in the left auricle and in the pulmonary veins, which will be transmitted through the short pulmonary circuit back to the pulmonary arteries. This will cause a sudden and sharper closure of the valves which guard the outlet of the right ventricle. Obstruction in the pulmonary circuit from disease of the lungs, by inducing hypertrophy and dilatation of the right ventricle, causes extreme distention of the pulmonary artery with each pulsation, and consequent accentuation of the second sound in the pulmonary area.

The heart-sounds become metallic or tinkling in quality in irritable conditions of the heart and when the stomach is distended with gas.

Exceptional.—The heart-sounds are very metallic in character in the rare disease known as pneumopericardium. They are sometimes metallic in left pneumothorax. The same character is sometimes noticed with the second sound, at the aortic orifice, when there is atheroma of this vessel limited to its initial portion.

SEAT.—The seat of the heart sounds may be altered by several diseases. The sounds obtainable over the apex are heard above their normal position, whenever the abdominal organs are so enlarged as to encroach upon the thoracic cavity; for example, in distention of the stomach, or enlargement of the liver, and also in ascites or in cases of large ovarian tumors. They are also heard above their normal position when effusion is present in the pericardial sac.

These sounds are heard below their usual seat, when the apex is depressed by tumors in the mediastinum, or by hypertrophy with dilatation of the auricles. They are displaced laterally by pleuritic effusions, pneumothorax, and by deformities of the chest. They are displaced to the left, whenever the heart is enlarged, whether by hypertrophy or by dilatation.

RHYTHM.—The rhythm of the heart-sounds is altered by many diseases.

Intermittent rhythm.—Frequently the heart acts regularly for some time and then drops one or more beats to go on again with its regular pulsations. This is known as an intermittent

rhythm. If the intermittent rhythm includes the period of one pulsation only, it is of no special importance, as such phenomena occur under a variety of circumstances, independent of cardiac disease.

It is a curious fact that intermission in the heart's action often occurs in some people just preceding a thunder-storm.

But if this intermission occupies the time of two or three pulsations, and if the heart's action is irregular—that is, beating rapidly, then slowly, finally intermitting, and then starting up with rapid pulsations, as if to make up for lost time—it is a sign of cardiac disease.

Heart-sounds altered in duration.—The first sound of the heart is prolonged by hypertrophy of the ventricles, and by agglutination of the surfaces of the pericardium. It is shortened in dilatation of the ventricles, and both sounds are shortened by fatty degeneration and softening of the heart-walls.

Rest prolonged.—The period of repose is sometimes prolonged by obstruction to the onward flow of the blood into the left ventricle, due to stenosis of the mitral orifice.

Reduplication of sounds.—Another alteration of the rhythm, known as reduplication, consists of a repetition of one or both of the heart-sounds during a single pulsation, so that three or four sounds may be heard with each contraction of the heart. Ordinarily the right and left sides of the heart contract at exactly the same time, and consequently the sounds which are produced in the two cannot be distinguished; but occasionally there is a slight interval between the closure of the valves at the auriculo-ventricular or at the arterial orifices of the two sides, so that the sounds do not occur simultaneously, and thus the first sound may be doubled, the second sound remaining natural; or the second sound may be doubled, the first remaining single; or both may be doubled.

This phenomenon occurs in diseases of the heart, but may often be discovered in health, if searched for with the differential stethoscope of Allison (Fig. 15, page 50). When occurring in disease, reduplication is usually caused by stenosis of the mitral orifice or incompetence of its valves. This gives rise to increased tension in the pulmonary circuit and to abrupt closure of the pulmonary semilunar valves, which thus slightly

anticipate the closure of the aortic valves, and cause reduplication of the second sound.

Reduplication of the first sound is due to tardy closure of the mitral valves. Some care will be necessary, to avoid mistaking reduplication for endocardial murmurs which precede or follow the normal sounds. Intermission is a characteristic of reduplication.* In some cases reduplication is influenced by the acts of respiration. In forced or laborious respiration the first sound may be reduplicated at the end of inspiration and at the beginning of expiration; and the second sound may be reduplicated at the end of expiration and at the beginning of inspiration.

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* Loomis' Physical Diagnosis.

LECTURE XVIII.

ABNORMAL SOUNDS OF THE HEART—CARDIAC MURMURS.

The abnormal sounds heard over the præcordial region are denominated murmurs. Sometimes these are produced upon the surface of the heart, between the two layers of the pericardium; but most of them originate within the heart. The latter are known as endocardial and the former as exocardial murmurs.

PERICARDIAL FRICTION SOUNDS.—The exocardial or pericardial friction sounds or murmurs are produced by the rubbing together of the roughened surfaces of the pericardium, in the same manner that friction sounds are produced within the pleura. These murmurs vary greatly in their intensity and quality. Sometimes they are very indistinct, and again they are loud. In quality, they may be grazing, grating, rubbing, creaking, or crackling, like pleuritic friction sounds.

The quality of an exocardial murmur yields no information regarding the peculiar condition of the surface which produced it, though, in the dry stage of pericarditis, the grazing sound is the one most likely to be heard.

These murmurs may be either single or double; that is, they may occur with the systole or with the diastole of the heart, or with both. They sometimes accompany the valvular sounds; at other times they are independent of them. They are always superficial in character, seeming to be produced immediately beneath the chest-walls. The area over which they can be heard is restricted to the præcordial space. They are generally heard loudest at the junction of the fourth left costal cartilage with the sternum. These murmurs generally last for only a few hours, seldom longer than one or two days, and then disappear in consequence of the exudation of serum into the pericardium. As the serous effusion becomes absorbed in the latter stage of pericarditis, the friction murmur may reappear.

Pericardial friction sounds are distinguished from endocardial murmurs, first, by their superficial character; second, by being limited to the præcordial space, *i. e.*, never being transmitted to the left of the apex, or above the base of the heart; third, by their being independent of valvular sounds; and fourth, by the variations in their intensity with changes in the position of the patient. When the patient is in the erect or in the recumbent posture, the heart does not approach so nearly to the surface of the chest as when he is leaning well forward, and therefore the sounds are not as distinct. In general, the intensity is greater during expiration than during inspiration.

Pericardial friction sounds are distinguished from pleuritic friction sounds by their confinement to the præcordia, by their synchronism with the movements of the heart instead of the lungs, and by not being interrupted by temporary suspension of the respiratory act.

Exceptional.—It should be remembered that in some cases of pleurisy, attrition of the fibrous layer of the pericardium with the inflamed pleura gives rise to a friction sound having the same rhythm as the heart, and continuing while respiration is suspended. Such a sign is called a *cardiac pleural friction murmur*. It is easily mistaken for the pericardial murmur, but its cause should always be suspected when other signs of pleurisy exist, especially if the pleurisy be associated with pneumonia. This friction sound differs from the pericardial murmur in the uniformity in intensity of the successive sounds, in its limitation to the border of the heart, and, in some cases, to the end of inspiration; and in generally being affected to a greater or less degree by the movements of inspiration.

Endocardial Murmurs vary in their intensity, pitch, and quality; but these elements are of very little importance from a diagnostic point of view, as the intensity and the pitch of the sounds yield us no information whatever, and the quality is never characteristic, except in the presystolic murmur due to stenosis of the mitral orifice.

These sounds are produced by changes in the physical condition of the heart, in which case they are known as organic murmurs; or by changes in the condition of the blood, when they are termed inorganic, anæmic, or hæmic murmurs.

Organic murmurs are usually permanent, though not infrequently they cease for a considerable length of time; and in some cases they may entirely disappear. The inorganic murmurs are transitory, being present for a few hours or days, and then disappearing permanently, or to recur after a short inter-

val. Sometimes they come and go while the examination is being made.

A murmur in the præcordial space indicates nothing except a disturbance of the normal relations of the heart to the blood. This may be a change in the physical condition of the heart itself, or in the normal composition of the blood, or it may result from irregular contractions of the cardiac muscle.

The important things to note regarding a murmur are: first, the seat; second, the rhythm; and third, the quality.

Seat.—The seat of a murmur is a limited space at which it can be heard most distinctly. The direction in which the sound is most clearly transmitted is also an essential feature in diagnosis.

Rhythm.—In noting the rhythm, we observe the relation of the murmur to the systole and the diastole of the ventricles, and consequently to the first and second sounds of the heart; that is, whether it precedes, accompanies, or follows one of these.

Quality.—In a few instances, the peculiar characteristics of the sound itself are important. Some murmurs are grating, others blowing or rushing in quality, and others are harsh, or soft, or musical. A murmur may have many of these characteristics at different times without any appreciable change in the conditions which produce it.

Whenever we hear an abnormal sound in the præcordial space, we should ascertain, by careful examination, its point of maximum intensity, that is, at what part of this space it may be heard most distinctly; and whether it is synchronous with either the contraction or the dilatation of the cardiac cavities, and depends upon a "fluid vein"* in the current of blood, through the valvular orifices; or whether it is produced outside the heart. As the majority of abnormal cardiac sounds are produced within the heart, the presumption is always in favor of a murmur being endocardial; and if we should find it comparatively deep-seated, and synchronous with the systole or the diastole of the ventricles, and transmitted to the left of the apex, or above the base of the heart, we may safely conclude that it belongs to this class.

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* M. A. Chaveau, *Comptes Rendus de l'Académie des Sciences*, 1858.

When we remember that nearly all endocardial murmurs are produced at one of the valvular orifices, and that these approximate so closely to each other that a circle half an inch in diameter may include a portion of each, it is at once apparent that it must be impossible to distinguish between different endocardial sounds, by listening for them directly over their point of origin. We must, therefore, take special measures to separate them from each other.

Sound loses its intensity by passing from one medium to another, as will occur in the passage of sound from one cavity of the heart to another, and any sound produced by fluid in motion is transmitted in the direction of the current which causes it. A knowledge of these two facts will aid us greatly in differentiating between endocardial sounds. We will find that, as a rule, sounds produced in any of the cavities of the heart, or transmitted into them, are best heard over the space where that cavity is most superficial. For example, the only point at which the left ventricle impinges directly on the chest-wall is where the apex-beat is felt; and we find that murmurs produced at its auricular orifice are best heard at this spot, while those at the tricuspid orifice are most distinct over that portion of the right ventricle which is superficial. The murmurs at the aortic and pulmonary orifices are respectively heard with the greatest distinctness where these arteries approach nearest the chest-wall.

Some of the endocardial murmurs, however, are produced by blood flowing in an abnormal direction. Therefore, the areas in which murmurs produced at the various orifices are most distinct, will not always exactly correspond to the positions in which the normal sounds are loudest.

Before examining the heart by auscultation, we should first ascertain its superior and lateral limits by percussion or by auscultatory percussion; and either by these methods or by palpation, determine the position of the apex.

MITRAL AREA.—The mitral area, as the space is named where the mitral sounds may be heard with maximum intensity, corresponds to a circle two inches in diameter, which includes the apex of the heart (A, Fig. 27). If this organ is in its normal position, the circle, as shown in the diagram, will have its centre near the normal position of the apex-beat; but if,

from enlargement or other causes, the heart is displaced to the left, the position of this circle should be correspondingly changed.

Mitral murmurs, if caused by regurgitation, are also heard diffused for a distance varying from one to three inches, to the left of the apex. Often they may be heard behind, along the left side of the sixth and seventh dorsal vertebræ, with nearly the same intensity as in front; sometimes they may be heard in this position when they are not distinct in front.

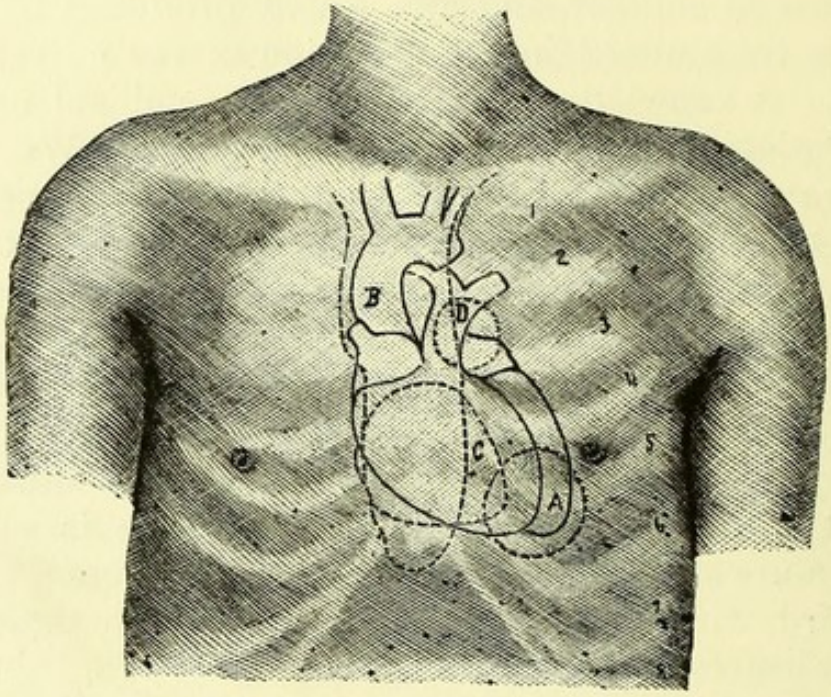


FIG. 27.—Areas of endocardial murmurs. A, mitral area. B, aortic area. C, tricuspid area. D. pulmonary area.

Care must be taken not to confound mitral murmurs with aortic regurgitant murmurs, which are occasionally heard at the lower angle of the left scapula, and in the left axillary region; or with aneurismal murmurs, which may also be heard along the left side of the spinal column, in the same position as the mitral regurgitant murmur.

A mitral regurgitant murmur differs from an aneurismal murmur in being heard only between the fifth and the eighth dorsal vertebræ. The aneurismal murmur may be heard above the fifth vertebra, and with diminished intensity, below the eighth vertebra, as well as between the two.

An aortic direct murmur, heard behind, should not be mis-

taken for mitral regurgitant, since it is heard loudest above the lower border of the fifth dorsal vertebra.

Mitral regurgitant murmurs may sometimes disappear, even though due to organic lesions. In such cases, accentuation of the second sound at the pulmonary orifice may be the only abnormal sign remaining.

If a mitral murmur is obstructive, or direct, *i. e.*, due to stenosis of the mitral orifice, it will be heard at the apex, but will not be distinctly transmitted to the left, and it will not be heard behind.

You must bear in mind that, in speaking of the areas of murmurs, we refer only to the positions at which they may be heard with the *greatest intensity*. Sometimes a mitral murmur may be heard over the whole præcordial region, or even over the entire chest, but its point of maximum intensity will correspond to the area which we have just described.

Tricuspid Area.—The area of tricuspid murmurs is limited to the triangular space (C, Fig. 27) where the right ventricle is superficial. These murmurs are ordinarily loudest over the xiphoid cartilage, or along the left border of the sternum, at the junction of the sixth or the seventh costal cartilage; and they are seldom audible above the third rib. This latter feature distinguishes them from aortic and from pulmonic murmurs. When the heart is hypertrophied or dilated, their intensity will sometimes be greatest at the junction of the fourth costal cartilage with the sternum. These murmurs are superficial in character as compared with those occurring upon the left side of the heart. If transmitted in any direction, they will be heard more distinctly to the right than to the left of the parasternal line.

Pulmonary Area.—Pulmonic murmurs are heard most distinctly directly over the pulmonary artery. The area of these sounds corresponds to a small circle about an inch in diameter, located just above the third costal cartilage at the left border of the sternum, and inclosing the pulmonary artery (D, Fig. 27, page 192). These sounds are never heard in the carotid and subclavian arteries. If due to regurgitation through the pulmonary valves into the right ventricle, they may be most intense, an inch or an inch and a half below this area, near the left margin of the sternum. They are not heard at the

apex, and this distinguishes them from some aortic murmurs. These, like the tricuspid murmurs, are comparatively superficial.

AORTIC MURMURS.—The area of aortic murmurs cannot be so sharply defined as the areas of the murmurs we have just described. These sounds are usually loudest in the second intercostal space of the right side, where the aorta approaches most closely to the thoracic walls; or along the right margin of the sternum from the second to the fourth rib; but they are often heard over the whole sternum (B, Fig. 27, page 192).

Aortic murmurs are propagated to the carotid or subclavian arteries, and are frequently heard best in these localities. Occasionally they are louder in the pulmonary area than at any other point. In such instances they are distinguished from pulmonary murmurs by being heard also in the arteries at the base of the neck. Aortic murmurs are often heard behind, along the left side of the third and fourth dorsal vertebræ, and with diminishing intensity for a considerable distance down the spine. They are frequently very distinct at the apex of the heart.

Aortic regurgitant murmurs are often loudest over the lower part of the sternum, though we expect to find them most distinct a short distance below the aortic valves. These murmurs are frequently audible in the left axillary region, and at the lower angle of the scapula. The patient may often hear them himself, especially when lying down.

Exceptional.—Aortic murmurs may sometimes be heard over the arteries when they are not distinct at the base of the heart. At other times they can be heard at the base of the heart only; and still again, they may be distinct over the entire præcordial region.

Regurgitant aortic murmurs are frequently heard in all the arteries which are accessible to auscultation. It should be remembered that the aortic murmurs are the only ones that may be heard above the clavicles.

Both the obstructive and the regurgitant aortic murmurs vary much in intensity. Sometimes it is necessary to listen intently in order to hear them at all. In other cases they are so loud that they may be heard at some distance from the patient.

RHYTHM.—The rhythm of a murmur refers to the relation

which it bears to the cardiac pulsation, and consequently to the first and second sounds of the heart. In determining the rhythm of a murmur, we must first ascertain which is the first and which the second sound of the heart. This will not be a difficult task if the heart is pulsating slowly, and both sounds are distinct; for we know that the first sound is the louder and longer, and that it is associated with the impulse of the apex against the chest-wall. In some instances only one of the valvular sounds can be heard at the apex or at the base, and in such cases a murmur would very naturally be mistaken for the other sound. In every case of doubt we must feel for the carotid pulse, which is always synchronous with the first sound of the heart, and will therefore enable us to determine the rhythm of the murmur.

QUALITY.—The quality of endocardial murmurs gives us no information regarding their place of origin or the conditions which produce them, excepting in cases of presystolic mitral murmurs, which will be presently described, and anæmic murmurs, which are always soft in character.

CAUSES OF ENDOCARDIAL MURMURS.

PRESYSTOLIC, MITRAL, AND TRICUSPID MURMURS.—These murmurs, preceding as they do the first sound of the heart, must occur while the blood is passing from the auricles into the ventricles, and while the valves are thrown out upon the current (Fig. 28). They are always caused by narrowing (stenosis) of the auriculo-ventricular orifice, which obstructs the onward flow of blood. Such a murmur, if produced upon the left side, will be loudest at the apex, but it will not be transmitted to the left of the apex, and it cannot be heard behind. It is called a mitral presystolic or obstructive murmur. This is perhaps the only murmur where the quality of the sound is of any special diagnostic value. According to Balfour, the quality of these murmurs is characteristic, though not exactly the same in all cases. It may be quite accurately represented by vocalizing the symbols "R r r b or V o o t." If a murmur which precedes the first sound of the heart is produced upon the right side—which is extremely uncommon—it is called a tricuspid obstructive murmur, and its area is limited to the tri-

angular space C, at the lower portion of the sternum—Fig. 27, page 192).

SYSTOLIC MURMURS.—A murmur accompanying or following the first sound of the heart, must occur with the contraction of the ventricles, the closure of the auriculo-ventricular valves, and the propulsion of the blood from the ventricles into the arteries. It may be due to lesions at any of the valvular orifices.

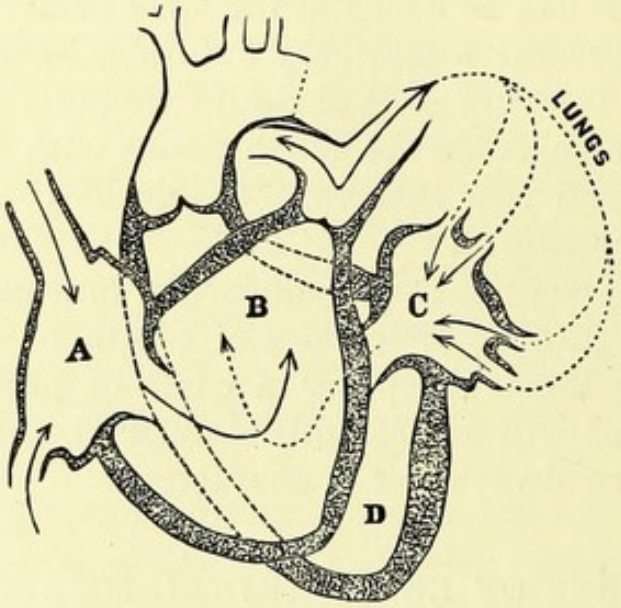


FIG. 28.—Auricular Systole. A, C, contracted auricles. B, D, dilated ventricles. Mitral and tricuspid valves open ; semilunar valves closed.

MITRAL SYSTOLIC OR REGURGITANT MURMUR.—This murmur is produced at the mitral orifice, and is due to thickening, corrugation, or adhesions of the valves, which prevents them from perfectly closing the orifice, and thus allows the blood to regurgitate into the left auricle. This murmur is generally soft and blowing, and it may be musical in quality ; it will be loudest in the mitral area. It will be transmitted to the left of the apex; and may be heard posteriorly along the left side of the spinal column from the fifth to the eighth dorsal vertebra. It is seldom heard in this situation with the same intensity as at the apex, but occasionally it is distinct behind when it is not audible in front. If a mitral murmur is caused simply by roughening of the ventricular surface of the valves, it will not be heard beside the sixth or seventh dorsal vertebra, though it may be heard about the inferior angle of the scapula, and in the left axillary region.

TRICUSPID SYSTOLIC OR REGURGITANT MURMUR.—This murmur will be heard in the tricuspid area ; and if transmitted in either direction it will be louder to the right than to the left. It will not be heard at the apex distinctly, and never to the left of the apex or behind. This murmur is generally of a blowing quality.

AORTIC SYSTOLIC, OBSTRUCTIVE, OR DIRECT.—If this murmur is of organic origin, it will be caused by constriction of the aortic semilunar valves, or by roughening of their ventricular surfaces, or possibly by disease of the artery. It will be produced while the blood is passing from the ventricles into the arteries (Fig. 29), and it will be heard in the aortic area

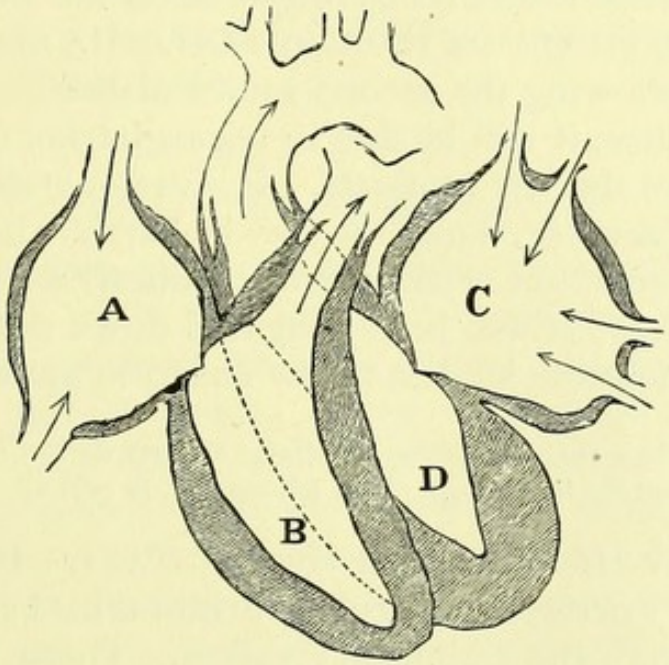


FIG. 29.—Systole of the ventricles. A, C, auricles dilating. B, D, ventricles contracting. Semilunar valves open ; mitral and tricuspid valves closed.

over the second intercostal space of the right side, or over other portions of the sternum as shown by the space B, Fig. 27, page 192. It will also be heard in the arteries of the neck, and frequently it will be audible posteriorly at the left of the third and fourth dorsal vertebræ, and possibly with diminished intensity farther down the spine.

If this murmur is loudest over the pulmonary artery, as occasionally happens, it may be distinguished from murmurs produced at the pulmonary orifice, by the fact that it is transmitted to the carotid and subclavian arteries.

PULMONARY SYSTOLIC, OBSTRUCTIVE, OR DIRECT.—A sys-

tolic murmur produced at the pulmonary orifice, is likely to be a hæmic murmur; but if of organic origin, it will be due to obstruction similar to that just described as occurring at the aortic valves. These murmurs are sometimes caused by pressure on the artery by enlarged glands; or by constriction of the artery from pleuritic adhesions, or fibroid phthisis with contraction of the lung. Such a murmur will be heard most distinctly in the pulmonary area (D, Fig. 27, page 192), and it will not be heard in the arteries at the base of the neck.

A murmur accompanying or following the second sound of the heart occurs with the diastole of the ventricles and must be due to regurgitation of blood from the arteries through the semilunar valves, either on the right or on the left side.

Aortic Diastolic, or Regurgitant.—If a murmur, accompanying or following the second sound of the heart, occurs at the aortic orifice, it will be due to regurgitation of blood from the artery into the left ventricle. It will generally be soft and blowing in character, though it may be harsh. It will be heard in the aortic area, but usually most distinctly a short distance below the valves; it will be propagated down the sternum and it may sometimes be loudest at the ensiform appendix.

Exceptional.—In some instances such murmurs are very distinct at the apex, in the axillary region about the lower angle of the left scapula, or over all superficial arteries.

Pulmonary Diastolic, or Regurgitant.—If produced at the pulmonary orifice, a diastolic murmur must be due to regurgitation through the pulmonary valves. These murmurs are extremely rare.

When such a murmur occurs it will be heard in the pulmonary area, or an inch or inch and a half below this space, and it will not be transmitted to the arteries or to the lower part of the sternum. From this latter fact it may easily be distinguished from a similar murmur at the aortic orifice.

From what has been said, you will observe that we may have eight distinct valvular murmurs, four of which are obstructive and four regurgitant. However, two of these, viz., the regurgitant pulmonary, and the obstructive tricuspid murmurs, are so very rare that their existence is doubted by many skilled diagnosticians. Regurgitant tricuspid murmurs are rare, except as the consequence of disease of the left side of the heart, which

gives rise to such dilatation of the right ventricle that the auriculo-ventricular orifice becomes too large to be closed by the tricuspid valves.

We may have two or more of these sounds combined in any case; thus it is not uncommon to obtain a mitral regurgitant murmur associated with an aortic obstructive, and perhaps also with an aortic regurgitant; or we may have both the mitral obstructive and regurgitant, with the aortic obstructive and regurgitant.

Murmurs are common in the left side of the heart, but rare in the right side.

According to my observation, the various murmurs occur in the following order of frequency: mitral regurgitant, aortic regurgitant, aortic obstructive, mitral obstructive or presystolic, and tricuspid regurgitant.

VENTRICULAR MURMURS.

There are certain murmurs occasionally heard in the præcordial region, which are neither of valvular nor of hæmic origin. They are most frequent during the active stage of endocarditis, but they also occur in chronic endocarditis. They sometimes precede and sometimes follow endocarditis, and in some instances they are apparently induced by simple irritability of the heart. They occur with the first sound of the heart, and are loudest at the apex. These murmurs seem to be caused by roughening of the endocardium or of the chordæ tendinæ, or by irregular contraction of the muscular fibres of the ventricles. They are of comparatively rare occurrence, and then are usually mistaken for valvular murmurs. They may be distinguished from the latter by their rhythm and by their seat. These murmurs are most likely to be confounded with mitral regurgitant, and aortic or pulmonary obstructive murmurs.

A ventricular murmur, though heard at the apex with the first sound of the heart, is never transmitted to the left. Thus it is distinguished from the mitral regurgitant murmur, which possesses the same rhythm. A ventricular murmur is never heard above the base of the heart, and thus is distinguished from aortic and pulmonary murmurs.

LECTURE XIX.

MURMURS, Continued—SPHYGMOGRAPH.

In order to more clearly define the difference between these various murmurs, it will be profitable to enumerate again their distinctive features, as concisely as possible, with the addition of a few hints concerning their differential diagnosis.

Mitral obstructive murmurs precede the first sound of the heart. They are heard at the apex, but are not transmitted to the left, or into the arteries, and they are not heard behind. The rhythm of these murmurs is to be ascertained by placing the finger over the carotid pulse. Their quality is characteristic, and may be represented by vocalizing the symbols R r r b or V o o t.

Mitral regurgitant murmurs accompany or replace the first sound of the heart. They are loudest at the apex, but are transmitted to the left, and may often be heard behind, beside the sixth and seventh dorsal vertebræ, if the chest-walls are not too thick. They are distinguished from the mitral obstructive murmurs by accompanying or following the first sound instead of preceding it, and by being transmitted to the left of the apex. They are distinguished from the aortic obstructive murmurs, which have the same rhythm, and may sometimes be heard at the apex, by being propagated to the left of the apex, by not being transmitted into the arteries, and by their limitation behind to the mitral area. They are distinguished from tricuspid regurgitant murmurs by their seat, and by being transmitted to the left instead of to the right. They are distinguished from aortic and from pulmonary regurgitant murmurs by occurring with the first sound of the heart instead of with the second.

Aortic obstructive murmurs are usually best heard in the aortic area, or over the upper part of the sternum, and in the carotid and subclavian arteries. They always occur with the first sound of the heart.

When they are loudest in the pulmonary area, they may be distinguished from pulmonic murmurs by being transmitted into the arteries. When heard at the apex, they may be distinguished from mitral murmurs by not being transmitted to the left, and by being propagated into the arteries.

Aortic regurgitant murmurs are usually most distinct over the lower part of the sternum; but they are heard also over the aorta and its main branches. They occur with, or following the second sound of the heart. These murmurs are not likely to be confounded with any other murmur, except the pulmonary regurgitant, which is so exceedingly rare that it may here be left out of the question.

The tricuspid obstructive murmur is so rare that it merits no description.

The tricuspid regurgitant murmur seldom occurs, except as a result of cardiac disease of the left side. When present, it will be loudest in the tricuspid area and will be transmitted toward the right of the sternum. It will not be distinct at the apex of the heart; nor will it be heard posteriorly; and it will be associated with pulsations in the jugular veins. These features at once distinguish it from a mitral murmur.

The pulmonary obstructive murmur will be heard in the pulmonary area, that is, the second intercostal space of the left side close to the sternum, and will occur with the first sound of the heart. It can only be distinguished from aortic murmurs, which are sometimes heard in the same locality, by the fact that it is not heard in the arteries, above the clavicles.

The pulmonary regurgitant murmur, like the tricuspid obstructive, hardly merits present description. When it occurs, it may be heard in the pulmonary artery, and about an inch or an inch and a half lower. It occurs with the second sound.

Ventricular murmurs are heard with the first sound at the apex, and are not transmitted beyond the limits of the heart; this will distinguish them from all other systolic murmurs excepting the tricuspid regurgitant, which is not heard at the apex.

Beside the ventricular murmurs resulting from endocarditis, there are rare adventitious sounds which might appropriately be called ventricular murmurs, which are apparently produced by irregular contractions of the muscular fibres of the heart. They are likely to be heard for two or three pulsations and then to disappear, to recur again after a few moments.

Sometimes endocardial murmurs are produced by dilatation of the ventricles, which prevents perfect closure of the mitral valves. Such murmurs have been termed *Curable mitral regurgitant murmurs*, as they disappear when the tonicity of the muscular fibre has become sufficiently restored to contract the cavities to their original size. These murmurs are probably caused by dilatation of the ventricles without a corresponding elongation of the musculi papillares in consequence of which the chordæ tendinæ are too short to allow the valves to close.

Frequently in the examination of the heart, *impure sounds* are obtained, which closely resemble faint valvular murmurs. These are not constant, but may come and go during the examination. They are generally heard just at the end of inspiration, and they usually cease when respiration is suspended.

Congenital Murmurs.—Imperfect closure of the foramen ovale allows the blood to pass directly from the right into the left auricle, and this occasions a murmur which is audible over the base of the heart. It is heard with the systole of the ventricles, and is not transmitted into the arteries, or to the left of the apex. It may thus be distinguished from aortic and mitral murmurs. This murmur always occurs in early life, and is associated with a cyanotic appearance of the countenance. When the child reaches the age of ten or twelve years, other abnormal sounds usually supervene.

Hæmic Murmurs.—Another variety of adventitious sounds is due to the composition of the blood instead of to changes in anatomical condition of the heart. These are termed anæmic, hæmic, or inorganic murmurs. They are generally most distinct over the aorta, and are diffused through the vessels of the neck. Sometimes they may be heard in the second intercostal space of the left side, about an inch and a half to the left of the pulmonary artery. They are always systolic.

The hæmic murmurs which are produced in the aorta are due simply to change in the composition of the blood. Those heard to the left of the pulmonary artery seem to be produced by slight dilatation of the left ventricle, with consequent imperfect closure of the mitral valves, and more or less regurgitation of blood into the auricle.

These murmurs are inconstant, often coming and going dur-

ing the examination, and finally permanently disappearing, as proper treatment removes the anæmic condition of the blood.

They are distinguished from organic murmurs by the following characteristics: they always accompany the first sound of the heart; they are soft and blowing in character; those which are arterial may be heard over many of the aortic branches; and those which are mitral may be heard a variable distance to the left of the pulmonary artery. They are inconstant and likely to be present when the heart's action is rapid, but absent when it is slow. These murmurs are also attended by the symptoms and signs of general anæmia. Except in complicated cases, they are not associated with the signs of other cardiac disease. They are incapable of supplanting the normal heart-sounds, or even of making them less distinct. They are usually associated with the *venous hum*.

ANOMALOUS HEART-SOUNDS.

In rare instances, sounds may be heard over the præcordial space, which are not endocardial, and are not produced between the two surfaces of the pericardium. These result from the action of the heart upon the lungs, and they usually cease when the respirations are suspended.

With the systole of the ventricles, a loud blowing sound may be occasioned by a large pulmonary cavity situated near the heart. More or less distinct blowing sounds are frequently heard when the systole of the heart occurs just at the end of inspiration. These cease when the patient holds his breath.

Friction sounds may be produced by the action of the heart upon the overlying pleura. Generally these may be easily distinguished from pericardial friction sounds by their seat, and by their disappearance with the cessation of respiration. The pericardial friction sounds are heard most distinctly along the left border of the sternum; but sounds produced within the pleura by the action of the heart are heard most clearly over the outer portion of the mammary region. They are also usually associated with friction sounds over other portions of the left lung. Ordinary friction sounds, due to pleurisy, are sometimes observed in the præcordial region; but these disappear when the patient holds his breath.

The sounds caused by the action of the heart upon the lungs occasionally resemble bronchial râles; but as these are limited to the præcordial space, they are not likely to be mistaken for sounds due to pulmonary disease.

SUBCLAVIAN MURMURS.

Subclavian murmurs are often heard just beneath the clavicle, at the outer portion of the infraclavicular region, and more frequently upon the left than upon the right side. Most of these seem to me to be produced by the pressure of the stethoscope; but murmurs frequently occur in this locality, and over other parts of the subclavian artery, which are not due to external causes. They are supposed to result from pressure upon the artery, either by consolidated lung tissue or by cicatricial bands resulting from pleurisy; but their exact cause is not known. They are most frequently associated with consolidation of the apex of the lung.

VENOUS SIGNS.

CONGESTION.—Congestion of the superficial veins of the neck and upper part of the trunk is a sign of cardiac or pulmonary disease, and of aortic aneurism or other intrathoracic tumors. The condition is caused by direct pressure on the veins, or by increase in the intrathoracic pressure from pulmonary disease, and consequent interference with the return of blood to the heart. It is always most noticeable when the patient is in the recumbent position.

This turgescence may be either temporary or permanent. If temporary, it is most marked in expiration, or after attacks of coughing, and it will entirely disappear upon deep inspiration.

TEMPORARY TURGESCENCE OF THESE VEINS is generally due to congestion of the pulmonary circuit, resulting from disease of the lungs, which compresses the capillaries, and consequently causes distention of the pulmonary arteries and of the right side of the heart, and, through it, of the descending vena cava and its branches.

PERMANENT TURGESCENCE most commonly results from disease of the mitral valves, which either obstructs the onward

current of blood into the ventricle, or allows free regurgitation into the auricle. This gives rise to congestion of the pulmonary circuit, which cannot be relieved by deep inspiration. In other instances, permanent congestion is due to obstruction of the descending vena cava by a thrombus, or more frequently by the pressure of an aneurism or other tumor.

LOCALIZED TURGESCENCE, that is, confined to a single vein and its branches, is always the result of a thrombus or of pressure upon the blood-vessel.

VENOUS PULSATION.—Marked pulsation in the jugular veins is observed when there is permanent engorgement of the descending vena cava, which generally results from extreme emphysema or stenosis of the mitral valves.

Pulsation in the jugular veins is most frequently observed just above the clavicles, though sometimes it extends over the whole course of the vessel. It is most marked in the dorsal decubitus; and it is more distinct upon the right than upon the left side, because the current of blood from the right ventricle, through the auricle, finds its way more readily into the veins of that side.

Venous pulsation may precede the impulse of the apex and the first sound of the heart, or may follow it. In other words, it may be either presystolic or systolic.

Presystolic venous pulsation is due to regurgitation of blood into the veins during the contraction of the auricles.

Systolic venous pulsation is due to contraction of the right ventricle with regurgitation of blood through the tricuspid valves into the auricle and thence into the veins. When slight and temporary, this is termed relative venous pulsation; when permanent, it is known as absolute venous pulsation. In order to be of value in the diagnosis of tricuspid regurgitation, this pulsation must be visible during both inspiration and expiration.

Pulsation of the jugular veins may be simply the transmitted impulse from the carotids. In such cases, there will be simply a lifting impulse, instead of expansion of the blood-vessel, and the vein will not be tortuous as in true venous pulsation.

Pulsation in the veins on the back of the hands has been repeatedly noticed by Prof. Peter, of Paris, in advanced consumption, and occasionally in other affections. The pulsation

is increased by compressing the wrist, and therefore must be propagated through the capillaries from the left side of the heart. It may be seen more readily than it can be felt.

Prof. Peter thinks this phenomenon due to paralysis of the muscular fibres of the arteries, through excess of carbonic acid in the blood. This rare phenomenon, when seen, indicates the near approach of death.

COLLAPSE OF THE JUGULAR VEINS is said to occur with the systole of the ventricles, in some cases, where there is agglutination of the two surfaces of the pericardium.

VENOUS MURMURS.—The venous hum, or *bruit de diable*, is a constant humming sound, which is frequently obtained over the jugular vein just above the clavicle, or in the interclavicular notch. It is generally associated with an arterial hæmic murmur. It occasionally occurs in healthy persons, but is most often found in those who are anæmic, and especially in chlorotic females.

This sign is usually soft and humming in character, but occasionally it is musical, hissing, or even loud and roaring. It is most likely to be heard when the patient is sitting or standing.

INTERMITTENT VENOUS MURMURS, synchronous with the pulsations of the heart, are among the rarest signs of cardiac disease. These murmurs may be presystolic, systolic, or diastolic. The presystolic murmurs are heard only when the patient is lying down, and must result from regurgitation of blood from the right auricle into the open veins. The systolic murmur is usually heard most distinctly just above the clavicle on the right side. It is due to regurgitation from the right ventricle through the auricle and into the veins. The diastolic murmur is extremely rare. It is said to require for its production, hypertrophy and dilatation of the heart, with aneurism. These murmurs may be mistaken for arterial murmurs. They may be distinguished from the latter by slightly pressing on the blood-vessel, which will prevent the venous hum, but will not so affect the arterial murmur.

THE SPHYGMOGRAPH.

By the use of the sphygmograph we are enabled to obtain an accurate graphic statement of the condition of the circulatory

system, written, so to speak, by the heart itself. When all the conditions are favorable, this statement furnishes important information; but so much depends upon the adjustment of the instrument, its proper working, and the pressure made upon the

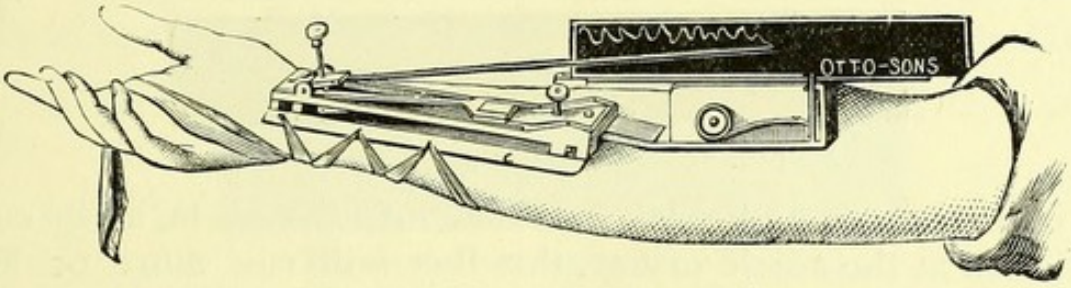


FIG 30 —Marey's Sphygmograph.

artery, that up to the present time the instrument has been of little clinical value. When all the conditions are perfect, the tracings of the pulse indicate: the time occupied by the systole and the diastole of the heart; the force of the heart's contrac-



FIG. 31.—Normal radial pulse (Foster).

tion; the resistance to the onward current of blood, or its regurgitation through the valves, and the tension of the arteries.

The trace is composed of a series of curves, each of which represents a cardiac pulsation.

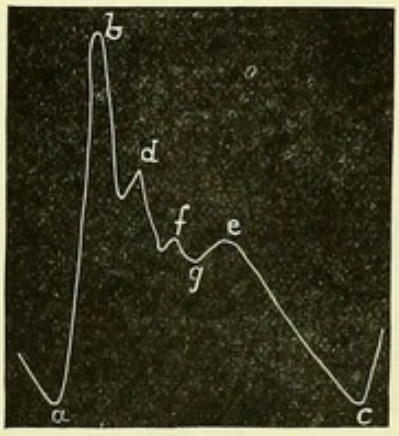


FIG. 32.—Normal radial pulse, single trace enlarged.

In the trace of the normal radial pulse as shown (Figs. 31 and 32) each curve consists of a line of ascent, a summit, and

a line of descent. The line of ascent *a b* in the normal condition is perpendicular to the plane of the base. It is produced as the blood is propelled into the artery. This line indicates the force of the heart by its height, and the rapidity of the current of blood, by its direction. When the blood is retarded



FIG. 33.—Aortic obstruction (Hayden).

in its passage from the left ventricle into the aorta, as in constriction at the aortic orifice, this line will run more or less obliquely to the right, according to the amount of obstruction (Figs. 33 and 34). When the pulsation is forcible the altitude



FIG. 34.—Aortic obstruction (Foster).

is much greater than when it is weak. The summit *b* (Fig. 32) in the normal condition is a mere point. It is reached at the instant when the artery is most fully distended, immediately after the systole of the left ventricle. When the artery is in-

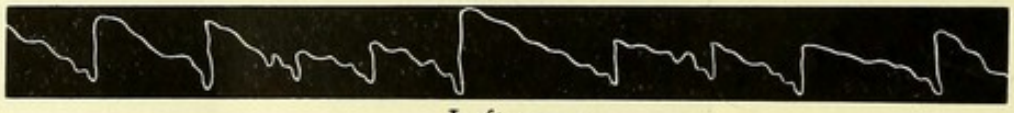


FIG. 35.—Mitral regurgitation.

completely filled, the summit is rounded, or the line of descent may run almost horizontally for a short distance. Examples of this are found in mitral regurgitation (Fig. 35), or when the artery is partially occluded by an aneurism (Fig. 36), and when



Right arm.



Left arm.

FIG. 36.—Aneurism of ascending aorta (Loomis).

free regurgitation through the aortic valves prevents full distention of the artery (Figs. 37 and 38). The line of descent *b c*

(Fig. 32) corresponds to the period of arterial systole and cardiac diastole. The length of the line indicates the rapidity of the heart's action. When the heart is beating rapidly, the line is short, and when beating slowly, it is correspondingly lengthened. The undulations in this line *d e f* (Fig. 32) are

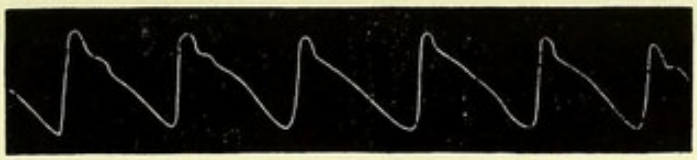


FIG. 37.—Aortic regurgitation (Boileau).

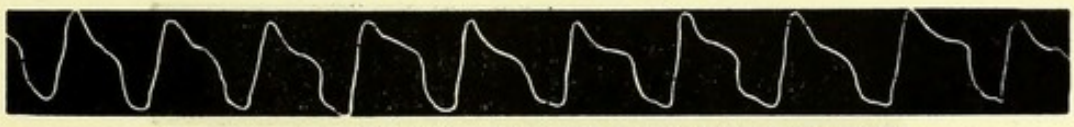


FIG. 38.—Aortic obstruction and regurgitation (Loomis).

known as the first, second, and third secondary waves. The first secondary wave *d* is produced by the natural contraction of the artery. The second wave *e* corresponds to the impulse occasionally felt, which is termed *dicrotism*. The third wave *f* is not often present. The depression *g* marks the complete closure of the aortic valves. A small notch in the line of descent is often seen near the summit.

Instead of having the form shown in this figure, the line of descent may run obliquely downward in nearly a straight course. It may have a generally convex or concave form, and the position of the secondary waves may vary in distance from the points *b* and *c*.

Convexity of the line of descent or small secondary waves (Fig. 39) are due to increased arterial tension, as when there is incipient hypertrophy of the heart in consequence of contraction of the arterioles in Bright's disease.

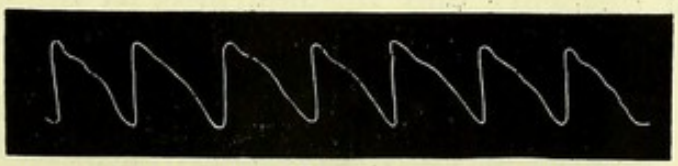


FIG. 39.—Commencing hypertrophy from obstruction in the arterioles, due to Bright's disease of the kidneys.

Concavity of the line of descent is due to diminished arterial tension.

Sudden dropping of the line of descent indicates aortic regurgitation (Figs. 37 and 43).

In the normal trace, the first secondary wave is found on a level with the junction of the middle with the upper third of the line of ascent; but with loss of elasticity of the artery it occurs nearer the summit, as in the senile pulse (Fig. 40). The



FIG. 40.—Senile pulse (Foster).

same condition of the artery is indicated by absence of dicrotism.



FIG. 41.—Mitral constriction (Hayden).

In mitral stenosis the line of ascent is oblique, the summit rounded, the line of descent prolonged, and the secondary waves are absent or indistinct.



FIG. 42 —Mitral constriction and tricuspid regurgitation (Hayden).

From what has been said, we learn that the sphygmographic trace is not diagnostic of any disease, as will be at once apparent in looking over the tracings taken in different cases of the same disease (Figs. 33 and 34, 37 and 38); but the general appearance of the curve may indicate special conditions. The special points to notice in the trace are: the height and the obliquity of the line of ascent; the acuteness or rotundity of the summit; the length of the line of descent; the convexity of the line of descent; and the nearness to the summit of the secondary waves.

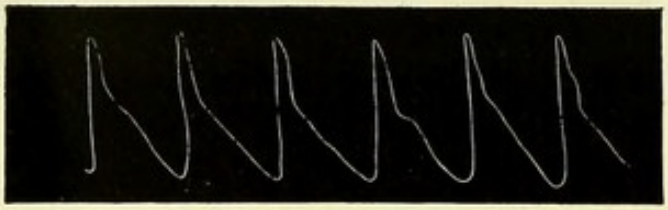


FIG. 43 —Hypertrophy and dilatation of the heart (Hayden). High line of ascent; sudden falling of line of descent.

Dr. Sanderson considered this instrument principally useful

in detecting increased arterial tension, consequent upon hypertrophy of the left ventricle (Fig. 39).

The late Dr. Anstie thought that when the instrument worked perfectly, if accurately adjusted, it would be of value in the diagnosis, not only of commencing hypertrophy of the heart, but also of aortic regurgitation (Fig. 37), and especially of aneurism of the aorta (Fig. 36).

LECTURE XX.

DIAGNOSIS AND TREATMENT OF CARDIAC DISEASES.

PERICARDITIS.

Pericarditis is an inflammation of the serous membrane enveloping the heart. It results generally from rheumatism, renal disease, or pyæmia. Inflammation here, as in other serous membranes, first causes dryness, which is soon followed by an exudation of inflammatory lymph, and this is succeeded or accompanied by an effusion of serum. This disease may be divided into three stages, similar to the three stages of pleurisy, viz.: the first, or dry stage; the second, or stage of effusion; and the third, or stage of absorption.

SYMPTOMS.

The most common symptoms are pain in the præcordial and epigastric regions, shooting to the shoulder, and augmented by movements or by pressure; with more or less fever, a small wiry, irregular pulse, œdema, dyspnœa, and occasionally dysphagia. Any or all of these symptoms may be absent.

SIGNS.

The essential signs in the order of their occurrence are: irritable action of the heart; friction fremitus and murmur; increased dulness over the heart, ultimately obtained over a triangular area, which extends considerably to the left of the apex; with feebleness of the heart's impulse and sounds, both of which are intensified by causing the patient to lean well forward.

Signs of the First Stage.

Inspection and Palpation.—In the first stage, upon inspection and palpation, we discover nothing except an irritable action of the heart, with slightly increased force, and in the latter part of the first stage, friction fremitus.

AUSCULTATION.—Upon auscultation a grazing friction sound may sometimes be heard, very early in the disease, along the left border of the sternum. This sound may be distinguished from endocardial murmurs by its rhythm and seat, and by the fact that its intensity is increased by pressure. In the latter part of this stage, friction sounds of a harsher quality may be obtained. These may be either feeble or very intense.

Signs of the Second Stage.

In the second stage of the disease, the signs vary somewhat in proportion to the amount of the effusion.

INSPECTION.—In children or in young adults, with elastic chest-walls, bulging of the præcordial region extending from the second to the sixth rib, may be noticed. The respiratory movements of the left lung are somewhat disturbed, and the position of the apex-beat is altered, being carried upward and to the left into the fourth intercostal space.

PALPATION confirms the signs obtained by inspection. The impulse of the heart is feeble, especially when the patient is lying upon his back; but when he is leaning forward it is much more forcible than in either the erect or the recumbent position. This is an important fact in the diagnosis. When the pericardium is greatly distended, the diaphragm may be forced downward, so as to cause bulging in the epigastric region. Undulation of the whole præcordial region, due to the action of the heart upon the fluid inclosing it, may frequently be felt, and occasionally fluctuation can be detected.

PERCUSSION.—Upon percussion both the superficial and the deep-seated areas of dulness are found to be increased. At first the area of deep-seated dulness is increased in its vertical diameter, and dulness is noticeable principally above the base of the heart in the second intercostal space, where the serum first collects. This is especially noticeable when the person is in the recumbent posture. When the effusion becomes somewhat greater, serum collects at the lower part of the pericardial sac; dulness is then increased in the transverse diameter at the level of the apex, and the area of dulness becomes triangular with its base downward, corresponding to the form of the pericardium. This triangular shape remains, however great the effusion may be. In extensive effusion, the dulness may extend

from the first rib above to the resonance of the stomach below, and laterally from the right nipple to a point about two inches beyond the left nipple. The position of the apex-beat having been determined by palpation or by auscultation, the existence of dulness to the left of this point and below it becomes an important element in distinguishing pericarditis from enlargement of the heart; in the latter the apex-beat corresponds very nearly to the limit of dulness on the left.

In the differential diagnosis of pericardial effusions, Dr. T. M. Rotch, of Boston, considers an area of flatness in the fifth intercostal space of the right side, about an inch from the border of the sternum, a very important sign.

AUSCULTATION.—The friction sounds which are usually heard in the first stage generally disappear when effusion occurs, in consequence of the separation of the pericardial surfaces; yet they often remain at the base of the heart throughout the entire course of the disease. In the second stage, the heart-sounds are feeble and distant, but they may be rendered more distinct by causing the patient to lean well forward; sometimes friction sounds may be reproduced by this means.

Pulmonary sounds are not heard over the area of flatness in the præcordial region.

Signs of the Third Stage.

In the third stage of the disease, the signs of the second stage disappear, the bulging gradually diminishes, the apex-beat becomes more and more perceptible, and returns to its normal position; there is a gradual diminution in the area of dulness; the friction sounds may return and remain until resolution has taken place, or until the two surfaces of the pericardium have become adherent; and the respiratory sounds may again be heard in the præcordia.

Exceptional.—Occasionally friction sounds continue a long time after apparent recovery.

We have no means of determining when adhesions of the pericardial surface have taken place unless the external layer of the sac has also adhered to the chest-walls. When this accident has occurred, the intercostal spaces are seen to be depressed with each systole of the ventricles, and ultimately permanent depression of the præcordial region may take place.

In some cases, when the heart is considerably hypertrophied and dilated, dragging-in of the epigastric region is caused by each pulsation of the heart.

DIFFERENTIAL DIAGNOSIS.

Pericarditis is liable to be mistaken for pleurisy, or endocarditis.

Pleurisy.—The first stage of this affection causes pain and friction sounds similar to those of pericarditis and if it happen to involve only the anterior portion of the left pleura, considerable care will be necessary to avoid an error in diagnosis. The distinctive features between the two affections are presented in the following table:

PERICARDITIS.	PLEURISY.
Symptoms.	
Pain usually in the præcordial region.	Pain usually in the infra-axillary region.
Signs.	
Friction sounds confined to the region of the heart and synchronous with its movements, and not affected by the respiratory movements.	Friction sounds, though they may be confined to the præcordial region, are generally heard farther to the left. They are not synchronous with the pulsations of the heart, but occur with the respiratory movements, and almost invariably cease when respiration is suspended.

Endocarditis.—For the distinctive features between this disease and inflammation of the pericardium see page 218.

TREATMENT.

With the first symptoms of pericarditis, the patient should be placed in bed, there to remain absolutely quiet until convalescence has been established. Hot poultices should be kept constantly applied to the whole anterior surface of the chest. Opiates should be given in just sufficient quantity to control pain. Depressing measures of all kinds must be avoided.

If the cause of the disease can be ascertained, it should be removed. When this is not possible, its effects should be modified by proper treatment. Rheumatism will call for alkalies, guaiacum, and small doses of colchicum. The latter must not be given in doses sufficient to derange the digestive organs or to cause depression. Salicylic acid should not be given on account of its depressing effects on the heart. If this affection

follows depressing fevers, the supporting measures which are required for the latter should be more assiduously applied. If it results from Bright's disease, saline cathartics in moderate doses; diaphoretics, especially vapor or hot-air baths; dry cupping over the loins; and small doses of digitalis will be indicated. In most cases, iron is a necessary remedy, and quinia will usually be beneficial in maintaining the patient's strength.

The diet should be concentrated and nutritious, and, so far as possible, fluids should be avoided. If effusion takes place, its removal will be favored more by the means calculated to maintain the strength than by the various drastic cathartics so often prescribed. In many cases, good effects will follow the judicious use of hot-air baths, to promote diaphoresis; of iodide, bitartrate, or acetate of potassium, or fluid extract of scoparius, to cause diuresis; or fluid extract of euonymus or small doses of elaterium, to induce catharsis.

If pressure on the heart from pericardial effusion becomes excessive, the question of aspiration will suggest itself. With reference to this operation I would recommend it in cases where heart-failure seems imminent, but it should be held as a dernier resort.

During convalescence from this disease, the greatest care should be exercised for ten or twelve weeks to avoid exposure or active exercise. The heart is always weakened by such an attack, and there is a tendency to dilatation, which should be guarded against by small doses of digitalis, strychnia, and arsenic. To promote the patient's strength still farther, we should make free use of iron and good diet. The patient should avoid everything which would cause the organ extra labor.

CHRONIC PERICARDITIS.

If acute inflammation of the pericardium does not terminate in recovery within three weeks, the disease is termed chronic pericarditis. This condition may be characterized by a collection of fluid in the pericardium or by adhesion of the two surfaces of this sac.

In the former case, counter-irritation, diuretics, and cathartics

are indicated; but in both cases iron and cardiac tonics must be constantly employed and excessive action must be avoided.

PNEUMO-HYDROPERICARDIUM.

This is one of the rarest of cardiac diseases. As indicated by the name, it is a condition in which air, or gas, and fluid occupy the pericardial sac. The essential signs of the affection are tympanitic resonance over the air, and flatness over the fluid; and on auscultation a splashing sound synchronous with the pulsation of the heart and entirely independent of the respiratory movements.

DIFFERENTIAL DIAGNOSIS.

Pneumo-hydrothorax and certain conditions of the stomach might possibly be mistaken for this affection; but there is no danger of an error in diagnosis if we remember that the signs of pneumo-hydrothorax are found on the side and posteriorly; and that the splashing sounds which are sometimes produced within the stomach are heard below the præcordial region.

TREATMENT.

These cases are usually speedily fatal, and when of longer duration the treatment must be expectant.

ENDOCARDITIS.

This is an inflammation of the lining membrane of the heart. It seldom occurs as a primary disease. It is frequently associated with pericarditis, and it is often the result of pyæmia, Bright's disease, or acute rheumatism.

SYMPTOMS.

The usual symptoms of this affection are: a sense of uneasiness about the heart, fever, a short cough, dyspnœa, and an anxious countenance.

SIGNS.

The affection is often denoted by a feeble ventricular murmur, apparently due to thickening of the valves, with possibly shortening of the chordæ tendinæ.

When the symptoms just mentioned come on in the course of any of the affections named, especially if a ventricular mur-

mur supervenes over a heart the sounds of which were formerly normal, we may reasonably conclude that inflammation of the endocardium exists.

DIFFERENTIAL DIAGNOSIS.

Endocarditis, when occurring independently of pericarditis, is liable to be mistaken for the latter disease. *Pericarditis* may be distinguished from uncomplicated inflammation of the endocardium by the rhythm and seat of the murmur.

ENDOCARDITIS.	PERICARDITIS.
Rhythm of murmur.	
Murmur synchronous with the first sound of the heart, and does not occur with the diastole unless regurgitation takes place through the aortic or pulmonary semilunar valves.	Murmur not exactly synchronous with the valvular sounds, and often occurs during both the systole and diastole of the heart.
Seat of murmur.	
Murmur loudest at apex of heart.	Murmur heard loudest at border of sternum near the fifth left costal cartilage.

TREATMENT.

This affection is nearly always the result of rheumatism, chorea, pyæmia, or the acute exanthematous fevers. The proper treatment for these affections is that which should in the main be employed in the secondary heart disease.

In this disease, perfect quiet should be maintained, not only during the active stage, but also during the convalescence.

In the very inception of the attack, a full dose of quinine will occasionally cut it short. Later in the disease, this remedy and iron are very useful. During the treatment, the patient should be kept in a warm room at 70° to 75° F., and the chest should be specially guarded from exposure.

Sibson recommends a liniment of belladonna and chloroform sprinkled on cotton wool and kept applied to the præcordial region. Great depression calls for alcoholic stimulants and digitalis. The latter in moderate doses, combined with quinine, arsenic, and iron, is needed during convalescence, but care should be taken not to overstimulate the heart.

Exceptional.—Nearly all cases of endocarditis are associated with, or follow other diseases, and are attended by symptoms which demand supporting treatment; but now and then one occurs without apparent cause in a robust person of full habit. In such case general bleeding would undoubtedly prove beneficial by relieving the overburdened heart.

HYPERTROPHY OF THE HEART.

Synonyms.—Enlargement of the heart; Active aneurism; Hypersarcosis cordis.

This consists of hypertrophy of the muscular walls of one or more of the cardiac cavities without enlargement of the cavity itself. It is due to increased functional activity of the heart, brought about in some cases by obstruction to the circulation at one of the valvular orifices, as by contraction of the valves; and in some by obstruction in the pulmonary circuit, due to emphysema or other pulmonary disease. In other cases the obstruction occurs in the arterioles, in consequence of their contraction caused by retention in the blood of morbific material, as for example in Bright's disease, where proper elimination of urea does not take place.

SYMPTOMS.

The symptoms are not marked.

SIGNS.

The signs in this affection vary with the extent of the hypertrophy, and with the portion of the organ involved. The essential signs are: increased area of dulness and increased force of impulse while the heart's action remains regular.

INSPECTION.—In children, there is frequently a prominence of the præcordial region when the hypertrophy is general, but in adults this cannot be detected. The action of the heart is regular and forcible. If the left ventricle alone be hypertrophied, the apex-beat will be seen farther than usual to the left, and the visible area of the impulse will be increased. If the right ventricle is affected, there will be strong epigastric pulsation, and the apex-beat, if perceptible, will be below the usual position and to the right of it.

PALPATION confirms the signs as to the position and force of the apex-beat.

PERCUSSION.—On percussion there is an increase in the areas of superficial and deep-seated cardiac dulness. The deep-seated dulness in simple hypertrophy of the left ventricle seldom extends more than an inch to the left of the normal position. A larger area is almost always associated with more

or less dilatation. In hypertrophy of the right ventricle, the dulness extends considerably to the right of the sternum.

AUSCULTATION.—In hypertrophy of the ventricles, the first sound of the heart is greatly increased in intensity, and the elements of muscular contraction and impulsion are especially marked. The second sound is also increased in intensity and is more widely diffused than normal. The heart's action remains regular as long as the hypertrophy compensates for the obstruction.

The respiratory murmur is diminished or is absent over a portion of the præcordial region corresponding to the displacement of the lung.

TREATMENT.

Hypertrophy of the heart is nearly always a conservative process, and should be favored rather than retarded; but in some instances, symptoms appear of cerebral congestion, such as pain, fulness of the head and vertigo, and require prompt attention. Bleeding will temporarily relieve these, but it is not to be recommended. Tincture of aconite root in doses of two or three drops every two hours until relief is obtained is the most efficient remedy in such instances. It must not be forgotten that similar symptoms are caused by passive congestion depending upon cardiac failure, and that in such cases the aconite would be harmful. These latter cases I have found most quickly relieved by nux vomica. The causes of the hypertrophy should be sought for and so far as possible they should be removed.

HYPERTROPHY AND DILATATION OF THE HEART.

This consists of hypertrophy of the muscular walls with dilatation of the cavities. It is caused by yielding of the walls to excessive pressure, which may result from the same causes which induced the hypertrophy; or from regurgitation of blood through incompetent valves.

SYMPTOMS.

Dyspnœa on exertion, œdema especially of the ankles, and occasional vertigo and palpitation of the heart, are common symptoms. In this affection, the action of the heart remains

regular if the hypertrophy is sufficient to compensate for the dilatation; but it becomes irregular if the dilatation predominates.

SIGNS.

The essential signs are: increased area of visible impulse, with displacement of the apex-beat downward and to the left, and a peculiar heaving impulse with increased area of dulness. Endocardial murmurs are nearly always present.

INSPECTION AND PALPATION.—The area over which the cardiac impulse may be seen and felt is greatly increased. Sometimes it may be seen over the entire left side, and the impulse often has a peculiar heaving or lifting character, which is sufficient in some instances to shake the bed on which the patient is lying. The apex-beat may sometimes be found two or three inches to the left of the left nipple, and as low as the eighth rib.

PERCUSSION.—The area of dulness is increased to the left and downward, in proportion to the enlargement of the organ; or, if the right ventricle is affected, it is also increased to the right.

AUSCULTATION.—Both sounds of the heart are prolonged, and they may often be heard over the entire chest. If valvular murmurs are present, they will be loudest in the normal areas, which were described in a previous lecture (Fig. 27, page 192); but they may also be heard in some instances over the whole thorax.

DIFFERENTIAL DIAGNOSIS.

This affection might be mistaken for pericarditis, hypertrophy of the ventricles, or for simple dilatation of the heart.

It may be distinguished from *pericarditis* or from *dilatation of the heart* by the force of the apex-beat and by the intensity of the heart sounds. It can easily be distinguished from simple *hypertrophy* of the heart by the size of the area of dulness and the force and character of the impulse.

TREATMENT.

The treatment of this condition is essentially the same as that of valvular disease of the heart, with which it is nearly always associated (page 232).

DILATATION OF THE HEART.

Synonyms.—Aneurism or passive aneurism of the heart; Cardiectasis.

This consists of dilatation of the cavities of the heart without thickening of their muscular walls. It results from excessive pressure, which is not compensated for by hypertrophy, and which follows as a consequence of valvular disease of the heart, of obstruction to the pulmonary circuit through emphysema, or of cirrhosis of the lungs.

Dilatation is also produced by weakening of the muscular fibres, as in anæmia, fevers, and obesity.

SYMPTOMS.

The most frequent symptoms are: rapid irregular pulse; palpitation of the heart; syncope; dyspnœa; œdema; turgescence of the veins, and congestion of the various organs, causing œdema of lungs, jaundice, or albuminuria.

SIGNS.

The most important signs of this disease are: feeble and irregular action of the heart; an enlarged area of dulness, oval in form, and not extending far to the left of the apex-beat; and feebleness of the heart-sounds.

INSPECTION.—The impulse of the heart's apex may not be visible. If seen at all, it is likely to extend over a wider area than in health, and the point of maximum intensity is not easily determined. It is occasionally of an undulatory character.

PALPATION.—The apex-beat is found below the normal position and to the left of it, and the heart's action is irregular in rhythm. The impulse is feeble, and this characteristic enables us readily to distinguish this affection from hypertrophy, or hypertrophy with dilatation. A purring tremor may frequently be obtained, especially when there is mitral regurgitation.

PERCUSSION.—The area of cardiac dulness is increased to the right when the right cavities are involved, and to the left

when the left cavities are dilated. This area maintains an oval outline, which enables us to distinguish the disease from pericarditis, in which the signs, upon inspection and palpation, are nearly identical.

AUSCULTATION.—Both sounds of the heart are short, abrupt, and feeble. They are often of equal length. The second sound may be inaudible at the apex.

If valvular murmurs have been present, these become less intense, and sometimes of a swirling character. The respiratory sounds over the upper portion of the left lung are often enfeebled.

DIFFERENTIAL DIAGNOSIS.

There is no difficulty in distinguishing this affection from all other diseases excepting pericarditis. The distinctive features between these two are shown below.

DILATATION OF THE HEART.	PERICARDITIS.
History.	
Chronic.	Acute.
Palpation.	
Impulse feeble and irregular—felt *below* and to the left of its normal position, and not materially affected by leaning the patient's body forward.	Impulse feeble and irregular—felt *above* its normal position, and increased in force when the patient leans forward.
Percussion.	
Oval outline of dulness which does not extend far to the left of the apex.	Triangular outline of dulness which extends considerably to the left of the apex-beat.
Auscultation.	
Heart-sounds feeble, short, and valvular, and not altered by position.	Heart-sounds feeble, and not so markedly valvular, but intensified by leaning the body forward.

ASYSTOLISM.

This is a term which has been applied to a condition in which the ventricle cannot completely empty itself. It is nearly always associated with dilatation of the right ventricle.

In this condition, the impulse of the heart becomes very feeble, and shortly before death the valvular sounds or murmurs which may have been present become almost inaudible, or they may be supplanted by a continuous humming sound.

Tricuspid regurgitation with pulsation in the jugular veins is likely to be developed during the course of this affection.

TREATMENT.

The treatment of dilatation of the heart and of asystolism should be the same as that recommended for valvular disease of the heart, page 232.

LECTURE XXI.

DIAGNOSIS AND TREATMENT OF CARDIAC DISEASES—Continued.

ATROPHY OF THE HEART.

Synonym.—Phthisis of the heart.

This is an extremely rare affection. It consists of simple attenuation of the walls of the heart, the cavities usually remaining of normal size, but in some cases both the thickness of the walls and the size of the cavities are diminished.

The affection is sometimes congenital. It may be caused by chronic wasting disease or by constriction of the coronary arteries.

DIAGNOSIS.

A diagnosis can rarely, if ever, be made during life; but in the congenital variety we may possibly detect decreased area of cardiac dulness independent of pulmonary emphysema.

FATTY DEGENERATION OF THE HEART.

There are two recognized varieties of this disease: one, in which there is a deposit of fatty tissue upon the surface of the heart or between its muscular fibres; and the other, in which the muscular fibres themselves undergo fatty degeneration. The first variety is attributed, by Kennedy, to a "fatty diathesis;" the second variety usually results from atheromatous degeneration of the aorta, old age, alcoholism, gout, or some prolonged wasting disease. The physical signs of either are not always well marked, and a positive diagnosis is often impossible.

SYMPTOMS.

The symptoms of fatty disease of the heart are practically the same in both varieties, and they are of the greatest importance in a diagnostic point of view. The most prominent of

these are: melancholia or irritability of temper; partial loss of memory, or hesitating speech; palpitation of the heart; dyspnœa and angina pectoris. Other symptoms, which are frequently noticed, are: pallor and a sallow appearance of the surface, with congestion of the ears and lips; weight and pain in the head; a sense of pain in the epigastrium; double vision or loss of vision; and the arcus senilis. Two other symptoms sometimes occur, and when found, they are of the greatest value in a diagnostic point of view. These are pseudo-apoplexy and the Cheyne-Stokes respiration.

Pseudo-apoplexy consists of sudden attacks, similar to those of apoplexy, in which the individual suddenly loses consciousness and falls. It differs from true apoplexy in the rapidity of recovery. When these attacks first make their appearance, they seldom continue more than a minuté or two, and the patient comes out of them feeling perfectly well; but, as the disease progresses, they become more and more frequent, prolonged, and severe, and are attended with paralysis; but even then the patient usually recovers completely in a few days at most.

The "Cheyne-Stokes respiration" appears late in the disease. "It consists in the occurrence of a series of inspirations increasing to a maximum, and then declining in force and length until a state of apparent apnœa is established. In this condition a patient may remain for such a length of time as to make his attendants believe he is dead, when a low inspiration, followed by one more decided, marks the commencement of a new ascending and descending series of inspirations." Although an important symptom of fatty heart, it must not be forgotten that this peculiar respiration occurs in dilatation or valvular disease of the organ.

In the variety of this disease which is caused by deposit, obesity is a symptom of great importance. In fatty degeneration of the muscular fibres, loss of weight, after a person has been fleshy, is a valuable symptom.

SIGNS.

In *fatty deposit* on the heart, the pulse is usually slow—forty or fifty per minute—full, and sometimes even bounding. Very careful percussion may detect an increase in the area of cardiac dulness.

In *fatty degeneration* of the muscular fibres, auscultation over the apex will sometimes reveal slow pulsation; and even when the pulsation equals seventy per minute, it often conveys to the ear a sense of slowness.

The impulse of the apex is weak, and the intensity of the sounds feeble in either variety. If valvular disease co-exists, a soft systolic *souffle* may be detected by care.

INSPECTION AND PALPATION.—The impulse is either indistinct or absent; the apex remains in its normal position; the action of the heart is often irregular, frequently intermittent, and may be either slow or rapid. The pulse in fatty deposit is slow and full; in fatty degeneration it may be slow or rapid, but it usually appears to be rapid at the wrist, even though the heart is beating slowly.

PERCUSSION.—The heart is of normal size in fatty degeneration, but slightly enlarged in fatty deposit.

AUSCULTATION.—The first sound is feeble, short, and valvular, having lost nearly all of its muscular element; it is sometimes inaudible. The second sound is usually short, clacking, and distant.

A soft, blowing murmur may frequently be heard over the aorta with the first sound, especially if the patient is in the recumbent position.

Exceptional.—Sometimes the heart-sounds in this disease are like those of the fœtus in utero. Sometimes they are metallic or ringing, and it is said that the second sound is sometimes prolonged and intensified.

Stokes considers the occurrence of pseudo-apoplexy with a soft *souffle* in the aortic area with the first sound of the heart, and a slow pulse, positive evidence of fatty degeneration of the heart; but these signs seldom occur combined in the same individual.

A combination of several of the important symptoms and signs which have been enumerated is often present, and may justify a positive diagnosis.

DIFFERENTIAL DIAGNOSIS.

Fatty heart is most likely to be mistaken for functional affections of the organ, from which it can only be distinguished by careful scrutiny of the symptoms and signs already enumerated, and the exclusion of hysterical affections.

TREATMENT.

The general treatment for this affection is the same as for valvular diseases.

Arsenic is one of our best remedies, as it not only increases the power of the heart, but also relieves the neuralgic pains, which are among the most distressing symptoms of this disease. When the affection consists of fatty deposit on the surface of the heart, or between its muscular fibres, much may be accomplished by regulation of the diet. In these cases the patient should live principally on lean meat, and should avoid, as far as possible, all fat-producing food, such as sugar, starch, and alcoholic stimulants. He should take as little fluid as possible, and should wear warm clothing, even in summer, to favor free diaphoresis. These measures will greatly lessen obesity.

Fucus vesiculosis (bladder-wrack) has obtained some reputation for reducing obesity, but I have had no experience with it.

MYOCARDITIS.

Myocarditis consists of an inflammation of the muscular fibres of the heart.

This is a rare affection, and of its symptoms and signs we know nothing, apart from its association with endocarditis or pericarditis. If, during the progress of either of these diseases, the heart's action becomes intermittent or irregular, and there is a tendency to syncope, it is probable that the muscular tissue of the organ has become involved.

SYMPTOMS AND SIGNS.

The essential symptoms and signs of the disease are: extreme pallor of the countenance, with coldness of the surface and a tendency to syncope; also pain and oppression at the præcordia, with dyspnœa amounting to orthopnœa, and suspirious respiration. The action of the heart is feeble, fluttering, and irregular. The area of cardiac dulness remains normal unless pericarditis exists. Both sounds of the heart are sharp and valvular, the first very closely resembling the second. They may sometimes be represented by the "*ta, ta*" characteristic of the fœtal heart. Frequently with these symptoms and signs the patient complains of severe pain in the head and limbs, and there may be delirium or hemiplegia. All or only a part of

these signs and symptoms may be present in any individual instance.

DIAGNOSIS.

If an acute affection of the heart is attended with pallor and coldness of the surface, syncope, pain in the cardiac region, and a feeble, fluttering, and irregular pulsation, we may fairly suspect inflammation of its muscular walls. Inflammation of the cardiac walls may eventuate in circumscribed dilatation or in abscess, and finally in rupture of the heart.

TREATMENT.

Treatment should be the same as for endocarditis.

ACUTE ANEURISM OF THE HEART.

This consists of bulging of that portion of the cardiac walls which has been softened by inflammation.

There are no symptoms or signs to distinguish it from myocarditis. It usually eventuates in rupture of the heart.

ABSCESS OF THE HEART.

This is one of the results of myocarditis; therefore it possesses similar symptoms and signs. The course of the disease is rapid, and, unfortunately, the diagnosis is usually made only at the autopsy.

If the abscess opens into the pericardium, purulent pericarditis supervenes; if into one of the cavities of the heart, pyæmia follows.

TREATMENT.

Treatment should be the same as for endocarditis.

RUPTURE OF THE HEART.

This accident may follow myocarditis or fatty degeneration of the heart. In the latter case, it seldom occurs in persons less than sixty years of age.

SYMPTOMS.

The symptoms are: sharp sudden pain in the præcordial region, faintness, collapse, and speedy death; though some patients have lived forty-eight hours after the accident.

SIGNS.

Death is usually so sudden that an examination cannot be made, but the signs must of necessity be those of distention of the pericardium by fluid, with extreme weakness of the heart.

TREATMENT.

Treatment would be unavailing.

FIBROID DISEASE OF THE HEART.

Synonyms.—Fibroid infiltration, connective tissue hypertrophy, cirrhosis of the heart, chronic myocarditis.

This is one of the very rare diseases of the heart. It consists of a diffused or circumscribed increase in the interstitial connective tissue, with or without atrophy of the muscular fibres.

SYMPTOMS.

The symptoms which have been most frequently noticed are cardiac pain, œdema, dyspnœa, a weak slow pulse, and irregularity of the heart's action, but all of these may be absent.

SIGNS.

There are no distinctive signs. The heart's impulse is feeble, and there may be a systolic murmur.

DIAGNOSIS.

Neither the symptoms, nor signs, or these combined are sufficient to distinguish this condition from dilatation or fatty degeneration of the heart; so that the diagnosis must be made post-mortem. This is a matter of little moment, as the proper treatment would be the same as that for other conditions causing weakness of the heart.

SYPHILITIC DISEASE OF THE HEART.

A few cases have been observed where heart disease seemed to have resulted from constitutional syphilis. Syphilitic affections of this organ consist of fibrinous exudations into the connective tissue which may either soften and suppurate, forming ulcers or small abscesses, or may be converted into masses of hardened fibroid tissue; and it is not improbable that, as suggested by Corvisart, vegetations on the valves may in some

cases have a syphilitic origin. An accurate diagnosis is impossible. No treatment can be suggested where a diagnosis cannot be made.

ULCERATIVE ENDOCARDITIS.

This is an acute destructive disease of the valves, supposed to be caused most frequently by pyæmia; but according to Virchow, it is not infrequently found to occur in the latter months of pregnancy. It is also apparently due in some cases to acute rheumatism. In other cases it cannot be traced to any known cause. This affection is most often denoted by symptoms and signs similar to those of myocarditis.

SYMPTOMS AND SIGNS.

The principal symptoms are those of enteric fever. The attack is often ushered in by a chill, which is followed by prostration, delirium, or coma. The temperature usually ranges from two to four degrees F. higher than normal. The tongue is often dry and brown; vomiting and diarrhœa are common. The pulse is quick and irregular, and sometimes there are præcordial pains and palpitation of the heart, with dyspnœa and occasionally articular pains.

Sometimes no signs whatever are present, but in other instances auscultation enables us to detect the signs of valvular disease, and repeated examination may show that changes in the valves are rapidly progressing.

DIAGNOSIS.

The absence of cardiac symptoms in many cases is likely to mislead the physician into the diagnosis of intermittent or typhoid fever, or of pyæmia; but if attention is directed to the heart, and it is known to have been previously healthy, the occurrence of a systolic mitral or tricuspid murmur, with the symptoms just mentioned, renders the diagnosis reasonably certain.

TREATMENT.

This affection results from pyæmia or septicæmia, and consequently requires the most vigorous supporting measures. Large doses of quinine or alcoholic stimulants are indicated.

VALVULAR DISEASE OF THE HEART.

Affections of the various valves are diagnosticated by the detection of the murmurs spoken of in a former lecture, page 195. Nearly all of these affections sooner or later cause irregularity of the heart's action, lividity of the lips, œdema, and dyspnœa on exertion.

TREATMENT.

In the treatment of valvular lesions, three things are constantly to be borne in mind.

First. The labor of the heart must be rendered as light as possible.

Second. The blood must be kept in a healthy condition.

Third. The strength of the heart must be maintained.

With the first object in view, we interdict rapid walking, running, or heavy lifting, and enjoin the patient to avoid climbing stairs, and indeed every act or form of exercise, mental or physical, which causes dyspnœa and palpitation of the heart. We attempt also by proper treatment to remove all obstruction to the circulation. This obstruction may occur in the lungs, in which case the pulmonary diseases must receive appropriate treatment. Even a simple bronchitis may be sufficient to greatly obstruct the circulation through the pulmonary circuit. The obstruction may result from portal congestion, which must then be relieved; or it may occur in the capillaries throughout the body, which may be contracted as the result of nervous irritation caused by the retained excreta in Bright's disease.

We must remember that affections of the lungs, the liver, the alimentary canal, the kidneys, or the skin, may have caused the cardiac disease, or may greatly aggravate it. Therefore whenever found these must be combated by appropriate treatment.

With the second object in view we recommend vegetable tonics, iron, and nutritious diet, with regular habits and gentle exercise.

To accomplish the third object, besides the means already suggested for relieving the heart of work and for furnishing it with proper nutrition, we prohibit the use of tobacco and of

all other depressing agents; and we administer various heart tonics, chief among which are digitalis, arsenic, and cactus grandiflora. Belladonna and squills have a tonic effect on the heart similar to these though less potent. In many cases nux vomica is a most useful remedy. Though the remedies directed to the heart itself are of the greatest service in the treatment of valvular disease, they should not be used indiscriminately, for the apparent weakness may sometimes be much more effectually overcome by medicines which act upon some other organ.

In aortic obstruction or regurgitation it is especially important to avoid taxing the power of the heart, and to maintain its strength by cardiac tonics and a good supply of rich blood. Nature always attempts to compensate for the obstruction or regurgitation by hypertrophy of the left ventricle; but a time will finally come when the compensation will fail, and then digitalis should be given to strengthen the muscular walls. Ten minims of the tincture of digitalis three times a day is the ordinary dose, but the amount may be gradually increased until the heart is made to pulsate regularly and with normal force, providing the kidneys act freely and the stomach is not deranged. Twenty minims may be given as often as every two hours, without danger, if there is a free secretion of urine; but if the flow stops, the digitalis must be at once suspended.

In mitral obstruction or regurgitation digitalis usually has the best effects. It should be given as just recommended for aortic disease. When it loses its effects, arsenic or nux vomica should be tried, or these may be given with the digitalis. Other diuretics, vapor or hot-air baths, and cathartics will be required from time to time, to relieve pulmonary congestion and œdema, or general dropsy. It is important to continue the use of cardiac tonics for many months after the distressing symptoms, for which we were first called, have passed away; but the amount must always be carefully regulated, so as not to over-stimulate the organ.

Disease of the *pulmonary valves* requires similar treatment to that recommended for mitral affections.

In *tricuspid regurgitation* the same general rules laid down for the treatment of other valvular lesions are to be followed; but unless mitral disease co-exists, digitalis will do more harm

than good, by increasing the venous congestion of the brain and of the abdominal organs.

MORBUS CÆRULEUS.

Synonyms.—Cyanosis or the blue disease.

This condition is the result of congenital malformation of the heart, which allows the venous and arterial blood to commingle so as to be imperfectly oxygenated.

SYMPTOMS AND SIGNS.

The affection is indicated by a deep purple or bluish color of the surface, which is generally associated with dyspnœa, frequent palpitations, and cough.

Systolic murmurs and thrill are found over the heart or in the pulmonary area.

DIAGNOSIS.

In the *London Lancet*, May, 1879, Dr. Sansom formulates the following propositions relating to the diagnosis of congenital disease of the heart in children.

First, in cases of congenital cyanosis, in which no cardiac murmur is manifest, there is probably patency of the foramen ovale.

Second, in cases of cyanosis with murmur varying at intervals, and heard over the sternal ends of the third and fourth costal cartilages and intercostal spaces, there is probably patency of the foramen ovale.

Third, in cases of cyanosis with loud unvarying systolic murmur, with maximum intensity internal to the position of the apex-beat, but heard also at the back between the scapulæ, there is probably imperfection of the ventricular septum.

Fourth, in cases of cyanosis and of marked anæmia, in children who manifest a pronounced superficial systolic murmur at the base of the heart, there is probably constriction of the pulmonary artery at its orifice. Such murmurs may be associated with anæmic murmurs which are heard above the clavicles.

Fifth, in cases of congenital affection of the heart, in which there is evidence of considerable dilatation of the left chambers,

it is probable that endocarditis affecting the valves has constituted a complication.

TREATMENT.

No specific treatment can be recommended, but the same general rules should be observed as in cases of valvular disease of the heart.

NEUROTIC OR FUNCTIONAL DISEASE OF THE HEART.

This affection ordinarily manifests itself by frequent palpitations and irregularity of the heart's action. It is stated by Balfour, that if a patient come to you complaining of disease of the heart, you may, in the majority of cases, assure him that it is only a functional affection, and that no organic disease exists; for the latter generally escapes notice until detected by the physician.

SIGNS.

In functional disease of the heart, physical diagnosis is of importance so far as it aids us in excluding organic disease; but the physical signs of the neurotic affection are in no way characteristic.

INSPECTION AND PALPATION.—By inspection and palpation we find the apex in its normal position, but usually the impulse is comparatively feeble, though the stroke may seem sharp and quick; the action of the heart is usually irregular.

PERCUSSION shows the heart to be of normal size.

AUSCULTATION.—Both sounds of the heart are abrupt, and they may be intensified. Occasionally the first sound has a metallic character. Frequently anæmic murmurs are found in the aortic area and also in a space which has been improperly termed the pulmonary area, viz., a limited area, an inch or an inch and a half to the left of the sternum in the second intercostal space. The murmurs in the latter position seem due to a weakened condition of the left ventricle which allows dilatation to such an extent that the mitral valves are unable completely to close the auriculo-ventricular orifice, and slight regurgitation results. In such cases the dilatation disappears, and consequently the murmur ceases as the muscles regain their tonicity.

The symptoms of functional disease of the heart may be associated with the signs of organic lesions merely as a coincidence. In such instances an exact diagnosis would be extremely difficult. It could only be made by repeated, careful examinations and by the evidence afforded by treatment, under which many of the functional signs may have disappeared.

TREATMENT.

The first thing in these cases is to impress upon the patient the fact that his heart-symptoms are not due to organic disease, and that he is likely to recover entirely. This must be done *after* a careful and painstaking examination. Remembering that neurotic affections of the heart are usually due to anæmia, hysteria, uterine irritation, sexual abuses, or the excessive use of alcoholic stimulants, or of tobacco, or of tea and coffee, we should ascertain which of these operates in the case before us and advise accordingly.

Attacks of angina pectoris are most promptly relieved by morphia or by chloroform. The latter would seem a dangerous remedy, but when used as recommended by G. W. Balfour, of Edinburgh, I have found it harmless, prompt, and efficient. In using this remedy, half a teaspoonful should be placed in a sponge in the bottom of a small wide-mouthed bottle; and the patient should be allowed to breathe from it *ad libitum* until the pain is relieved. As soon as the patient becomes partially unconscious he will drop the bottle, and with it rolls away all danger which might be apprehended from the anæsthetic.

During the intervals between the attacks of angina, the same hygienic rules should be observed as in valvular disease. Arsenic should be given in moderate doses, with or without iron, strychnia, and digitalis, according to special indications.

LECTURE XXII.

DISEASES OF THE THORACIC ARTERIES.

AORTITIS.

The symptoms ascribed to acute exudative inflammation of the aorta have been described by Frank, Bizot, and others, but as stated by R. Douglass Powell, the disease as a primary affection is of very doubtful, if not impossible, occurrence. We need not attempt to describe any of the signs or symptoms it might possibly occasion.

ATHEROMA OF THE AORTA.

Synonyms.—Aortic endarteritis; Atheromatous degeneration of the aorta.

This may be defined as a degeneration of the coats of the aorta, consisting of an irregular thickening and softening of its walls, especially of its inner coat, with consequent fatty degeneration of the affected parts, and fibroid thickening of the entire wall of the vessel; and finally breaking-down or calcareous degeneration of the internal or middle coat. As the result of these changes there is usually, at first, narrowing of the calibre of the aorta or roughening of its inner surface, which interferes with the natural current of blood, and thus gives rise to abnormal signs. This condition is sooner or later followed by dilatation of the vessel.

The affection is usually limited to the initial portion of the blood-vessel; and indeed, clinical evidence of its existence beyond the transverse portion of the arch is very rare.

SYMPTOMS AND SIGNS.

The symptoms of this disease are always obscure, and its physical signs, in many cases, are far from positive. Among the most prominent symptoms and signs we observe attacks of

palpitation, or pain and dyspnœa termed angina, which often occur independent of exertion, but are also brought on by exercise. During these attacks the pulse is very weak, but at other times its rhythm may be normal. The temporal, radial, and brachial arteries are sometimes rigid and less elastic than in the healthy condition, on account of an atheromatous condition of the arteries in general.

INSPECTION AND PALPATION.—When dilatation has taken place, feeble pulsation may be seen or felt in the second intercostal space, close to the sternum, on the right side.

PERCUSSION—Upon percussion there is found a somewhat increased area of dulness over the ascending or transverse portion of the aorta.

AUSCULTATION.—Early in the disease there may be some evidence of hypertrophy of the left ventricle, as indicated by an increased impulse and muffling of the first sound of the heart. These signs, however, are not characteristic, as they might easily be accounted for by co-existing emphysema or other cause of obstructed circulation.

With the advent of dilatation, the first sound of the heart becomes more indistinct, while the second sound over the aortic valves is accentuated. Accentuation of the second sound in this locality is thought by some to be diagnostic of dilatation of the aorta. A short murmur is usually heard over the aorta, immediately after the systole of the ventricles, especially when the action of the heart is rapid. As dilatation progresses, the bruit becomes more and more distinct. It is sometimes rough in character, and it may be associated with a purring tremor.

The second sound may be partially supplanted by a faint diastolic murmur, due to dilatation at the origin of the artery; which renders the semilunar valves incompetent to close the orifice, and allows regurgitation into the ventricles.

When the heart is beating slowly and regularly, both the first and second sounds may be accentuated over the upper part of the sternum; and the systole of the heart may be attended by a slight impulse, which can be appreciated by the ear. But this latter sign, to be of value, must be obtained when the patient is perfectly quiet.

Later in the disease, dyspnœa becomes marked; the attacks

of angina are more frequent and persistent; and the symptoms of embolism, that is, hemiplegia, rigors, hæmaturia, superficial hemorrhages, or gangrene may make their appearance; or the formation of a sacculated aneurism from the affected portion of the artery may be indicated by the sudden occurrence of pain, dyspnœa, and faintness. Finally, sudden death may result from heart-failure or from rupture of the aorta.

DIFFERENTIAL DIAGNOSIS.

The principal symptoms and signs of this affection are palpitation, pain, and dyspnœa; with rigidity of the superficial arteries, muffling of the first sound of the heart, and accentuation of the second sound, over the aortic valves. The first heart-sound is usually followed by a more or less distinct systolic murmur. Sometimes there is a diastolic murmur in the region of the ascending or transverse portion of the arch of the aorta, with slight increase in the area of dulness during the later stages. The affection might be mistaken for simple disease of the aortic valves, or inorganic disease of the heart, with anæmic murmurs.

Disease of the aortic valves, though it may cause all the other symptoms and signs of atheroma, is not attended by a rigid condition of the superficial arteries. It does not cause the peculiar neuralgic pains which usually attend atheroma, and it does not cause accentuation of the second sound at the aortic valves or an increased area of dulness.

Anæmic murmurs associated with functional disease of the heart are not attended by rigidity of the superficial arteries; by the peculiarly distinct accentuation of the second sound; by the systolic shock; or by the diastolic bruit; or by increased area of dulness.

TREATMENT.

Morphia or some of the antispasmodic remedies are indicated during the attacks of dyspnœa. Iodide of potassium in moderate doses is sometimes useful. Excessive exertion must be avoided.

ANEURISMS OF THE SINUSES OF VALSALVA.

Aneurisms in this position are usually so small as to give rise to no peculiar symptoms or signs. The symptoms and signs

of atheromatous degeneration, with a pulmonary systolic or diastolic murmur due to pressure of the aneurism on the origin of the pulmonary artery, might lead us to suspect the true nature of the lesion. The diagnosis can rarely, if ever, be made with certainty, as the tumor lies enveloped in the peri cardium, so close to the heart that it is almost impossible to distinguish between the murmurs which it produces and those of valvular origin.

ANEURISM OF THE THORACIC AORTA.

This consists of preternatural dilatation of the artery, which may be general, that is, involving the whole circumference in a fusiform cylindrical or globular swelling; or sacculated, that is, springing from one side of the artery in a sort of pouch.

Sacculated aneurisms are usually globular at first, but they may subsequently acquire different forms, especially the conical.

The smaller of the fusiform aneurisms are usually spoken of as atheroma of the aorta.

Aneurisms may occur at the sinuses of Valsalva, or in the ascending, transverse, or descending portion of the arch of the aorta. Nearly one fifth of these aneurisms spring from the sinuses of Valsalva. About two fifths have their origin in the ascending portion of the arch; a few involve both the ascending and the transverse, or simply the transverse portion of the arch. Nearly one fifth arise from the descending arch, and about the same number from that portion of the aorta between the arch and the diaphragm.

SYMPTOMS.

Tumors of this character may sometimes be detected by scrutinizing the symptoms, when they cannot be diagnosticated by the physical signs. Therefore, I wish to direct your attention to a few of the more prominent symptoms which, though not individually characteristic, may be sufficient for the purpose of diagnosis when grouped together. They will, at least, be of great value when taken in connection with the physical signs.

The symptoms, enumerated nearly in the order of their im-

portance, are: pain, dyspnœa, palpitation, dysphagia, headache, and disordered vision.

Pain.—The pain in aneurism of the aorta is persistent, and has a peculiar wearing, aching, or burning character, which is referred to the region of the tumor. Frequently there are neuralgic exacerbations, the pain radiating in the course of contiguous nerves.

Dyspnœa.—Dyspnœa of varying degree is generally present, and is usually aggravated by much slighter causes than those which would occasion the same symptom in other varieties of intra-thoracic tumors. It frequently occurs in severe paroxysms, which may be due to one of two or three causes. Ordinarily these paroxysms are ascribed to spasm of the glottis, resulting from irritation of one or both of the recurrent laryngeal nerves. A more probable explanation is that they are due to paralysis of the abductor muscles of the glottis, which are supplied by these nerves, with consequent falling-together of the vocal cords, and obstruction of the glottis during inspiration.

The exacerbations of this symptom are due in some instances to a collection of mucus at the glottis; in others to the varying pressure of the aneurism upon the nerve which, at one time, completely suspends its function, and at another interferes with it more slightly. The voice is also modified more or less by the same cause, and it may be lost.

Dyspnœa is sometimes dependent upon narrowing of the trachea or of the bronchi from the pressure of the aneurism. In such instances, the paroxysms are doubtless due to a collection of mucus at the point of stricture, which the patient may be unable to expectorate.

Palpitation.—Palpitation of the heart is generally produced by slight exertion.

Dysphagia.—Dysphagia, due to pressure upon the œsophagus, is often present, though it is a less frequent symptom with aneurismal than with other tumors.

Headache.—Headache, due to interference with the return of blood to the heart, is not uncommon.

Disordered Vision.—The disordered vision is due to pressure upon the sympathetic nerve, with consequent interference with the action of the iris. Ordinarily the pupil upon the affected

side is strongly contracted, but, in rare instances, it may be dilated.

Hæmoptysis, to a slight degree, is an occasional symptom due to congestion of the mucous membrane. Copious hæmoptysis frequently occurs at the close of the disease, when the aneurism ruptures into the air-passages.

SIGNS.

The essential signs are: a pulsating tumor in the region of the aorta, with systolic and diastolic shock and sometimes bruits.

INSPECTION.—Upon inspecting a patient suffering from aneurism of the aorta, we observe marked lividity of the face, neck, and upper extremities; with turgescence and a varicose condition of the veins, and perhaps œdema, due to obstruction in the return of blood to the heart by pressure of the aneurism upon one of the venæ innominatæ or the descending vena cava. Occasionally a thick fleshy collar is found about the base of the neck, due to capillary turgescence.

Œdema and turgescence are ordinarily limited to one side and are caused by pressure on one of the venæ innominatæ. If the pressure is upon the descending vena cava, which is most likely to occur with an aneurism of the ascending arch, these signs will be found upon both sides.

Upon inspection of the chest, the surface is seen to have a marbled appearance, caused by the prominence and blueness of the veins. A tumor may usually be observed in the course of the aorta, the position of which will indicate the part of the blood-vessel which is affected.

An aneurism originating in the sinuses of Valsalva causes no external tumor. When it springs from the ascending portion of the aorta, if bulging occurs, it will be seen in the second intercostal space at the right side of the sternum; but the tumor may be large enough to extend into the mammary and infra-clavicular regions.

Aneurisms of the transverse portion of the arch cause a tumor at the upper part of the sternum.

When the descending arch is involved, the tumor generally presents posteriorly at the left of the spinal column.

Exceptional.—In exceptional cases an aneurism of this kind may be seen in front, and in very rare instances it may be found at the right of the spinal column.

Aneurisms of the descending aorta present posteriorly, below the fourth dorsal vertebra at the left of the spine. Very rarely they are seen at the right of the spinal column. These tumors vary in size from a slight prominence to one as large as a child's head. The absence of a tumor does not necessarily prove that no aneurism exists; for, while the aneurism is small, it may not press upon the chest-walls, and even when of considerable size the position may be such that no bulging is occasioned.

The larger of these tumors are generally conical in form, and present very much the appearance of an immense boil, covered by thin, glazed integuments.

If pulsation of the tumor can be observed, it will be seen to occur rhythmically with the apex-beat of the heart. Pulsation, which cannot otherwise be seen, may sometimes be detected by bringing the eye to the level of the surface of the chest, as in standing behind the patient and looking down over his shoulders. No pulsation will be visible if the aneurism is occupied by fibrine or coagulated blood.

If the tumor press on one of the main bronchi, the respiratory movements on the corresponding side will be diminished or absent.

PALPATION.—By palpation we may frequently detect a tumor, the impulse of which cannot be seen; we can ascertain the condition of the chest-walls, whether there be perforation of the costal cartilages, sternum, or ribs; and we may usually determine whether the contents of the tumor are fluid or solid. By this method we also learn the character of the pulsation, which, in aneurism, is expansile, that is, alike in every direction, and not simply lifting, as is the case when a solid tumor rests upon an artery.

The most valuable sign obtained by this method is the detection of two pulsating points; as though there were two hearts, one beating in the normal position in the fifth interspace, and the other above the third rib.

If the aneurism is so small as to escape observation by ordinary palpation, it may sometimes be detected by pressing firmly with one hand over the aorta in front, and with the other posteriorly.

The impulse obtained over an aneurism may be systolic, that is, occurring with the contraction of the ventricles; or it may

be both systolic and diastolic. The latter is produced by contraction of the artery, and is usually slight, but it is sometimes quite forcible. When found it is a valuable sign.

Frequently these tumors give rise to a peculiar thrill, similar to the purring tremor; and sometimes very early in the course of an aneurism of the tranverse arch, an impulse or a thrill may be felt by thrusting the finger downward behind the episternal notch.

Valuable information may be obtained in some cases by palpation of the pulse or from sphygmographic tracings (Fig. 36, page 208). If the aneurism press upon the arteria innominata, or upon either of the subclavian arteries, or if either of these vessels is obstructed by a coagulum, the radial pulse will be feebler upon the corresponding side than upon the other. The carotids are sometimes similarly affected. If atheromatous degeneration of the arteries be general, the superficial arteries, especially the radial and temporal, will be found rigid and non-elastic.

Alterations in the movements of the chest-walls and in the vocal fremitus are also to be sought for by palpation. Pressure on the air-passages will diminish the respiratory movements, and cause local or general diminution or absence of the vocal fremitus, according as a bronchus or the trachea is obstructed or the lung itself compressed.

PERCUSSION.—Percussion must be performed gently, especially over large aneurisms, as a forcible stroke might possibly cause rupture of the weakened blood-vessel. Upon gentle percussion, the extent of dulness will not correspond to the size of the tumor, on account of the overlapping borders of the lungs; but by a more forcible stroke, or by auscultatory percussion, we may determine the limits accurately.

The area of abnormal dulness is usually much smaller than in other tumors, causing symptoms of equal gravity.

The sense of resistance felt upon percussion is a valuable sign in distinguishing between aneurisms and other intra-thoracic tumors. Over a tumor filled with fluid, the resistance is much less than over a solid growth or over an aneurism filled with fibrinous deposits.

If the aneurism present posteriorly, dulness will be obtained in the interscapular region. If it has pressed upon a main

bronchus, or upon one lung, so as to cause collapse or congestion of this organ, dulness will be found over the corresponding side of the chest.

AUSCULTATION.—Upon listening over an aneurism, we first notice an impulse, or shock, which is transmitted through the stethoscope to the ear, with each contraction of the heart. This impulse is frequently immediately followed by a second, or diastolic shock, due to contraction of the arteries. The shock is usually attended by one or two sounds which consist mainly of the transmitted heart-sounds, but which are in part produced by dilatation and contraction of the artery.

These sounds may be associated with or supplanted by murmurs somewhat similar in character to endocardial murmurs. However, they are ordinarily less intense, though they may be even louder than the loudest heart-murmurs. They are usually harsh in quality, and are not transmitted into the same regions as endocardial murmurs. Sometimes neither sounds nor murmurs can be detected over the aneurism.

If the tumor press upon a main bronchus, the respiratory murmur will be diminished or absent upon the corresponding side, while on the opposite side it will be exaggerated. In these instances a forced inspiration will sometimes distend the lung, and bring out the respiratory murmur where it could not be heard during ordinary breathing. Vocal resonance will be diminished or absent over the obstructed lung, and absent over the aneurism. If the lung be condensed by pressure, broncho-vesicular respiration may be heard.

If the tumor press upon the recurrent laryngeal nerve, so as to cause paralysis or spasm of the vocal cords, stridulous respiration will be produced, with dysphagia or aphonia. Inspection of the larynx will usually reveal the existence of paralysis of the cord on the corresponding side, with possible paresis of the opposite cord. Occasionally both nerves are pressed upon, and consequently both vocal cords may be paralyzed.

DIAGNOSIS.

Venous turgescence, displacement of the heart, dulness on percussion, and modifications of the respiratory sounds, due to pressure, are signs common to these and to other varieties of intra-thoracic tumors. Variation in the force and volume of

the pulse on the two sides, expansile pulsation of the tumor with a shock and bruit are characteristic of aneurisms, but occasionally even these signs may be caused by solid growths. A diastolic bruit and shock over an intra-thoracic tumor accompanied with a clear second sound at the base of the heart, is diagnostic of aneurism, especially if following a distinct systolic bruit and shock. A murmur at the base of the heart, taking the place of the second sound, when associated with the signs of a tumor, in the course of the aorta, is valuable evidence of probable atheromatous degeneration of the aorta, which is the usual cause of aneurism.

ANEURISM OF THE ARTERIA INNOMINATA.

Aneurisms of this artery cause pulsating tumors similar to those of the aorta.

DIAGNOSIS.

Such an aneurism may be distinguished from an aneurism of the arch of the aorta—first, by its position; second, by the comparative absence of signs due to pressure; and third, by the effect on the pulsation of compression of the subclavian and carotid arteries. An aneurism of the arteria innominata is located entirely upon the right side of the sternum, and causes a prominence in the region of the inner end of the clavicle. It is not likely to cause much pressure upon the recurrent laryngeal nerve, with consequent obstruction of the larynx; or on the œsophagus, so as to interfere with deglutition; or upon the trachea, so as to cause dyspnœa. Compression of the carotid or subclavian artery, on the affected side, greatly diminishes the pulsation in an aneurism of this artery, but does not affect the pulsation of an aneurism involving the arch of the aorta alone.

ANEURISM OF THE PULMONARY ARTERY.

This is one of the rarest affections of the circulatory system. From the few cases which have been described, we are unable to obtain any characteristic symptoms or signs. The principal symptoms and signs which have been noticed are: extreme cyanosis, with dropsy and great dyspnœa, associated with a

strongly pulsating tumor, located in the second intercostal space of the left side, and limited to this region. This tumor is likely to yield a thrill upon palpation. Upon auscultation, systolic or diastolic murmurs, or both, may be detected, but they are not propagated above the clavicles. It is hardly possible to distinguish aneurisms of the pulmonary artery from those of the aorta, which happen to present to the left of the sternum.

DIFFERENTIAL DIAGNOSIS.

Aneurisms of the aorta may be confounded with solid tumors; with aortic pulsation, due to regurgitation through the semilunar valves; with pulsating empyema; with dilatation of the auricle; with aneurism of the pulmonary artery; and with consolidation of the anterior border of the lung. The differential features are pointed out in the following tables.

Aneurisms can only be distinguished from other intra-thoracic tumors by attention to the history and symptoms as well as to the physical signs.

Solid Tumors.—The distinctive features between thoracic aneurisms and solid tumors are seen below.

Aneurisms.	Solid Tumors.
History.	
They seldom or never occur before the twenty-fifth year of age, and usually not until after the forty-fifth year. Slight if any constitutional disturbance.	Usually malignant. They may occur in early life, and not unfrequently before the twenty-fifth year. Grave constitutional disturbance.
Symptoms.	
The pain is constant, and of a burning, wearing, or aching character; but frequently subject to neuralgic exacerbations. The symptoms and signs of pressure vary from time to time, owing to changes in the direction of the pressure.	Pain not so deep-seated as in aneurisms; it may be sharp and lancinating in character. It is not subject to neuralgic exacerbations. The symptoms and signs of pressure are constant and steadily increase from day to day.
Signs.	
Expansile pulsation. Often disparity in the radial pulse of the two sides. The area of dulness is small in proportion to the size of the tumor, and the length of its history. The sense of resistance is slight.	No pulsation, or if any, simply a slight lifting impulse, caused by the tumor resting upon a large artery. Usually no disparity in the pulse of the two sides. The area of dulness is large, and rapidly increases. The sense of resistance is well marked.

Aortic pulsation is distinguished from aortic aneurism by the following symptoms and signs:

Aneurism.	Aortic Pulsation.
Symptoms.	
Symptoms of pressure upon the trachea, œsophagus, or recurrent laryngeal nerve.	No symptoms of pressure.
Signs.	
Pulsation in a limited space over the arch of the aorta.	Pulsation not only over the aorta, but in the carotids, subclavians, and brachials.
The radial pulse is not exaggerated on either side by elevation of arm; usually it is feeble on one side.	The pulse is sharp and apparently forcible;—hammer pulse exaggerated by elevation of the arm, and alike on both sides.
Increased area of aortic dulness.	No increase in the area of dulness.
Arterial bruits, systolic or diastolic, generally distinct from endocardial murmurs.	Aortic regurgitant murmur, but no special bruit over the pulsating vessel.

Pulsating empyema may simulate aneurism, but ordinarily it can be easily distinguished by its position. If, however, perforation of the chest-walls should take place in the course of the aorta, as in a case recorded by Prof. Flint, the diagnosis would be much more difficult.

Aneurism.	Pulsating Empyema.
Symptoms and Signs.	
Symptoms and signs of pressure upon adjacent organs.	Usually no symptoms of pressure upon the trachea, œsophagus, and other adjacent organs.
Dulness confined to the region of the aorta.	Dulness or flatness over the pulsating tumor and also over the lower part of one side.
Arterial bruits. No pulmonary signs, unless there be pressure upon the trachea, bronchus, or lung itself. Expansile pulsation of the tumor.	No bruit. Signs due to compression of the lung by fluid in the pleural sac. Pulsation somewhat similar to that of aneurisms, but usually less expansile.

A dilated auricle is distinguished from an aneurism of the aorta as follows:

Aneurism.	Dilated Auricle.
Symptoms and Signs.	
Signs and symptoms due to pressure upon adjacent organs. Pulsation following the systole of the ventricles and the apex-beat.	Few, if any, signs and symptoms of pressure. Pulsation preceding the apex-beat.
Dulness in the region of the aorta.	Dulness extending far beyond the re-

Arterial bruits common, but propagated mostly over the arteries.	gion of the aorta, and usually at a lower level; usually endocardial murmurs propagated in directions different from those of the aneurismal bruit.

Consolidation of the anterior border of the lung is differentiated from aneurism by the position of the dulness and by the signs upon auscultation. If the consolidation is due to an aneurism, care must be taken not to overlook the signs of the latter.

Aneurism.	Consolidation of the Lung.
Signs.	
Dulness limited to the course of the aorta.	Dulness not limited to the aortic region, but extending externally, and usually involving the whole apex of the lung.
A normal respiratory murmur may often be heard over the greater portion of the aneurism. Arterial bruits.	Râles and other signs of consolidation. No bruits.

An aneurism of the pulmonary artery is not likely to be mistaken for an aneurism of the aorta, because it is so very rare.

The position of a pulmonary aneurism is different from that of most aneurisms of the aorta. An aneurism of the ascending portion of the aorta might possibly present to the left of the sternum, though, in this locality, we are more likely to observe aneurisms of the descending aorta. The distinctive features between aortic aneurisms and those of the pulmonary artery may be stated, from the symptoms and signs which have been observed up to the present time, as follows:

Aneurisms of the Aorta.	Aneurisms of the Pulmonary Artery.
Aneurisms of the ascending arch present to the right of the sternum, and those of the descending arch usually present behind, at the left of the third dorsal vertebra, and very rarely in front.	The tumor is confined to the second intercostal space of the left side.
Signs and symptoms due to pressure upon the trachea, bronchial tubes, œsophagus, blood-vessels, or recurrent laryngeal nerve.	The signs of pressure are comparatively slight, but usually there is congestion f the face, anasarca, and great dyspnœa.
Bruits which may be propagated into the carotids and subclavians.	Bruits not propagated above the clavicles.

ANEURISM OF THE DESCENDING AORTA.

This affection causes a pulsating tumor behind, at the left of the spinal column, between the third dorsal vertebra and the

point at which the aorta perforates the diaphragm. By pressure erosion of the vertebræ is usually produced, with consequent curvature of the spine. Subsequent compression of the spinal cord may cause paraplegia. The tumor, if large, usually displaces the heart forward and to the right. In exceptional instances, aneurisms of this portion of the aorta may be detected upon the right side of the spinal column. The bruit, in an aneurism of the descending aorta, may be distinguished from a mitral regurgitant murmur, which is frequently heard in a similar position, by the fact that the aneurismal murmur is heard not only between the fifth and the eighth dorsal vertebræ, but also above and below this position. The mitral regurgitant murmur is not heard distinctly above the lower border of the fifth or below the upper border of the eighth vertebra.

TREATMENT OF ANEURISMS.

Two methods of treatment have been successfully employed in a few cases for the relief or the cure of intra-thoracic aneurisms.

Tufnell's method, which in several cases has succeeded in at least greatly relieving the patient, is a modification of Valsalva's starvation plan. It consists of perfect rest in the recumbent position, with moderate diet.

The other method consists of the use of large doses of iodide of potassium. This latter treatment usually soon relieves the severe neuralgic pains, and it possesses the advantage of allowing the patient to be about. The remedy should be given in doses of ten to thirty grains three times a day. The larger dose is much the best. Coryza may be relieved by moderate doses of nux vomica. If the stomach becomes irritable, the medicine should be suspended for a few days. It will sometimes be found that patients will bear large doses who cannot tolerate small ones.

COARCTATION OF THE AORTA.

Synonyms.—Narrowing or stenosis of the aorta.

This is one of the very rare affections of the circulatory system. The constriction may be ring-like, as though a cord

had been tied about the artery; it may consist of a cicatricial band, partially obstructing the calibre of the blood-vessel; or it may be due to irregular contraction of the artery, the result of inflammation. The narrowing of the vessel may be slight, or the aorta may have dwindled to an impervious cord. In a few instances the constriction has been found to be general, involving both the arch and the descending aorta. In such cases usually no symptoms have been observed until about the age of puberty, when deficient development of the lower extremities, and especially of the sexual organs, has been the first indication of the condition.

SIGNS.

INSPECTION.—This affection is accompanied by signs of hypertrophy and more or less dilatation of the heart. It is usually attended by dilatation of the arch of the aorta, of the subclavian arteries, and of the carotids; and by a dilated and tortuous condition of the superficial arteries, which in the normal state are not visible. This condition of the superficial arteries is attended by marked pulsation, and sometimes by small aneurismal enlargements of the intercostal arteries which may be sufficient to cause erosion of the ribs.

PALPATION.—A thrill can generally be detected by palpation over the large arteries. The obstruction of the vessel renders the pulsation feeble in the branches of the abdominal aorta, and causes feebleness or absence of the pulse in the tibial and popliteal arteries.

PERCUSSION.—No signs.

AUSCULTATION.—A harsh, high-pitched, and usually intense systolic or post-systolic murmur will be heard over the aorta and larger blood-vessels. This is usually most intense close to the edge of the sternum in the second intercostal space upon the right side. This murmur is propagated through the carotids and subclavians toward the shoulder, and it may also be heard posteriorly over the course of the aorta.

The occurrence of such a murmur will lead us to suspect the existence of an aneurism; but the latter may be excluded by absence of the symptoms and signs due to pressure, and by the want of an increased area of dulness on percussion.

DIAGNOSIS.

The diagnosis of coarctation of the aorta rests mainly upon the enlarged and tortuous condition of the superficial arteries in the upper portion of the body, and the feeble pulsation in the lower extremities associated with an aortic systolic murmur.

TREATMENT.

No treatment can be recommended.

SOLID INTRATHORACIC TUMORS.

Excluding aneurisms, tumors within the chest are nearly always malignant in character, and are therefore attended with grave constitutional symptoms.

SYMPTOMS.

These growths usually cause pain of a persistent character, sometimes lancinating, but not subject to the neuralgic paroxysms which attend aneurisms.

SIGNS.

The principal signs are: turgescence of the veins, œdema, dyspnœa, dysphagia, and other evidences of pressure on surrounding organs, with dulness and loss of respiratory murmurs over the growth.

INSPECTION.—These growths are likely to cause persistent turgescence of the veins, and œdema of the neck and upper extremities in a more marked degree than aneurisms. They are nearly always accompanied by enlargement of the lymphatic glands in the neck and axillary regions. The condition of these glands is an important point in the differential diagnosis; for, if it is due to malignant disease, they will be adherent to the surrounding tissues, but if not, they may be moved freely beneath the integument. The symptoms and signs caused by pressure on the surrounding organs are persistent, and they gradually increase in severity. Malignant tumors are not usually confined to the course of the aorta, but they are apt to extend a considerable distance beyond the borders of the sternum. A solid tumor does not ordinarily

pulsate, and when it does the pulsation is not expansile but is simply lifting. This impulse is caused by the pulsation of a large artery upon which the tumor rests.

PERCUSSION.—The sense of resistance is marked, and the area of dulness is usually much larger than over aneurisms, because the malignant disease gradually involves the adjacent lungs, instead of crowding them before it.

AUSCULTATION.—No bruit can be heard over the tumor, unless it presses upon an artery, and then the murmur is distant and comparatively feeble.

Exceptional.—In those unique cases, where a tumor co-exists with a quiescent aneurism, some peculiar phenomena have been observed. The sense of resistance to the percussion stroke over the aneurism may be great ; whereas over the solid tumor there may be only slight resistance, and in the same position we may detect an expansile pulsation, which should naturally be found over the aneurism.

DIFFERENTIAL DIAGNOSIS.

The essential features which enable us to distinguish between solid tumors within the chest and aneurisms were given in the beginning of this lecture when speaking of the latter (page 247).

TREATMENT.

No special treatment can be recommended.

DISEASES OF THE THROAT AND NASAL CAVITIES.

LECTURE XXIII.

EXAMINATION OF THE FAUCES, AND LARYNGOSCOPY.

A course of lectures upon the physical diagnosis of diseases of the chest would be incomplete, without a consideration of the instruments and methods which are employed for detecting diseases in the larynx and nasal cavities. As diseases of the fauces often cause symptoms which simulate those of pulmonary affections, they too must come in for a share of our consideration.

In some instances, so slight a difficulty as elongation of the uvula will cause the symptoms of laryngitis, or even the persistent cough, emaciation, and other symptoms of the later stage of phthisis.

EXAMINATION OF THE FAUCES.

For the examination of the fauces we generally find it necessary to depress the tongue. For this purpose a great variety of tongue depressors have been devised. These will be found useful, but if not at hand, a lead-pencil or the forefinger will answer the purpose.

For ordinary use, a spoon-handle is perhaps the best, as many patients object to an instrument which is used promiscuously. Of the different varieties of tongue depressors, those which are jointed, so that they can be carried in the pocket, are most convenient (Fig. 46). For office use, some of the larger,

stronger varieties will be found more convenient (Fig. 45). Some patients can depress the base of the tongue in such a way as to allow a view of the throat, without the aid of any instrument, but this is not the rule. In children, a fair view may often be obtained while they are crying or coughing. If the child resists, and neither of these methods succeeds, a

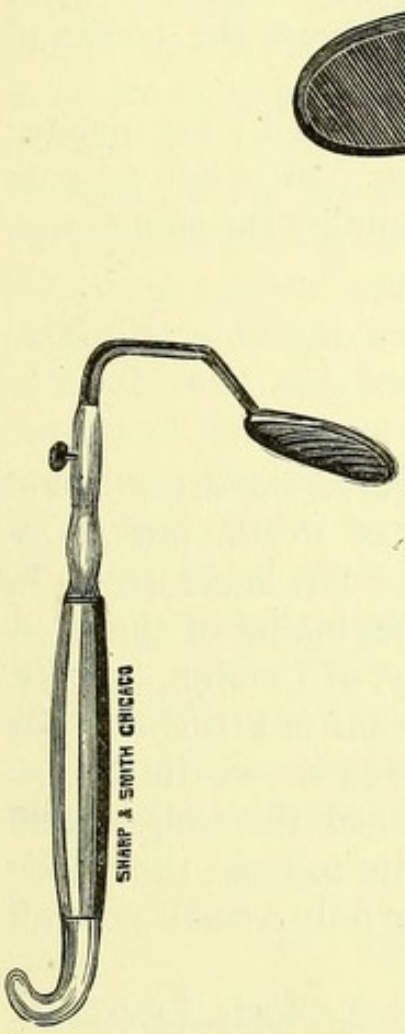


FIG. 44.

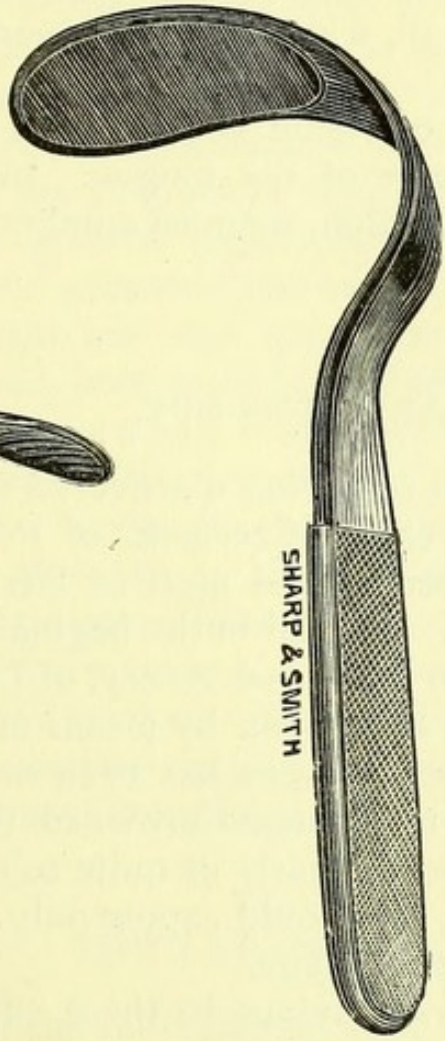


FIG. 45.

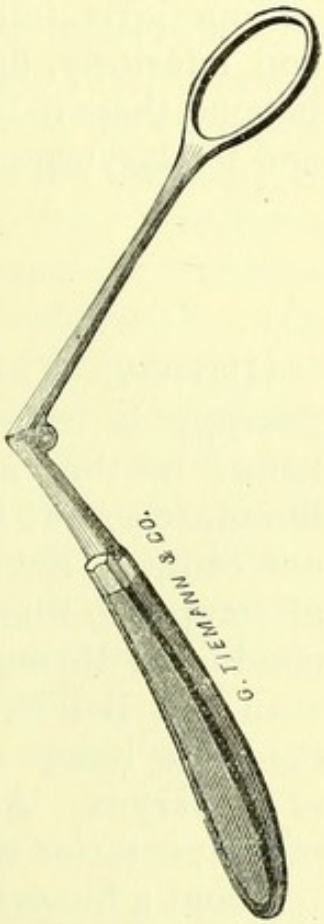


FIG. 46.

FIG. 44.—Tuerck's tongue depressor, $\frac{1}{3}$ size.
FIG. 45.—Hard-rubber tongue depressor, $\frac{1}{2}$ size.
FIG. 46.—Folding tongue depressor, $\frac{1}{2}$ size.

spoon-handle or some other depressor should be passed well back upon the base of the tongue, so as to induce retching, which will afford a good view of the pharynx. You should embrace every opportunity for inspecting the healthy throat, in order to become familiar with its normal conditions, otherwise you will be unable to recognize the signs of disease.

THE FAUCES IN HEALTH.—Upon inspection of the fauces, we first notice the soft palate with the pendent uvula, which forms the back part of the roof of the mouth. Running downward from either side of the soft palate will be seen two folds of mucous membrane, known as the anterior and posterior pillars of the fauces, between which may be seen a glandular mass, which is termed the tonsil. Posteriorly we observe the posterior pharyngeal wall, which closely covers the bodies of the cervical vertebræ.

Superiorly, our field of vision is obstructed by the palate; and inferiorly, by the base of the tongue. In order to pass beyond these in our inspection, we must employ the rhinoscope and the larynsgocope.

LARYNGOSCOPY.

HISTORY.—The credit of having discovered the art of laryngoscopy is usually given to Czermak, of Pesth, but many before his time had experimented more or less successfully in illuminating the larynx. Bozzini in the beginning of the present century, Bennatti in 1832, and Avery, of London, in 1844, attempted to illuminate the larynx by means of artificial light conducted through tubes; but, as has been shown by Trousseau and Belloc, these instruments crowded the tongue and epiglottis before them, so as nearly or quite to close the orifice of the larynx. At most, they could expose only a small portion of the posterior wall of the larynx.

About a hundred years previous to these efforts, Levret, of Paris, who was probably the first experimenter in this direction, attempted to obtain a view of the larynx by means of a small throat mirror, similar to that now in use. Senn, of Geneva, in 1827; Babbington, of London, in 1829; Baumes, of Lyons, in 1838; and Liston, of London, in 1840, employed similar instruments with equally unsatisfactory results. Warden, in 1844, made experiments with a couple of prisms. All of these experimenters failed more or less completely, for the reason that they could not secure suitable illumination.

The first to demonstrate the larynx in the living subject was Signor Manuel Garcia, a teacher of vocal music in London.

He became quite expert in auto-laryngoscopy, and also succeeded in demonstrating the larynx in others.

Garcia's observations were communicated to the Royal Society of London in 1855. They attracted little attention at first, for the art was thought to be of no practical value in the diagnosis of disease, because a thorough inspection was supposed to depend upon a peculiar education of the muscles which would enable the patient to control the position and movements of his throat. However, Garcia's writings induced Türck, of Vienna, to experiment with similar mirrors in the hospital during the summer of 1857. Although Türck was not very successful in these experiments, and finally threw aside his mirrors as the autumn came on, because of the difficulty in obtaining sunlight, his experiments were not lost. Czermak, of Pesth, who had been visiting in Vienna during the summer, borrowed the mirrors and continued the investigations. He overcame the difficulties which had previously prevented a clear view of the larynx, by employing the reflector and causing the patient to protrude the tongue, instead of depressing it, and by substituting artificial light for the direct rays of the sun. Soon a rivalry sprang up between Czermak and Türck as to the priority of their claims. Their letters, which were published in the various medical journals, soon spread a knowledge of the new art throughout the medical world.

THE LARYNGOSCOPE.

The essentials for an examination of the larynx are a throat mirror and a good light.

THROAT MIRRORS have been made of various forms. Some are round, others oval or lozenge-shaped, and still others quadrilateral. For general use I prefer the round mirrors, varying in diameter from three eighths of an inch to an inch and a quarter. I think these can be used with less difficulty by students than instruments of other forms. These mirrors should be made of clear and perfectly white glass. The quality of the glass may be tested by placing a white card before the mirror. If the glass is perfectly white, the reflection will also be white; if the glass is tinged with color, it will give a

corresponding shade to the reflected image of the card, and it would necessarily similarly affect the laryngeal image.

The glass and its setting should be thin, in order to economize space in the throat.

The glass should be set firmly in a metallic frame, which must encroach as little as possible upon the anterior surface of the glass, so that the largest possible reflecting surface may be secured. Some of these mirrors are backed with amalgam, and

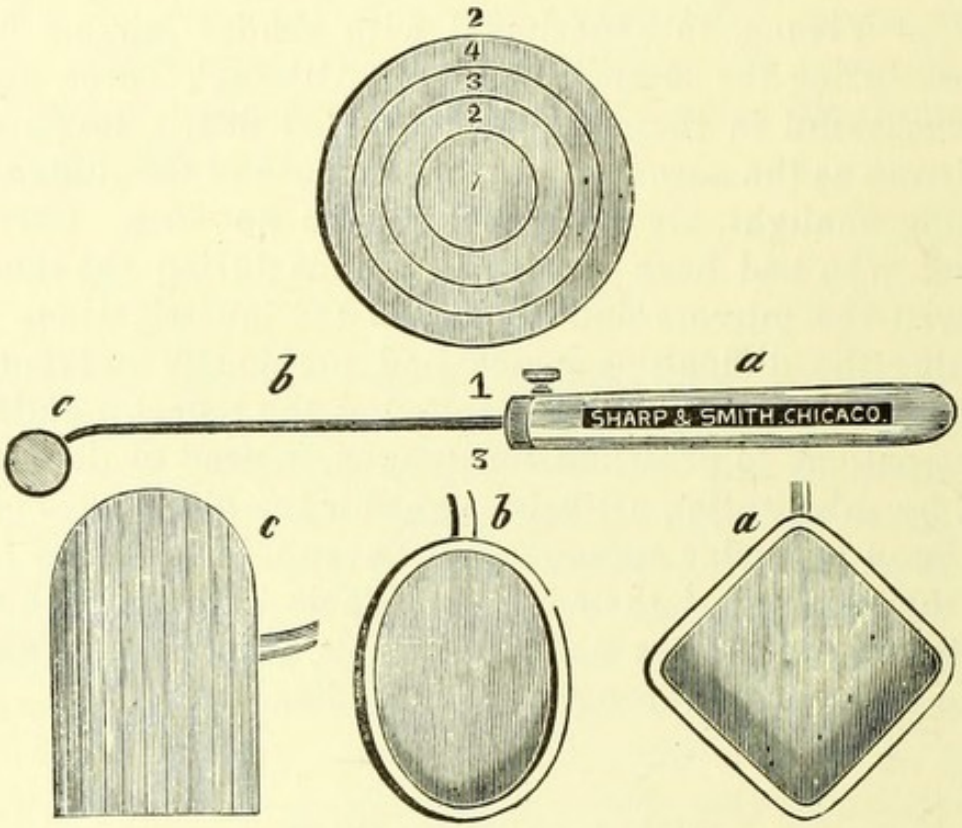


FIG. 47.—Throat mirrors for laryngoscopy. 1. *a*, handle; *b*, stem; *c*, mirror. 2. Different sizes of round mirrors. 3. *a*, *b*, *c*, different forms of throat mirrors.

others with silver leaf. Silver leaf renders a mirror more durable, as it is less affected by heat and moisture. I have used mirrors backed with amalgam daily for several months without injuring them, but others have been ruined in a week. Therefore, although the silver leaf does not give quite so clear an image as the amalgam when perfect, and though it is a trifle more expensive, I advise you to purchase mirrors made with it, instead of those backed with amalgam. The mirror should be firmly attached to a wire stem about four inches in length, at an angle of not less than one hundred and twenty degrees. This stem may be fixed in a small handle about three

inches long, or the handle may be removable, the stem when inserted being held by a set-screw. Some laryngologists recommend a flexible stem, so that the angle of the mirror can be easily altered; but this is objectionable, as it is likely to become bent by contraction of the palatine muscles when the mirror is in position, in such a manner that the larynx cannot be seen.

An inflexible stem is always preferable, for the obliquity of the mirror can be easily altered by elevating or lowering the handle. Again, it is better for the beginner to attribute want of success to lack of skill rather than to a defect in the mirror. If the beginner attempts to alter the obliquity of the mirror by bending the stem, he is likely to break the instrument in his frequent attempts to secure an angle which will give a different view of the larynx.

THE LIGHT.—To obtain a perfect illumination of the larynx three things are necessary. First, the eye should be brought as nearly as possible into the centre of the beam of light used in the illumination; second, a bright light is needed; and third, the focal point, when convergent rays are used, should fall upon the part to be inspected.

By such a position of the eye, the most distinct image is obtained. A good light is needed, and it must be very bright if a small throat mirror is used, for the smaller the mirror the fewer the rays which can be reflected from it; consequently we must make up in intensity what is lost in volume.

All forms of illumination which cast convergent rays into the larynx cause above and below the focal point, what are known as circles of dispersion, in which the illumination for a short distance is nearly as bright as at the focal point. In examining the larynx, an effort should be made to concentrate the rays of light on the vocal cords, and then the circles of dispersion will give a good illumination for half an inch above or below the plane of the glottis. In adult males, the glottis is about three inches below the mirror when it is held in the posterior part of the mouth, and in this position the mirror is about three inches from the lips, therefore the glottis is about six inches within the lips, or in females about five inches. As the eye cannot be brought nearer to the mouth than five inches, without interfering with the manipulation of the instrument,

the radiant or focal point must fall eleven inches from the reflector, which is worn on the forehead.

Being myself hypermetropic, I find it most convenient to have my eye at least eight inches from the patient's mouth; therefore I must use a reflector which will concentrate the rays of light at a point fourteen inches from itself.

Persons with presbyopic eyes may obtain a good view in the same manner, or deficient accommodation in the eye may be corrected by glasses.

Myopic eyes of less than one tenth will necessitate the use of concave glasses; but when from one tenth to one seventeenth, glasses will not be needed, excepting to view the bifurcation of the trachea.

When we wish to examine the bifurcation of the trachea, which is five or six inches below the plane of the vocal cords, we must remember that the focal point should be at least sixteen or seventeen inches distant from the reflector.

MANAGEMENT OF THE LIGHT.—The larynx may be illuminated by a simple flame, or a concave reflector with or without condensing lenses may be employed to reflect the rays of light into the throat. In illuminating the larynx by the direct rays of the sun, lenses are not used, and reflectors are not absolutely necessary. When diffused daylight is employed, reflectors are required to concentrate the rays. Though direct sunlight, or sometimes diffused daylight, gives a beautiful illumination, artificial light will be found indispensable for general use. Natural light cannot usually be secured in the proper position at the time we wish to use it.

Direct illumination with artificial light.—When using a simple flame without a reflector, the lamp must be placed directly in front of the patient's mouth, and shaded toward the eye of the observer. This will give a good illumination if the light is very bright, but with the ordinary lamp or gas-jet, it is not satisfactory. Such a method of illumination may be improved by using a condensing lens with a focal distance of six or seven inches. The lens having been warmed, to prevent the vapor in the breath from condensing on it, should be held between the light and the patient's mouth, and about five inches from the latter. The flame should be placed at a point which will cause its rays to be brought to a focus eleven inches beyond the lens on the

plane of the glottis. The observer's eye must then be brought near the edge of the lens.

Illumination with reflected artificial light.—This same apparatus may be supplemented by a plane perforated reflector which is placed in front of the observer's eye, the rays proceeding from the lens being thrown upon it, and thence reflected into the mouth. Or this reflector may be used with the simple flame without the intervention of a condenser.

Concave reflectors.—In order to fulfill the three essential conditions, that is, to have the eye in the centre of the cone of light, to obtain a bright illumination, and to have the focal point fall upon the part to be examined, laryngologists generally resort to perforated concave reflectors. This mirror collects many rays which would otherwise be lost, and concentrates them on the point to be examined, thus intensifying the illumination, and in consequence of the perforation in its centre, the observer's eye may be brought into the centre of the cone of light. Many laryngologists prefer to place the reflector above the eye, but unless a very bright light is employed, this position will not give a good illumination of the larynx, and if a brilliant light is used, it is very trying to the eyes.

The advantages of a perforated reflector are, other things being equal, that it gives the best possible illumination and it protects the observer's eyes from the glare of the flame.

These reflectors vary in size and in focal distance, also in the material of which they are constructed. Those used in laryngoscopy are usually from three to four inches in diameter, with a focal distance ranging from five or six to fourteen or sixteen inches. They are made either of glass or of metal; those made of glass are best, as the metallic reflectors soon become dim. For ordinary use, a reflector with a focal distance of seven or eight inches will give better satisfaction than one with a longer focus, except when parallel rays of light as those of the sun or of diffused daylight, are to be reflected. The rays coming from any artificial light are necessarily divergent, and consequently they cannot be brought to a focus in the larynx, by a reflector with a focal distance of eleven inches, which would concentrate parallel rays at the proper point.

With the ordinary position of the flame, and of the observer's eye, a reflector of seven inches focal distance will throw the

radiant point upon the glottis. The radiant point may readily be moved toward and from the eye by increasing or lessening the distance of the flame from the reflector, so that mirrors of varying focal distances may be employed, providing the light is sufficiently intense.

To make this matter clearer, I ask your attention to the following formula.

$$\frac{1}{F} = \frac{1}{A} + \frac{1}{A'}.$$

On account of its simplicity, this formula has been generally adopted in determining the focal distance of the reflector, or the proper position of the flame, which, with a reflector of a known focal distance, will cause the image of the flame to fall upon the glottis. The image of the flame and the radiant point are in this connection used as synonymous terms. The focal point is the same as the radiant point, when parallel rays of light are employed.

In this formula "F" represents the focal distance of the reflector; "A" represents the distance of the reflector from the flame; "A′" represents the distance of the reflected image of the flame (focal or radiant point) from the reflector. For example, knowing the focal distance of the reflector, which is seven inches, and the proper distance of the image of the flame, which, as I have already explained, must fall upon the glottis, and will therefore be eleven inches from the reflector—five inches from the observer's eye to the patient's mouth, and six inches from the patient's lips to his vocal cords—we can readily ascertain the proper position of the flame by placing the known quantities in the formula thus $\frac{1}{7} = {}^{1} + \frac{1}{11}$. This reduced will give a fraction over nineteen inches as the value of "A;" which will represent the proper distance of the flame from the reflector.

If we wish to find the focal distance of the reflector by artificial light, we proceed in a similar manner with the same formula. Placing the light at a fixed point and the reflector in front of it, we find the distances from the flame to the reflector, and from the reflector to the image of the flame, by direct measurement with an ordinary tape. These two known quantities being then inserted in the formula in the place of A and A′, the value of F can readily be obtained. The focal distance of a reflector may be easily ascertained with solar light, by

placing it in the sunlight, throwing the radiant point on some object, and then measuring the distance from the centre of the reflector to the focal point. The focal distance may be measured with diffused light, by reflecting the image of some distant object, as a window, on some plane surface, and measuring the distance from this image to the reflector.

In using reflectors, the essential thing to be remembered is that the light must be so managed that the radiant point will fall on the part to be illuminated.

Method of illuminating the larynx by the aid of a concave reflector.—Students of laryngoscopy usually have great difficulty in obtaining a uniform illumination. Sometimes the parts will be brilliantly illuminated, at other times with the same light and the same laryngoscope the larynx is only seen in a deep shadow. This is generally due to the improper position of the light. You must not forget that the larynx is necessarily from eleven to fourteen inches from the eye, and that, with a reflector of seven or eight inches focal distance, if the flame be placed too near the eye, the radiant point will fall a considerable distance beyond the glottis; or if the flame be placed too far from the eye, the radiant point will not reach the glottis. You should always know the focal distance of your reflector; you should ascertain by the formula (page 262) the proper distance at which to place the flame; and you must remember that the distance of the radiant point from the reflector will vary as the latter is carried toward or from the flame.

Practically, if you have a proper reflector of seven to eight inches focal distance, it will not be necessary to measure accurately the distance of the flame; but placing your light beside the patient, seat yourself in front with your reflector—worn upon the forehead or before the eye—ten or eleven inches in front of the patient's mouth. Now carry the light forward or backward until its perfect inverted image falls on the patient's lips, and there leave it. Then bring your reflector about four inches nearer the mouth, and the radiant point will fall upon the glottis.

Means for holding the reflector.—Various contrivances are employed for holding the reflector. Czermak at first had it fastened to a mouth-piece of orris-root which he held between his teeth. Semeleder and others are in favor of spectacle

frames, to which the reflector is so fastened that it may rotate in any direction. If the physician happen to be myopic or hypermetropic, lenses may be fitted in the frames so as to correct the error in accommodation. Jointed arms for holding the reflector accompany many forms of illuminating apparatus (Fig. 52, page 267). These are inconvenient if the patient moves after the arm has been adjusted, for each movement of the patient may require a change in the position of the reflector. Kramer's head band, or some modification of it, is the most common, and, I think, the best device for holding the reflector. This consists of a head band with a metallic or vulcanite plate in front to which the reflector is attached by a ball and socket joint, which enables us to fix it in any position. Most of the head bands are open to two objections; first, they cannot be made tight enough to hold the reflector firmly without causing headache; and second, the ball and socket joint is



FIG. 48.—Schroetter's head band with nasal rest.

so constructed that, after it becomes a little worn, it is impossible to fix the reflector firmly. Schroetter's head band, with nasal rest, obviates these difficulties very completely. I have had an arm constructed with an extra joint which affords a point for the attachment of a plane mirror in addition to the reflector. This enables me to inspect the larynx through the aperture in the concave reflector, while persons standing near can see the same image in the plane mirror.

Whatever the means employed for holding the reflector, it must be borne in mind that the flame must have a certain definite relation to the reflector, depending on the focal distance of the latter and its distance from the glottis, so that the image of the flame will fall upon the vocal cords.

LECTURE XXIV.

LARYNGOSCOPY—Continued.

In place of throwing the radiant point on the glottis, some physicians prefer to illuminate the parts to be examined with the bright disk of light which may be obtained in the circle of dispersion above or below the radiant point.

Several instruments have been devised for the purpose of rendering the light in this disk more intense.

One of the simplest of these is *Krishaber's Illuminator* (Fig. 49).

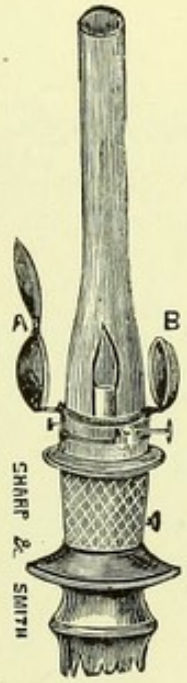


FIG. 49.—Krishaber's Illuminator. *A*, Lens; *B*, Reflector.

It consists of a reflector and a convex lens, which may be fastened by the clamp to an ordinary lamp.

This apparatus will often give very satisfactory results.

Mackenzie's Bull's-Eye Condenser is used for the same purpose. This consists of a rack-movement gas fixture with a metallic chimney, which can be adjusted to the ordinary gas burner (Fig. 50). The chimney has an orifice on one side for the condensing lens, and the latter is placed at a fixed point in front of the

flame, so that the rays of light on leaving it will be nearly parallel. This illuminator may be brought directly in front of the patient's mouth for direct illumination, but it is generally

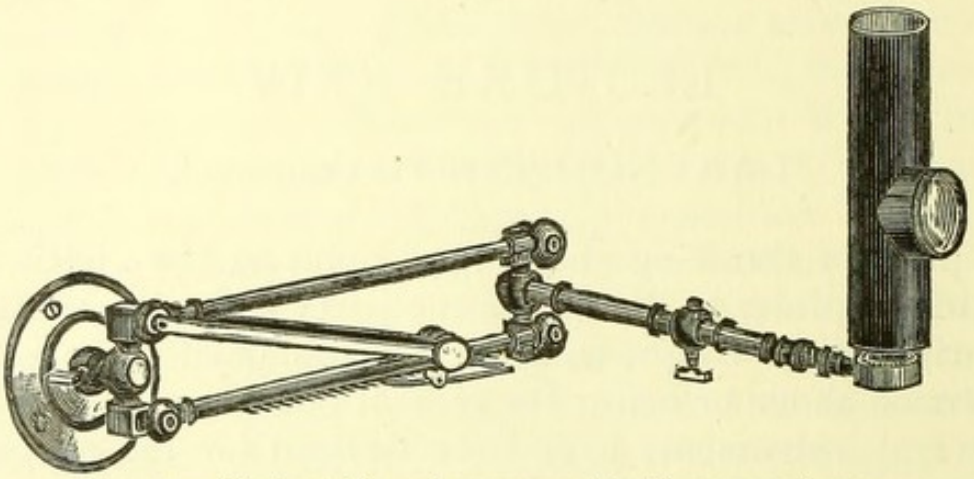


FIG. 50.—Mackenzie's rack-movement bull's-eye condenser.

used with a reflector of from eleven to fourteen inches focal distance.

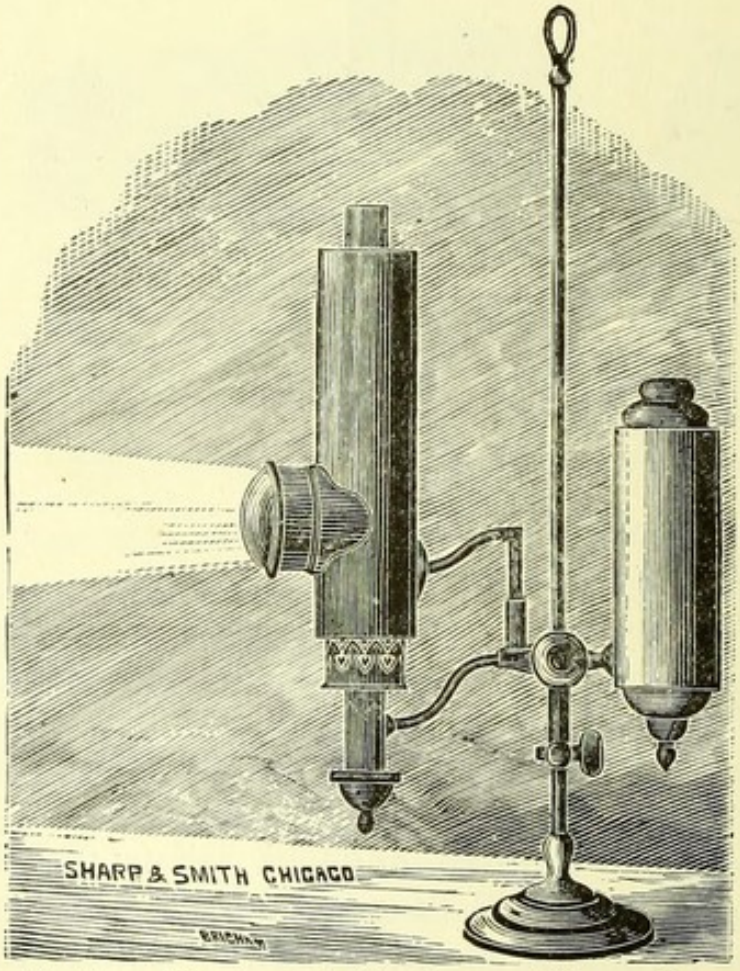


FIG. 51.—Modification of Mackenzie's illuminator which may be used either with a student's lamp or an Argand gas burner.

Fraenkel's Illuminator is somewhat similar in construction as

regards the condensing lens, but is so arranged that the rays of light on leaving the lens may be made either divergent, parallel, or convergent, according to the size and focal distance of the reflector which is employed.

I have had Messrs. Sharp and Smith, of this city, construct a similar condenser, which may be used with the ordinary Argand gas burner or German student's lamp (Fig. 51). In this condenser the lens is so set that the rays of light are divergent on leaving it, and are thus adapted for a reflector with a focal distance of seven or eight inches. If it is desired to obtain a bright circle of dispersion for illumination, or to use a reflector with a longer focal distance, the cap in which the lens is set can be drawn out so that the rays will be less divergent.

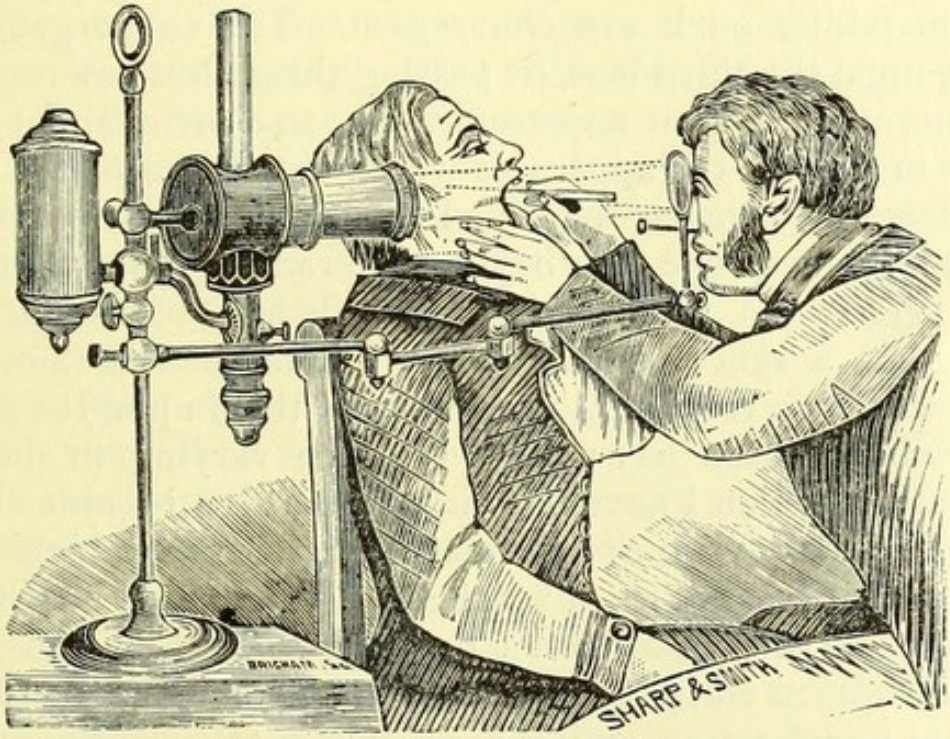


FIG. 52.—Tobold's Illuminator.

This condenser is comparatively inexpensive, and possesses all the advantages of the last two described, as well as those of Tobold's illuminator, without the imperfections of the latter. With this condenser and Fraenkel's, either the radiant point or the circle of dispersion may be used for illuminating the glottis.

Tobold's Illuminator.—With a view to increasing the illumination, a combination of lenses was devised by Tobold, whose apparatus (Fig. 52) is in common use; but such a combination has no special advantages. On the contrary, Weil has shown

that the apparatus is improved by removing one or two of its lenses. These lenses merely cause a large circle of dispersion, which, though very handsome when thrown on an external object, is in point of fact less intense than the image of the the flame.

Tobold's apparatus has a combination of three lenses, two of which, each having a focal distance of about three inches, are placed closely together, and so near the flame that they collect divergent rays as they leave the lamp, and concentrate them to a focus about six inches in front of the second lens. The third lens, which is farthest from the flame, has a focal distance of about five inches. It is placed four inches in front of the second lens, about two inches within the point at which the rays of light are concentrated by the latter, so that the rays of light falling on it are convergent. The convergent rays falling upon the third lens, by passing through it, are rendered still more convergent and are brought to a focus about three inches in front of the apparatus where the image of the flame is perfect. The reflector is fixed about four inches in front of the apparatus, or one inch beyond the radiant point of the last lens. Here, the rays having crossed, are so widely divergent, that a reflector of one and a half inches focal distance would be required to concentrate them upon the glottis. The reflector used has a focal distance varying in different instruments which I have examined, from five to nine inches. Therefore the rays must also leave the reflector widely divergent, so that most of them will be lost. Hence we see that the large bundle of rays collected by the first lens, which might then have been entirely utilized, is first subjected to the loss incident to refraction, and is then largely thrown away. Yet we must admit that a sufficient number of rays are still retained to give a good illumination, though less intense than when only one lens is employed. It follows then that no possible advantage can be derived from a combination of lenses, except where cheap lenses of a moderate convexity are placed together to secure a short focal distance. A single lens of sufficiently high power to accomplish the same result would be comparatively expensive. Tobold has also devised a smaller instrument known as the pocket illuminator, the construction of which is similar to that of the one just described.

The image of the flame may be so magnified by a single lens, as found in the condensers already mentioned, that it is as large as can possibly be reflected from any throat mirror.

Use of condensing lenses.—In using condensing lenses, any one of three methods may be adopted. First, the flame may be placed at the focal point of the lens; second, it may be placed beyond the focal point; or third, it may be placed nearer to the lens than its focal point.

With the flame at the focal point, the rays which always leave the light in a divergent direction are refracted, so as to leave the lens in a parallel direction, and they must then be managed in the same manner as the parallel rays of sunlight or diffused daylight. In this instance, in order to lose none of the light, a reflector of a diameter the same as that of the lens should be employed, and it should have a focal distance of from eleven to fourteen inches. This will bring the image of the flame upon the glottis, providing the eye is from five to eight inches from the mouth.

When the flame is placed beyond the focal distance of the lens, its divergent rays, after passing through the lens, become convergent. In this case, the reflector may be smaller than the lens, but you will readily understand that it must have a focal distance of more than eleven or fourteen inches; otherwise the rays will be brought to a focus too soon.

When the flame is placed nearer the lens than its focal distance, the rays, after passing through the lens, are still divergent, and in order that none of them be lost, they must be received on a reflector larger than the lens, and it must have a focal distance of not more than eight inches, or in other words the same focal distance as that required when a flame is used without a condensing lens. This is by far the best method for practical purposes, as it gives an illumination equally as good as the other methods, and it does not necessitate the possession of a number of reflectors.

Some form of condenser is desirable for office use, but I have always found a simple concave reflector of large size and short focal distance sufficient for purposes of diagnosis, and ordinarily for operations within the larynx. Such a reflector may be used with an ordinary gas jet or with any lamp, and it may be sufficient, even if we are obliged to rely on candles for our

light. For general use it will certainly be found more satisfactory than a cumbersome illuminating apparatus.

When performing operations in the larynx, it is desirable to have as large a field illuminated as possible. This end may be attained by means of the bull's-eye condenser with the ordinary flame; or by the same with a brighter light, and a reflector with a long focal distance, so that the circle of dispersion can be utilized in place of the radiant point.

The light.—The electric light would perhaps be the best for laryngoscopy, and next to it, the oxy-hydrogen light.

The former, however, cannot as yet be readily obtained, and the latter, besides being difficult to manage, requires a great deal of apparatus, and is consequently expensive. A good Argand gas burner or a German student's lamp with a bull's-eye condenser is all that is necessary for illumination, even during operations. I have sometimes obtained brilliant illumination even with a common kerosene lamp, having a round wick like that shown in Fig. 49. For purposes of diagnosis, any ordinary lamp, freshly trimmed, and with a clean chimney, will generally be sufficient. As suggested by Dr. Cohen, two or three candles tied together, and placed in front of the bowl of a spoon used as a reflector, may be made to answer the purpose, if a lamp cannot be obtained.

Diffused day-light, when properly managed, gives a beautiful illumination of the larynx. Artificial light, more or less, discolors the image, causing the normal larynx to appear yellowish or red, whereas diffused daylight shows the parts in their natural colors. Unfortunately the latter is seldom sufficiently bright. On a bright day, if light can be admitted through a small opening into a darkened room so as to fall upon the reflector, it will give a good illumination. If it is impossible to admit the light through a small aperture, a good view may sometimes be obtained by placing the patient at the farther side of the room, opposite a single window left uncovered, with his back to the light. This position will give a much better view than when the patient is placed near the window.

Direct sunlight may be employed by placing the patient, facing the window, in such a position that the rays will fall upon the throat mirror held in the pharynx. A serious objection to this method is that the light cannot often be obtained

in a suitable position. Reflected sunlight may more frequently be employed with the aid of a plane reflector, or of one with a long focal distance. Even this light is open to serious objection, for it is only in comparatively rare instances that we have a proper exposure and find the sun at the desired altitude.

Heliostats have been constructed for reflecting the sunlight in a given direction. They may be arranged by a system of clock-work so as to maintain the beam of light at a given point throughout the day. This apparatus is very expensive, and therefore I do not recommend it.

An ordinary toilet mirror may be so placed as to receive a beam of sunlight, and direct it horizontally in any desired direction; but this is not often satisfactory, for the angle of the mirror must be changed frequently, and a cloud is liable to hide the sun just as its light is most needed. For these various reasons we are usually compelled to use artificial light.

You should practice laryngoscopy both with natural and with artificial light, in order to become familiar with the appearance of the parts under both forms of illumination. The same larynx will have a different shade when viewed by the different lights. The larynx, which appears congested when viewed by artificial light, may seem of normal color by natural light.

For the purpose of magnifying the image of the larynx, Dr. Wertheim recommended concave throat mirrors, and Dr. Türck suggested a small telescope, some improvements in which were made by Voltolini; but these have all been found practically useless.

Dr. A. W. Adams, of Colorado Springs, Colorado, has invented a laryngoscope for which the source of light consists of a coil of wire, heated to incandescence by electricity and placed immediately in front of a small metallic cap, which is attached to the handle of the throat mirror. The instrument is said to give a good illumination. The laryngoscope which I prefer consists of a perforated reflector four inches in diameter, with a focal distance of seven inches, attached to Schroetter's head band with nasal rest by means of a ball and socket joint; three round throat mirrors, three eighths, seven eighths, and nine eighths of an inch in diameter respectively, the smallest for children; and one oval mirror three fourths of an inch in diameter, for use in cases of enlarged tonsils. As before stated, these throat mirrors should be backed with silver leaf and

firmly fastened to an inflexible stem, which may be permanently fastened to the handle or not, as is most convenient. The reflector need not be more than three and one half inches in diameter, but the larger instrument will reflect a greater number of rays, and thus give a somewhat brighter illumination. The four-inch reflector possesses the additional advantage, when worn before one eye, of shading the opposite eye more perfectly from the flame. The only objection I have

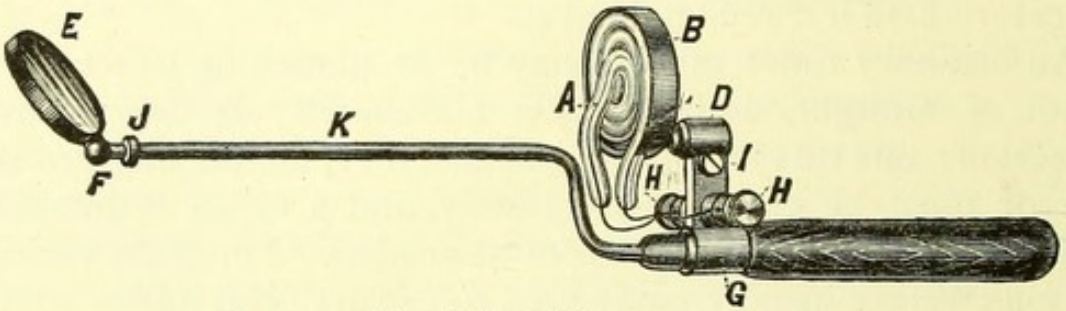


FIG. 53.—Adams' electric laryngoscope.

A, Spiral vacuum tube containing wire which, when heated by the electric current, furnishes the light. B, Cap for glass tube. D, Ball and socket joint regulated by screw I. H, Binding posts for wire. K, Stem. E, Mirror. F, Ball and socket joint. J, Sliding ring to regulate joint at F. G, Attachment of illuminating apparatus to handle of mirror.

found to it is, that the attachment for the ball and socket joint is placed a trifle too far from the perforation, which sometimes causes a little difficulty in bringing the perforation squarely before the eye. However, this difficulty may be overcome by wearing the nose-rest a little to one side. This objection might be easily remedied by the manufacturer. This reflector is a little more expensive than the one three and a half inches in diameter. For an illuminating apparatus, I would recommend an Argand gas burner attached to a rack-movement fixture, similar to the one shown (Fig. 50, page 266); or a German student's lamp which may be supplemented when you wish by a condenser (Fig. 51, page 266).

The cost of this outfit is small. A three and one half inch reflector, five dollars; a head band and nose rest, two dollars and a half; and five throat mirrors at a dollar to a dollar and a half each. It will be seen that an excellent laryngoscope need not cost more than fifteen dollars. A German student's lamp, or a rack-movement gas fixture with Argand burner, will cost

only five or six dollars; a condenser may be purchased at a cost of from eight to ten dollars.

THE RHINOSCOPE.

Rhinoscopy, or inspection of the posterior nares and the vault of the pharynx, is practiced with the same instruments used for laryngoscopy, excepting that smaller throat mirrors are usually required, *i. e.*, those from half to five eighths of an inch in diameter, and it is generally best to have a flexible stem to the mirror, which may be readily bent to conform to the floor of the mouth (Fig. 62, page 286).

The mirror may be set at right angles to the stem, or at the same angle as the laryngeal mirrors. An angle between these two is sometimes preferred, but the exact angle is a matter of little importance, as the obliquity of the mirror may be easily

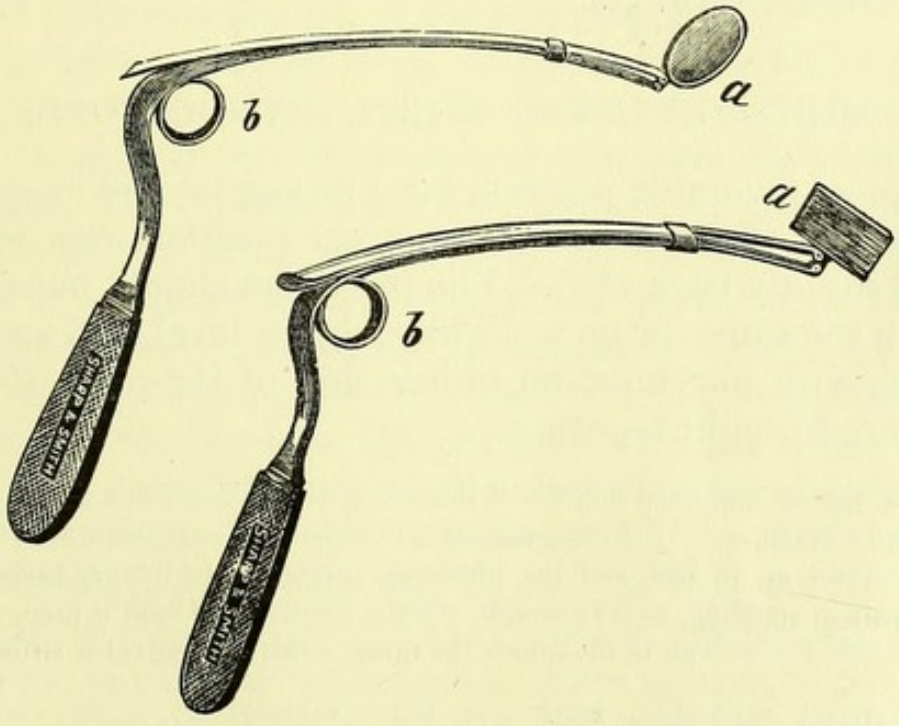


FIG. 54.—Fraenkel's rhinoscope. The angle of the mirror (*a*) can be changed at will by moving the sliding rod at *b*.

changed by raising or lowering the handle. Special throat mirrors have been constructed for rhinoscopy (Fig. 54) but they do not seem to me superior to those already described. A tongue depressor will be often needed in rhinoscopy, and various forms of blunt hooks and other instruments may be used for holding the uvula; but these latter are rarely em-

ployed, and are seldom, if ever, of any use excepting during operations.

Anterior rhinoscopy is performed with the aid of the laryngoscopic reflector and a nasal speculum. Various specula have been made for the purpose. A single bivalve speculum, such as

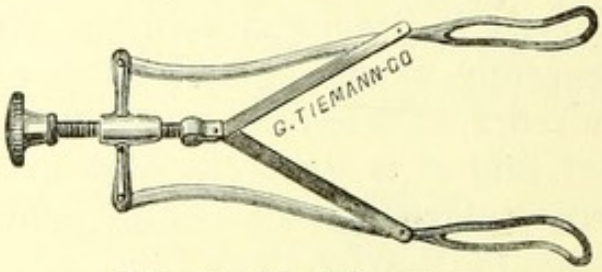


FIG. 55.—Nasal Speculum.

is also used for the ear, is as good as any for purposes of diagnosis; but when operations are to be performed an instrument which will retain its position, when placed in the nostrils, answers better (Fig. 55).

MODE OF USING THE LARYNGOSCOPE.

The most favorable position for a laryngoscopic examination is with the patient seated in an erect position with the head thrown slightly backward. The physician should be seated in front on the same or on a slightly higher level, and as close as possible, with one knee on either side of the patient's knees, which are brought together.

It must not be supposed that this is the only position in which a good view of the larynx can be obtained It is often necessary to make the examination with the patient slightly propped up in bed, and the physician sitting as best he may beside him; or with the patient standing, as for example, when a library drop-light is used, which cannot be brought low enough to illuminate the throat when the patient is sitting.

The most suitable seat for the patient is a narrow cane-seated chair, with a straight back, sufficiently high to support the head, and a seat not more than a foot in depth, which will compel the patient to sit erect. For the physician a piano stool, which can be raised or lowered to any desired level, is most convenient; but any common chair can be made to answer the purpose.

The patient should be seated beside or just in front of the table which holds the instruments. A cuspidor should be

placed beside him, and a glass of water should be close at hand. If direct sunlight is employed, the patient should be placed near the window, facing the light, which, coming in over the physician's shoulders, falls directly upon the pharyngeal mirror. With reflected sunlight the positions of patient and examiner as regards the window are reversed. When artificial light is employed, which is usually the case, the light should be placed on a level with the patient's eyes, and slightly behind him, so that it will not shine on his face; and about six inches distant at one side, so that the rays may fall without obstruction on the reflector. If the flame is placed much above or below the level of the patient's eyes, or far from his head, at one side, the angle at which the rays fall upon the reflector will be so great that a good illumination will be impossible. The patient's head should be thrown slightly backward (Fig. 56), so that the edge of the upper incisor teeth will be nearly on a horizontal plane with the posterior margin of the soft palate.

The reflector may be worn on the forehead, or, as I prefer, before one eye. If the lamp is on the patient's right, the reflector should be placed in front of the examiner's left eye, or *vice versa*. The throat mirror may be held in either hand, the patient's tongue being held by the other. For right-handed persons it is easier at first to hold the mirror with the right hand, but the left hand should be educated to the task as soon as possible; for when other instruments are to be used, the right hand will be required for this purpose. Even for the purpose of diagnosis ambidexterity is very desirable, for by holding the mirror first with one hand and then with the other, any false impressions of asymmetry may at once be corrected.

In making a laryngoscopic examination, everything being in readiness, the physician takes his position in front of the patient, and fixes the reflector in its place; his eye is now brought within about ten inches of the patient's lips, upon which the light is directed. If the lamp has been placed at the proper distance, a perfect inverted image of the flame will be seen on the patient's lips, otherwise the light should be moved backward or forward until this result is obtained. The patient is then directed to protrude his tongue, which the physician grasps and holds between his thumb and forefinger, which have been previously enveloped in a soft napkin. The examiner's

eye is then brought about four inches nearer, and the light from the reflector is so directed that the brightest point falls on the

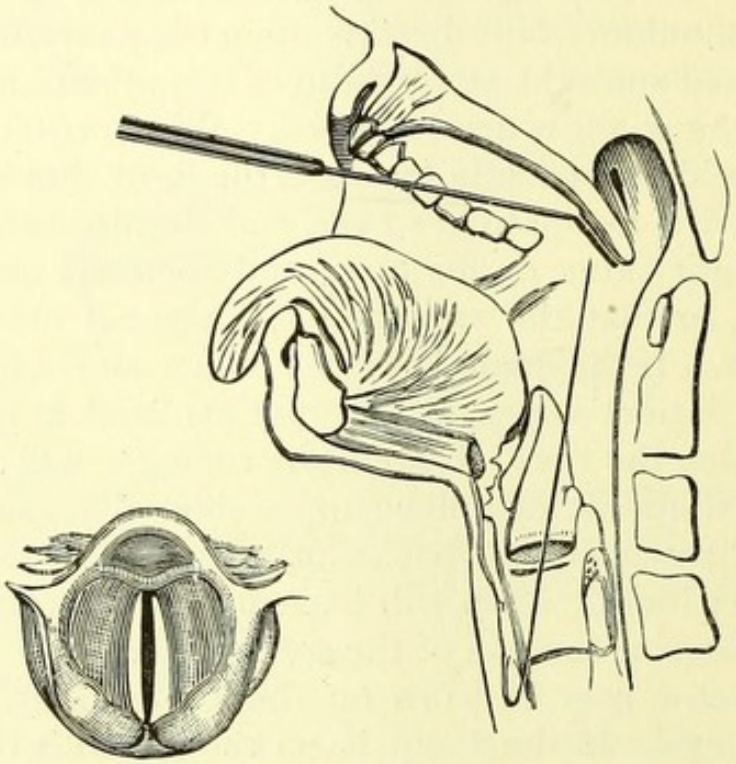


FIG. 56.—Position of head, giving the best view of larynx, as shown in small cut at the left (altered from Browne).

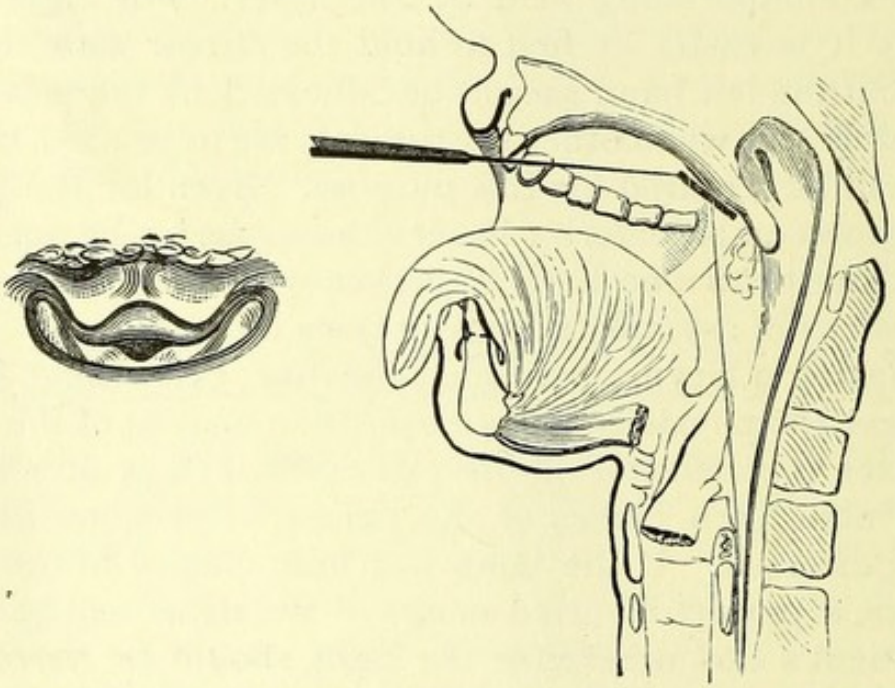


FIG. 57.—Position of head, giving a poor view of larynx, as shown in the small cut at the left (Browne).

base of the uvula where it must be retained. The throat mirror is then warmed for a moment over the lamp, its tempera-

ture tested on the cheek or back of the hand, and it is then carried into position in the throat.

Now, by a slight, steady movement of the mirror, the image of the larynx is brought into view (Fig. 58.)

The first difficulty which the beginner experiences is to

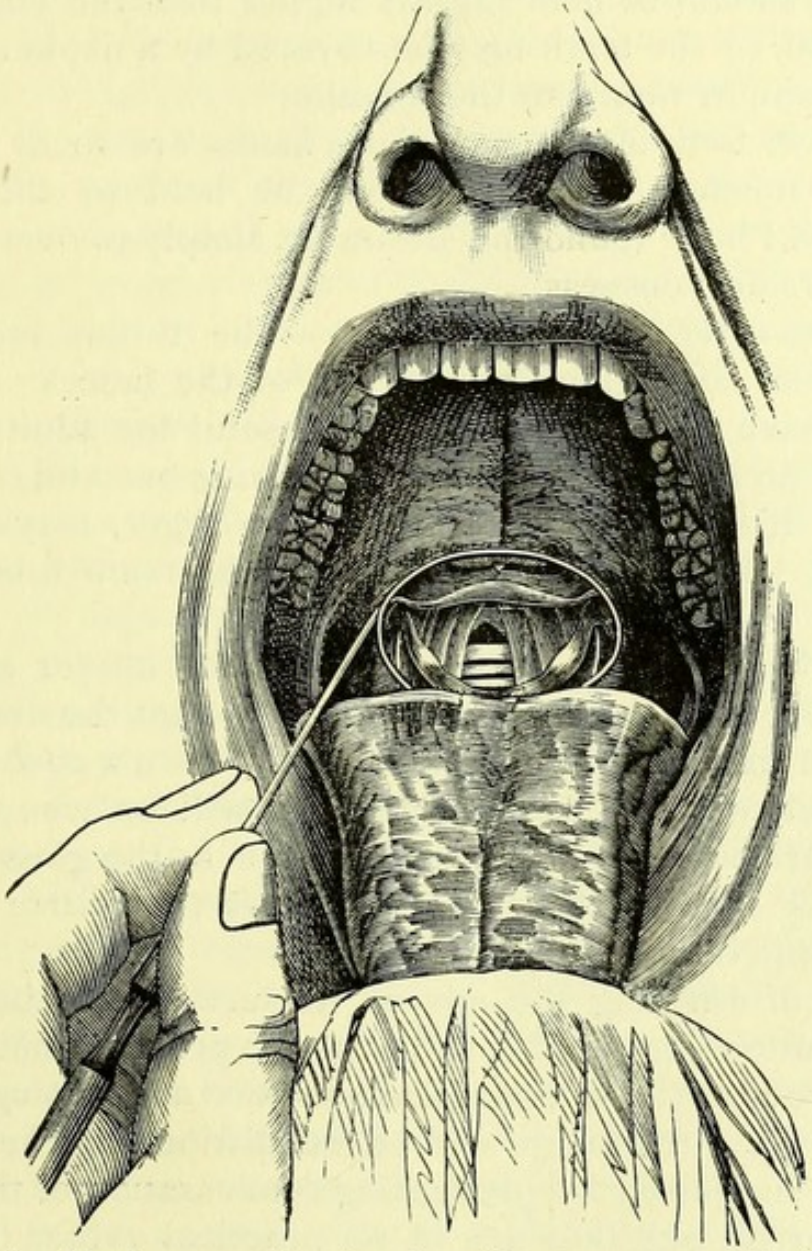


FIG. 58.—The laryngoscopic mirror in position, stem to one side (Cohen).

direct the light into the mouth, and the second is to keep it there. These may be readily overcome by practice, and they should always be mastered on a dummy or some other object before an attempt is made to examine a patient.

Holding the tongue.—The patient should protrude the tongue as far as possible by the muscles of the tongue itself, and it must be held gently by the physician without an attempt to

draw it farther out, for such an attempt would cause contraction of its muscles.

A soft cloth is necessary in holding the tongue, not only for neatness, but, because if it be grasped simply with the fingers it will slip away. In holding the tongue, the finger which is beneath it should be held slightly higher than the edge of the lower teeth, or the teeth may be covered by a napkin to avoid causing pain, or injury to the frænum.

Whenever both of the physician's hands are to be occupied with instruments, the tongue may be held by the patient. Sometimes I have found this desirable, simply to overcome the individual's nervousness.

Management of the throat mirror.—The throat mirror employed must correspond to the size of the fauces. The one which I have found most generally useful for adults is seven eighths of an inch in diameter; but mirrors one and one fourth inches in diameter, or even somewhat larger, may often be employed. The larger the mirror the better will be the illumination.

Before being passed into the throat, the mirror should be warmed over the lamp for an instant, so that the moisture of the breath may not condense upon it. When a cool mirror is first placed over the flame a thin film will be seen to spread over its surface, which disappears as soon as the glass becomes warm. As soon as this film disappears the mirror is of a proper temperature for use.

Instead of warming the mirror, its surface may be covered with a solution of glycerine and water to prevent condensation of moisture; but this does not leave so good a reflecting surface, and, as a result, the image will be less distinct. Other devices have been suggested for preventing condensation of the breath on the mirror, but they are of no practical value. The mirror is less irritating to the fauces when warm; and it will retain the heat as long as it ought to be kept in the throat. The mirror should be held like a pen-holder between the thumb and fingers, with the hand bent slightly backward upon the wrist. It should be passed horizontally into the mouth with the reflecting surface downward, and carried promptly midway between the tongue and the roof of the mouth back to the uvula, which is caught upon it and carried upward and

backward, until the rim of the mirror rests nearly against the posterior wall of the pharynx. If the uvula hangs too low to be easily caught on the back of the mirror, it may be elevated by causing the patient to take a deep inspiration or to phonate the syllables "ah" or "eh." If the throat will tolerate it, the mirror may be rested against the posterior wall of the pharynx.

The stem of the mirror may be held either above or at one side, and its handle should be carried outward toward the angle of the mouth, so that the hand will not obstruct the light. The angle of the mirror should be about forty-five degrees to the plane of the horizon, though, in practice, it will be found that good views can be obtained from different points with the mirror in various positions, by altering the relative positions of the physician and patient, or by inclining the patient's head more or less.

If the light has been properly directed, it will now fall on the mirror, whence it will be more or less perfectly reflected into the larynx, an inverted image of which will be seen in the mirror (Fig. 58, page 277). If the larynx is not perfectly brought into view, the mirror may be slightly rotated or its obliquity altered by moving the handle; but these movements must be few and they must be made with decision, for if they are made with an uncertain, tremulous hand, or if many movements are made, retching is likely to be produced, which will usually prevent further examination of the larynx. At this point in the manipulation, beginners generally have considerable difficulty either by losing the light or by being unable to obtain a view of the larynx, on account of an improper position of the throat mirror. In either case, the mirror should be promptly withdrawn and re-introduced; for if it is held in position while the light is being re-arranged, or if it is moved about in the throat to secure another view, it is likely to irritate the fauces.

With the throat mirror in position, you will obtain a more or less perfect view of the base of the tongue and of the larynx. If only the base of the tongue or the upper part of the epiglottis is brought into view, by depressing the handle slightly you will expose the parts below; or if these are first brought into view, the superior structures may be exposed by elevating the handle. By rotating the mirror slowly, the lateral walls of the pharynx or larynx may be exposed.

The hand which holds the mirror may be steadied by resting the ring and little fingers on the patient's cheek.

The mirror should not be kept in the throat more than twenty or thirty seconds, but the examination may be continued by re-introducing it several times.

Whenever the slightest indication of retching occurs, the mirror must be instantly withdrawn, but, after a few moments, another trial may be made, when the patient will usually tolerate it as well as in the first instance.

When inserting the mirror, be careful that its reflecting surface does not touch the tongue, and that its back does not rub against the palate. The former accident clouds the reflecting surface, and either is likely to cause retching or an attempt to swallow, which will prevent the examination.

LECTURE XXV.

LARYNGOSCOPY Continued—RHINOSCOPY.

OBSTACLES TO LARYNGOSCOPY.

Obstacles are frequently met with in making laryngoscopic examination, though by a little tact and patience they can usually be overcome, at least at a second sitting. You should never expect a thorough view of the larynx without introducing the mirror two or three times; however, if the patient's throat is not sensitive, by rotating the mirror slightly you may be able sometimes to inspect the entire larynx with a single introduction of the mirror.

The principal obstacles to be overcome are: an elongated uvula, enlarged tonsils, irritable fauces, a short frænum, arching upward of the back of the tongue, and a pendent epiglottis In two cases, one an actor, and the other an elocutionist, I have found difficulty in inspecting the larynx that was apparently caused by hypertrophy of the lingual muscles; which greatly restricted the space between the tongue and posterior wall of the pharynx.

ELONGATED UVULA.—An elongated uvula, hanging below the mirror, appears as though curled over the lower edge and resting upon the reflecting surface. This is very confusing and prevents a view of the parts below.

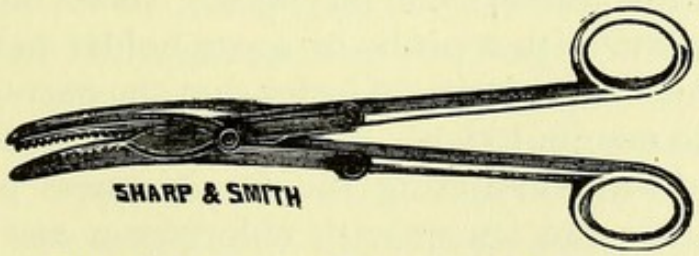


FIG. 59.—Scissors for amputating the uvula.

To obviate this difficulty in ordinary cases, it is only necessary to use a large mirror and to be careful in placing it against the uvula. Mirrors have been devised with a little

pocket in the back for catching the uvula, but I am not aware that they are now in use. If the uvula is so long that it cannot be managed with a large mirror, it may be contracted by astringents; or if these are inadequate, it should be amputated and the examination made at a subsequent sitting.

IRRITABLE FAUCES.—A patient will sometimes retch or gag if a person simply looks into his mouth, and others will do so when the tongue is protruded. In still other instances, this occurs as soon as the throat mirror touches the fauces. To overcome these difficulties, the patient should be fully impressed with the necessity of the examination, and he should be urged to exert himself to prevent retching; the mirror should then be introduced during a deep inspiration or as the patient says "eh" or "ah," which elevates the uvula and, by thus avoiding the necessity for pressure against the palate, often induces much greater tolerance of the instrument.

In nervous patients it is often best, for the sake of gaining their confidence, to introduce the mirror once or twice so as just to touch the palate, and then withdraw it at once without attempting to see the larynx.

If these devices fail, the most feasible method for overcoming this difficulty is to allow the patient to suck ice for fifteen or twenty minutes, which will produce some degree of temporary local anæsthesia.

Many persons, in whom the pharynx is sensitive, will tolerate an examination at a second or third sitting, in whom hardly a glimpse can be obtained at the first. In such cases it is a good plan to have the patient educate the throat to bear instruments, by introducing a spoon-handle against the uvula before a mirror several times daily during the interim. In cases of irritability of the fauces, some laryngologists recommend titillation of the palate with a probe or a pen-holder before attempting to introduce the mirror, in order that the parts may become accustomed to manipulation. Various other devices have been recommended for overcoming the sensitiveness of the throat, such as painting the fauces with chloroform and morphia, inhalation of a few whiffs of chloroform, and the internal use of large doses of bromide of potassium; but none of these measures are very satisfactory. Ordinarily we will succeed best simply by patience and care in introducing and holding the

mirror, supplemented, when necessary, by the use of ice. The fauces are more irritable when the stomach is disordered, and during digestion than at other times, therefore it is best, whenever the throat is sensitive, not to make examinations until three or four hours after meals.

SHORT FRÆNUM.—A short frænum is one of the minor obstacles. If it proves very troublesome it may be easily relieved with a pair of blunt-pointed scissors.

ARCHING OF THE TONGUE.—In some patients, just as the mirror is being carried between the teeth, the posterior part of the tongue will arch upward, so as to touch the soft palate, and thus prevent the passage of the mirror into the fauces; or it will intercept the rays of light after the mirror is in position so that a view cannot be obtained.

This difficulty is best overcome by cautioning the patient not to strain, and by care not to draw the tongue far out of the mouth, or downward toward the chin.

Sometimes a good view of the larynx can be obtained in these instances by holding the throat mirror nearly horizontal against the palate, and reflecting the light upon it from below upward. In some cases, by giving the patient a hand mirror, so that he can watch the movements of the tongue, he will be able to keep its base depressed. Other patients will have to practice before a mirror at home for several days, before control of the tongue can be obtained. Tongue depressors seem indicated in these cases, but they are of little value.

ENLARGED TONSILS.—When the tonsils are greatly enlarged, they may prevent the introduction of any mirror into the throat, and in such cases the only remedy is excision. When these glands are only moderately enlarged it will sometimes be impossible to introduce the ordinary mirror without touching them both, and perhaps causing retching; but in many cases, if the mirror is carried promptly between and behind the tonsils, the throat will remain quiet, even though both sides have been touched. In other cases it is best to use an oval mirror, which may be passed into the fauces without touching the tonsils.

PENDENT EPIGLOTTIS.—A large or pendent epiglottis is sometimes an insurmountable obstacle to laryngoscopy. When the glosso-epiglottidean ligaments are relaxed, or when the epiglot-

tis is swollen, it falls downward, so that its free edge may rest against the pharyngeal wall, and thus leave little if any space for the passage of light. In some of these cases we can obtain a view of the larynx by causing the patient to utter a high falsetto note, or to laugh or cough. By this means the epiglottis is thrown upward with a sudden jerk. A vocal sound, as "ah" or "eh," made during inspiration, will have a similar effect. In other instances it is only necessary for the patient to draw a deep breath in order to raise the epiglottis sufficiently to give a view beneath it. Frequently by passing the mirror lower into the pharynx, and more perpendicularly than usual, the inferior surface of the epiglottis and other portions of the larynx may be seen.

Various instruments have been devised for lifting the epiglottis. The best of these is a stout whalebone or metallic rod, bent nearly to a right angle about an inch from the end, with its terminal extremity turned slightly backward. This instrument is known as Voltolini's staff. It may be passed behind the lip of the epiglottis, so as to lift and draw it forward.

When operations are to be performed, and occasionally for simple inspection, some special instrument may be necessary to catch the lip of the epiglottis and draw it forward. For this purpose Bruns' pincette is the most serviceable. However,

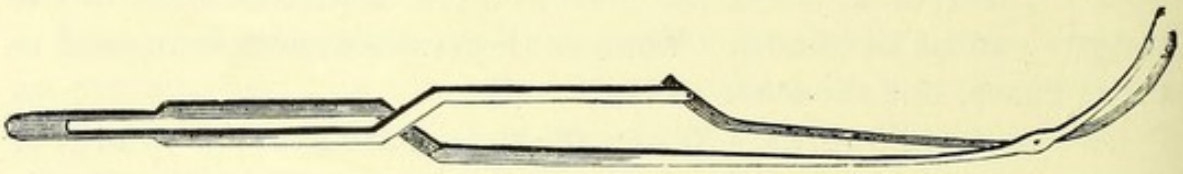


FIG. 60.—Bruns' pincette.

instruments of this kind usually cause so much irritation that they cannot be tolerated.

It occasionally happens that only the posterior part of the larynx can be seen, and the vocal cords cannot be brought into view. In such instances the movements of the arytenoid cartilages may be seen sufficiently to enable us to judge of the mobility of the cords; but the appearance of the tissue covering them cannot be taken as an accurate indication of the condition of the mucous membrane in other portions of the larynx.

After familiarizing yourselves with the laryngoscope and the rules for its use, before attempting laryngoscopy on a living

subject, you should practice for some time on a dummy, or on a larynx which has been removed from the body and attached to a standard. If these cannot be obtained, you may easily make a model by boring a couple of holes in a block of wood —one hole about two inches in diameter to represent the mouth, and the other about an inch in diameter, intersecting the first at an angle of eighty degrees, to represent the larynx. By practicing on any of these, you may familiarize yourselves with the management of the light, the reflector, and throat mirror, and you may educate your hands to steadiness.

Having learned to control your hands so that the mirror will not tremble, and to reflect the rays of light accurately to the point you wish to observe, you may begin to practice upon the living subject. At first, when possible, you should practice upon a patient who has been trained, so that your lack of skill will not induce retching; subsequently you must practice upon healthy individuals for some time, in order to become perfectly familiar with the appearance of the healthy larynx, so that any deviations from a physiological condition will be at once recognized.

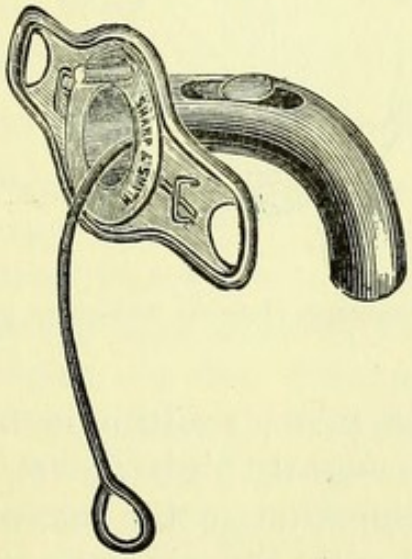


FIG 61.—Infra-glottic laryngoscopy. Small metallic mirror in position in the fenestra of the tracheal canula.

INFRA-GLOTTIC LARYNGOSCOPY.

It is sometimes desirable to inspect the larynx from below, which may be done, after tracheotomy, through a fenestra in the canula, by the aid of a small metallic mirror (Fig. 61).

RHINOSCOPY.

Rhinoscopy, or inspection of the vault of the pharynx and posterior nares, is practiced with similar instruments to those used in the inspection of the larynx, and in much the same manner, excepting that a smaller mirror is employed and its reflecting surface is turned upward instead of downward.

In rhinoscopy, the patient should sit erect, and the head must not be thrown backward, but may be slightly inclined forward.

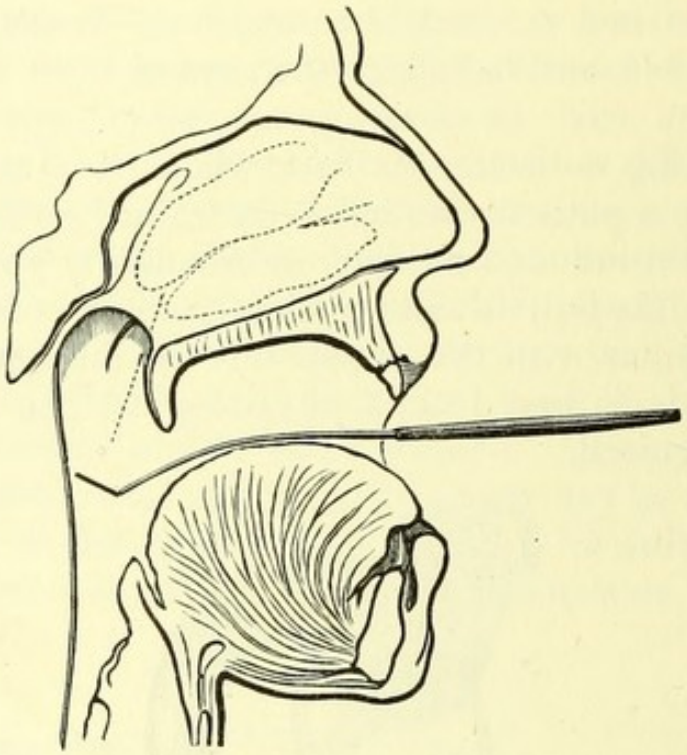


FIG. 62.—Position for rhinoscopy, showing also curve in stem of mirror. (Slightly altered from Browne.)

The physician should take a position in front, the same as for laryngoscopy, or on a slightly higher level, and the light should be placed as for inspection of the larynx, excepting that it should be on a level with the patient's mouth instead of his eyes. The patient's tongue should not be protruded, but must be left in the floor of the mouth where it will generally need to be held by a tongue depressor, though some patients can control it better without an instrument. The throat mirror in general use is a number one or number two laryngeal mirror, the stem of which is bent to conform it to the floor of the mouth (Fig. 62). It is to be warmed and introduced with the

same care as in laryngoscopy, with the reflecting surface upward. It should be carried back to the posterior pharyngeal wall, though it is better to avoid touching the latter. The surface of the mirror will then be at an angle of about thirty degrees to a horizontal plane. The stem may be rested on the dorsum of the tongue, but care must be taken not to touch the base of this organ. The handle should be depressed nearly to the lower incisor teeth (Fig. 62). A common caue of failure in this examination is holding the mirror handle too high.

The mirror should be introduced first on one side of the uvula and then on the other, to give a view of different parts. In some cases a larger mirror may be used if it is held completely below the uvula.

When the mirror is in position, if only the posterior wall of the pharynx is seen, in order to expose the posterior nares, the handle must be still farther depressed, or the mirror must be withdrawn and bent more nearly to a right angle with the stem. If at first only the uvula and posterior surface of the palate are exposed, the handle must be elevated to obtain a view of the posterior nares or vault of the pharynx. The mirror may be rotated slightly to obtain an image of the lateral walls of the pharynx, or of the orifices of the Eustachian tubes.

OBSTACLES TO RHINOSCOPY.

The principal difficulties which are met with in the examination of the posterior nares are, irritability of the tongue, which causes the patient to retch whenever an attempt is made to depress it with the spatula; an elongated or sensitive uvula; irritablity of the fauces; or too close approximation of the uvula and palate to the posterior pharyngeal wall.

IRRITABILITY OF THE TONGUE.—This condition will sometimes prevent the use of a tongue depressor, but this instrument may generally be employed if the physician is careful not to allow it to slip too far back on the base of the organ. In many cases it is not necessary to depress the tongue with any instrument, if patients are instructed to allow it to remain passive in the floor of the mouth. A hand mirror, in which the patient can see his tongue, will sometimes aid him materially in controlling it. In other cases the tongue may be held as in laryngoscopy.

Some one of these methods will nearly always overcome this difficulty; but if they should all fail, the patient must practice at home before a mirror until a spatula can be tolerated, or until the tongue can be held without one.

Instruments have been constructed which combine a tongue depressor and the throat mirror; but they are not necessary, for, whenever the physician desires to use both hands, the care of the spatula may be intrusted to the patient. Instruments of this kind are objectionable, as the depressor necessarily greatly restricts the movements of the mirror.

ELONGATED UVULA.—When the palate and uvula are so relaxed as to become an obstacle to the use of the rhinoscopic mirror, they may be contracted by astringents. If the uvula is too long to be managed in this manner, it should be excised.

Various instruments have been devised for raising the uvula and drawing it forward, but they are of very little service as they usually cause so much irritation that they cannot be borne.

IRRITABILITY OF THE FAUCES.—This condition can be overcome in many instances by allowing the patient to suck bits of ice for ten or fifteen minutes. In other cases prolonged practice in holding the tongue and in touching the palate and pharyngeal wall with a spoon handle must be resorted to by the patient at home.

CLOSURE OF THE POST-PALATINE SPACE, by contraction of the palatine muscles, often occurs the moment a patient opens his mouth, and it sometimes continues in spite of our best directed efforts to overcome it. This is the most common difficulty with which we have to contend in illuminating the vault of the pharynx and the posterior nares.

Sometimes this difficulty may be overcome by cautioning the patient to allow the fauces to remain passive when the mouth is opened, or, by directing him to simply open the mouth wide without attempting to show the throat. Then, by introducing the mirror carefully so as not to touch any part of the fauces, and withdrawing it and re-introducing it several times if necessary without attempting to obtain a view behind the palate, the patient's confidence may be secured and the examination completed.

If the patient can be taught to breathe quietly through the

nose during the examination the palate will hang loosely so as to cause no trouble.

Sometimes a view may be secured by directing the patient to sound the letters "n" or "ng." Frequently a glimpse may be had if the patient will attempt to expire through the nose.

Various palate or uvula hooks have been constructed for the purpose of overcoming the difficulty; but, as has been well stated, the time spent in teaching the patient to tolerate them is usually more than is necessary to educate the throat to maintain a position which will require no instrument. Time, patience, and frequent practice by the patient at home, must be the main dependence for successful examination in these cases.

When operations are to be performed, the palate may be drawn forward by a thread passed through the uvula, or by tapes passed through the nares by means of a Bellocq's canula and brought out of the mouth and tied. Or it may be done by means of a broad, strong uvula hook or palate elevator. The palate elevator ordinarily sold (Fig. 63) is only two eighths or three eighths of an inch in width, and is therefore too small for this purpose. Combinations of mirrors and uvula holders

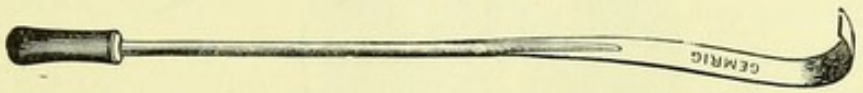


FIG. 63.—Palate elevator.

have been constructed, but they do not give general satisfaction.

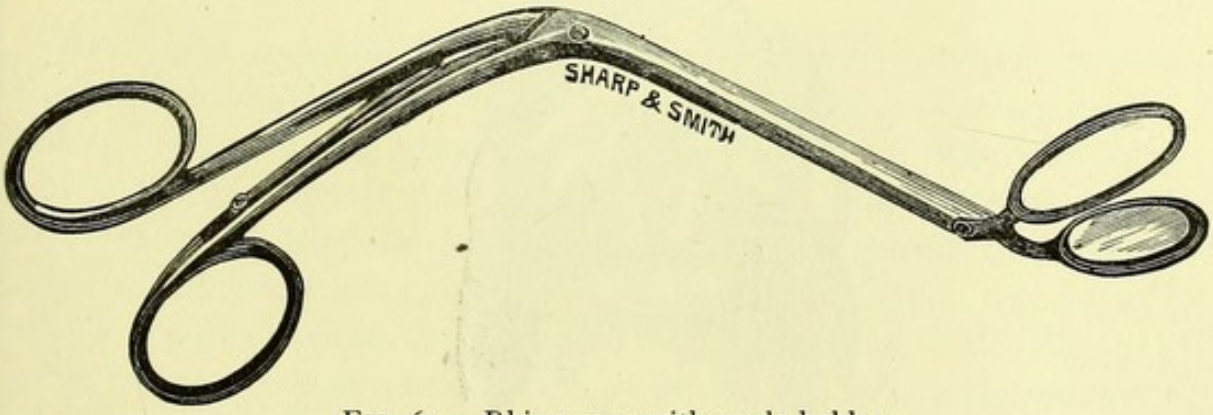


FIG. 64.—Rhinoscope with uvula holder.

LECTURE XXVI.

THE NORMAL LARYNX AND POST-NASAL SPACE.

LARYNX.

The image of the larynx, as seen in the throat mirror, is inverted, so that the anterior portion, which is nearest the observer, appears in the glass above and farthest from its surface, and the posterior portion appears below and close to the mirror. The sides of the larynx are not reversed in the image; what appears to the physician's right, and the patient's left, is, in reality, the left side of the larynx; and the right side appears in its normal relation.

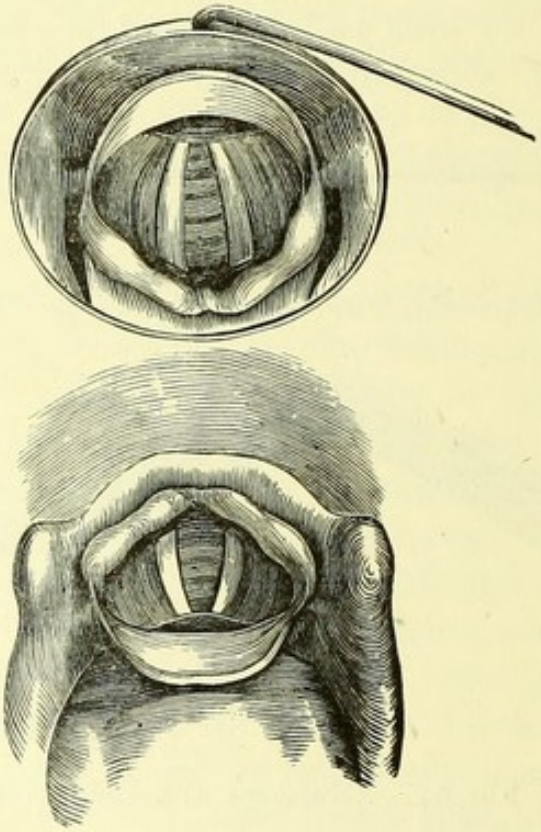


FIG. 65.—Relative relations of larynx and its image in the laryngoscopic mirror (Cohen).

An image of the whole larynx can seldom be obtained at a single glance; but by slight rotation of the mirror, with eleva-

tion and depression of the handle, so as to alter the plane of the reflecting surface, the different parts may be brought into view. The vocal cords, because of their bright appearance and frequent respiratory movements, usually attract the most attention, and when once seen can never be forgotten; but the epiglottis comes first into view.

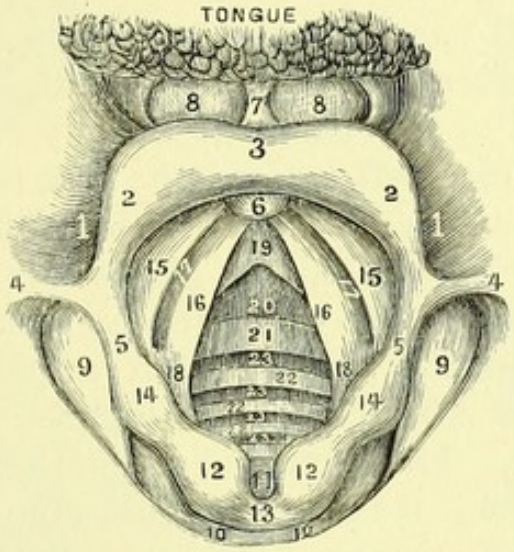


FIG. 66.—Normal larynx in respiration, enlarged. Parts exaggerated to render them more conspicuous. 1, lingual surface of epiglottis; 2, laryngeal surface of epiglottis; 3, indented crest of epiglottis; 4, pharyngo-epiglottic fold; 5, ary-epiglottic fold; 6, cushion of epiglottis; 7, glosso-epiglottic ligament; 8, valeculæ; 9, pyriform sinus; 10, posterior pharyngeal wall and entrance into œsophagus; 11, inter-arytenoid incisure; 12, cartilage of Santorini; 13, inter-arytenoid fold; 14, cartilage of Wrisberg; 15, ventricular band; 16, vocal cord; 17, ventricle; 18, posterior vocal process; 19, thyroid cartilage; 20, crico-thyroid membrane; 21, cricoid cartilage; 22, rings of trachea; 23, insterspaces between rings of trachea (Cohen).

EPIGLOTTIS.—The epiglottis is a leaf-like valve, which covers the superior opening of the larynx and closes it during deglutition. This varies greatly in size and form in different individuals (Figs. 67 to 72). It may be long and thin, or short and thick; it may be broad, or narrow and pointed; its free edge may be curved like a bow, it may be folded in upon itself like a scroll in what is known as the Jewsharp form (Fig. 71), or it may be asymmetric. It may cover the whole larynx, or it may be nearly invisible. Sometimes only the upper or anterior surface of the epiglottis can be seen, at other times its lower portion or laryngeal surface is most visible; again, only its tip is brought into view, and still again considerable portions of both the anterior and the posterior surfaces may be seen at tne same time.

With respiration, the lip of the epiglottis rises and falls slightly. With phonation it is generally thrown upward, and in deglutition it is carried downward to the posterior border of the larynx.

The base of the epiglottis—but in reality the apex of the cartilage—is connected with the thyroid cartilage at its receding angle by a long narrow band, known as the thyro-epiglottic ligament; a small band, the hyo-epiglottic ligament, connects it with the posterior surface of the hyoid bone. The lingual or upper surface of this cartilage usually curves forward, its concavity being directed toward the base of the tongue. Its covering of mucous membrane forms a median and two lateral folds, which are known as the glosso-epiglottic folds. The central one of these is also called the frænum of the epiglottis, or the glosso-epiglottic ligament as it contains a ligamentous band. The lateral folds contain no ligamentous tissue and are frequently absent. The laryngeal or inferior surface curves in a reverse direction. It is convex from above downward, and concave from side to side. To its sides are attached the pharyngo-epiglottic and the ary-epiglottic folds.

The whole epiglottis is seldom visible even to a skilful laryngologist. Usually a portion of its upper surface is visible on each side. In the middle, its laryngeal surface is turned upward like a lip, and below this a small prominence may frequently be seen near the base of the epiglottis, which is known as its cushion, pad, or protuberance (Fig. 69).

In order to obtain a good view of the laryngeal surface of the epiglottis, the patient should be directed to sound a high note quickly and with considerable force. This throws the cartilage upward with a sudden jerk. An inspiration accompanied with sound or an ironical laugh will answer the same purpose.

The color of this organ varies in different parts. The upper surface is of a pinkish hue, and frequently blood-vessels may be seen crossing it. The lip looks like a yellow cartilage, as it really is, covered with mucous membrane. The cushion generally appears of a much brighter red color than other portions of the epiglottis. When the whole of the laryngeal surface can be seen, it often has a uniform bright-red color, which might be easily mistaken for congestion. When only the edge

of the epiglottis is visible, it appears like a pale whitish line just beneath the base of the tongue.

THE VALECULÆ.—Upon either side of the frænum, between

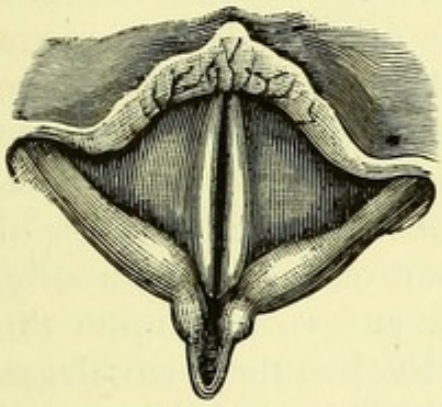


FIG 67.

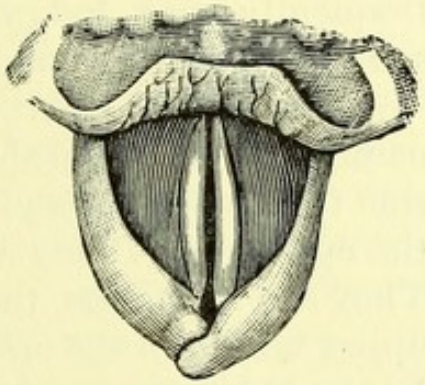


FIG. 68.

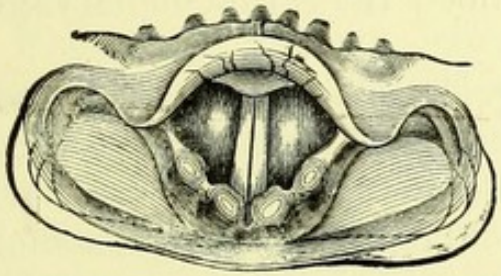


FIG. 69.

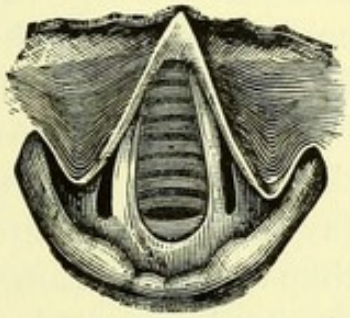


FIG. 70.

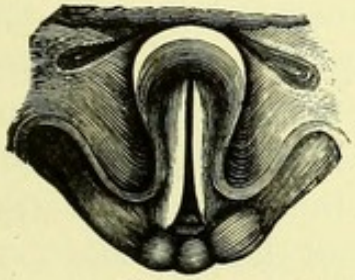


FIG. 71.

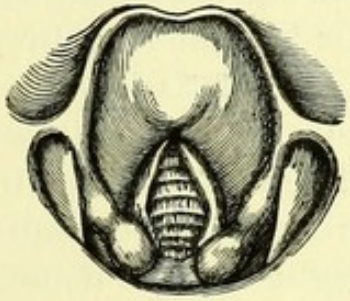


FIG. 72.

FIGS. 67 to 72.—Normal larynx, showing various forms of epiglottis and supra-arytenoid cartilages.

FIG 67.—Pitcher-shaped inter-arytenoid fold. Phonation.

FIG. 68.—Lapping of arytenoid cartilages in phonation, with gaping of vocal cords.

FIG. 69.—Cushion of epiglottis visible; no gaping of vocal cords in phonation.

FIG 70.—Pointed epiglottis. Ventricles distinct. Inspiration.

FIG. 71.—"Jewsharp" or omega-like epiglottis.

FIG. 72.—Female larynx in respiration (Cohen).

The female larynx may have the form shown in any of the preceding figures.

the epiglottis and the base of the tongue, are seen two sinuses closely resembling depressions, which might be caused by pressing the tips of two fingers into some soft substance; these

are known as the lingual sinuses, or the valeculæ (Fig. 66, page 291). They vary greatly in depth and in width in different individuals, and in various positions of the epiglottis in the same individual. These sinuses should always be examined, as they frequently give lodgment to portions of food which are a source of irritation, and they are sometimes the seat of ulcers.

ARYTENOID CARTILAGES. — The arytenoid cartilages — so named on account of their apparent resemblance during phonation to the nose of a pitcher—appear beneath the free edge of the epiglottis. They are two in number, one upon each side. They are located at the back of the larynx, resting upon the upper border of the cricoid cartilage. Each of these cartilages is somewhat pyramidal. The apex, which is slightly pointed and curved upward and inward, is surmounted by a small conical nodule, which has been named the caruncula laryngis, or cartilage of Santorini.

To expose the anterior or laryngeal surface of the arytenoids, the head should be thrown slightly backward during a deep inspiration, and the light should be directed more posteriorly than in illuminating the cords, by holding the throat mirror more nearly horizontal. To expose their posterior or pharyngeal surface, the head should be nearly erect, and the mirror should be held as just directed while the voice is sounded.

CARTILAGES OF SANTORINI.—The cartilages of Santorini are most prominent when the glottis is closed, as in phonation. The mucous membrane immediately covering their apices is of a lighter hue than that in other parts of the larynx, but the light color is usually surrounded by a zone of deeper red.

CARTILAGES OF WRISBERG.—Just external to the cartilage of Santorini, in the fold of mucous membrane which extends on either side to the edge of the epiglottis, is a prominence known as the cuneiform cartilage, or cartilage of Wrisberg.

These cartilages vary considerably in form in different individuals. They are usually round, but they are occasionally triangular, the apices being directed downward. Sometimes they are hardly visible, but they are generally quite distinct and fully as large as the cartilages of Santorini. These, like the corniculæ, are of a lighter color than the folds which contain them, but they are usually surrounded by a zone of mucous membrane redder than that of the general surface.

In a few instances a small nodule, due to a third cartilage, is seen between the cartilages of Wrisberg and the cartilages of Santorini on either side. The cartilages of Wrisberg and those of Santorini are sometimes termed the supra-arytenoid cartilages.

ARYTENO-EPIGLOTTIDEAN FOLDS.—The aryteno-epiglottidean or the ary-epiglottic folds constitute the lateral and part of the posterior border of the superior opening of the larynx. They consist of folds of mucous membrane, one on either side, which extend like bows from the arytenoid cartilages upward and forward to the sides of the epiglottis. They are usually quite thick, but are occasionally thin and sharp. In color they closely resemble the gums, and are somewhat lighter than the zones about the bases of the supra-arytenoid cartilages.

PYRAMIDAL SINUSES.—External to these folds, and between them and the wings of the thyroid cartilage, are found the pyramidal, pyriform, or laryngo-pharyngeal sinuses. The broad end of each sinus is directed forward, and its apex backward. It is bounded internally by the quadrangular membrane, the upper border of which is formed by the ary-epiglottic fold; anteriorly by the wing of the thyroid cartilage; and laterally by the wall of the pharynx. Like the valeculæ, these sinuses often give lodgment to foreign bodies, and they are frequently the seat of ulcerations.

VENTRICULAR BANDS, known also as the superior or false vocal cords, the regulators of the glottis, or the superior ligaments of the larynx. These are thick folds of mucous membrane which stretch across the larynx in an antero-posterior direction, about half an inch below its superior opening and a short distance above the true vocal cords. They are frequently very prominent, standing out in thick welts from the sides of the larynx. In other instances, they can hardly be distinguished from the surrounding tissues. They are of a deeper red color than the tissues above them, but their inferior or inner borders generally appear pale in the laryngoscopic image, on account of being illuminated more perfectly than the surrounding parts. Just beneath the anterior ends of the false vocal cords and above the true cords may frequently be seen a fossa, about the size of a pin's head, which has been named by Mackenzie, the

fossa innominata. This communicates with the laryngeal sinuses upon either side.

VENTRICLES OF THE LARYNX.—Immediately beneath the ventricular bands are found the ventricles of the larynx. These consist on either side of an oblong fossa, which is the opening to a *cul-de-sac* of mucous membrane, known as the sacculus laryngis. They are bounded above by the false vocal cords; below, by the true vocal cords; and externally, by the thyro-arytenoid muscles.

To examine either side, the mirror should be placed partly upon the opposite side of the fauces with its obliquity changed, so as to illuminate the parts to be inspected.

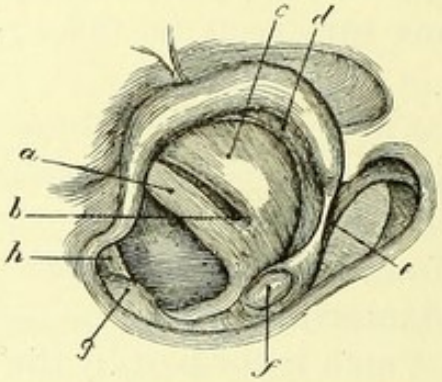


FIG 73.—View of left side of larynx (Türck). *a*, left vocal cord; *b*, posterior portion of left ventricle; *c*, left ventricular band; *d*, posterior surface of epiglottis; *e*, border of ary-epiglottic fold; *f*, left cartilage of Wrisberg; *g*, right cartilage of Wrisberg; *h*, right vocal cord.

The ventricles are seldom seen, and when visible, they usually appear merely as dark lines; but occasionally they are patulous, with a width of nearly one eighth of an inch.

SACCULUS LARYNGIS.—The sacculus laryngis extends upward and outward in a conical form beneath the ventricular band. The mucous membrane lining it is studded with the openings of sixty or seventy follicular glands, the secretion from which is apparently intended for lubricating the vocal cords. This pouch is covered by a fibrous membrane and this membrane by muscular tissue, which, according to Hilton, compresses the sacculus and discharges its secretion upon the vocal cords.

VOCAL CORDS AND GLOTTIS.—The vocal cords, known also as the inferior or true vocal cords, are the most important objects to be seen on inspection of the larynx. They appear as

two pearly white bands stretched along either side of the larynx from its anterior to its posterior part. During respiration they alternately approach each other and recede, leaving between them a triangular opening for the passage of air. The cords and the space between them form what is known as the glottis. The free edges of the cords constitute the lips of the glottis, and the chink or fissure between them is called the rima glottidis. The front of the rima is formed by the anterior commissure of the vocal cords, its sides by the cords themselves, and its base by the arytenoid cartilages, and the inter-arytenoid fold. In the adult this fissure varies in length; from seven to ten lines in females, and from ten to thirteen in males. At its widest part it ordinarily measures from three to six lines, but in deep inspiration it may measure as much as eight or ten lines. In children, it is, of course, much smaller.

The vocal cords in the adult vary from five eighths of an inch to one inch in length. They are usually about one eighth of an inch in breadth. They are of a bright white color, sometimes perfectly white in females; but in males they are usually of a yellowish-white hue. They consist of fibrous bands covered by a thin layer of closely adherent mucous membrane. They are attached anteriorly to a depression between the alæ of the thyroid cartilage, posteriorly to the anterior angles at the base of the arytenoid cartilages.



FIG. 74.—Normal larynx of female in formation of head tones (Cohen).

On inspiration the cords separate widely at their posterior extremities; but their anterior extremities remain close together, thus forming a triangular opening. In expiration they approach more nearly together, and in phonation their two borders are more or less closely approximated, but they usually gape slightly throughout their entire length. In females, and

occasionally in males, during the production of head-tones, the vocal processes are pressed firmly together, so that the fissure is left only between the anterior parts of the cords.

PROCESSUS VOCALES.—The vocal processes are sometimes seen as four yellowish spots, two anteriorly and two posteriorly, where the vocal cords are attached to the cartilages, but the anterior processes are not often visible. Usually when we speak of the vocal processes we refer simply to the anterior angles of the arytenoid cartilage.

Dr. Seiler has described narrow fusiform cartilages, which are found along the edge of the vocal cords in females. These cartilages are only rudimentary in males.

INTER-ARYTENOID FOLD.—The inter-arytenoid fold or posterior commissure is a band of mucous membrane which extends between the arytenoid cartilages. The prominence of this fold depends upon the position of the cartilages. When the glottis is open it may measure three or four lines in length, but when the cords are approximated to each other it is folded upon itself so that it can hardly be seen.

CRICOID CARTILAGE.—The cricoid cartilage may usually be seen a short distance below the vocal cords, separated from their anterior extremities by the lower portion of the thyroid cartilage and by the crico-thyroid membrane. This cartilage is of a lighter hue than the membranous tissue above or below it, and is similar in color to the rings of the trachea.

TRACHEAL CARTILAGES.—The rings of the trachea are usually seen arching across this tube from side to side with their concavities directed inward and downward. The upper of these rings are very distinct and of a yellowish or a light-pinkish hue. They are separated from each other by the intervening membranous tissue, which is of a darker color.

As we carry the inspection farther down the trachea, the cartilages appear narrower and narrower until their outlines are finally lost.

The mucous membrane lining the trachea is generally paler than that covering the surface of the larynx.

In order to obtain a good view of the trachea, it is usually necessary to hold the mirror more nearly horizontal than in the examination of the larynx, so as to reflect the light somewhat more posteriorly. The glottis must be widely opened, and the

focal point of the light must fall upon the parts to be examined, that is at a distance of from seven to eleven inches within the lips, or from twelve to seventeen inches from the reflector, according to the portion of the tube to be examined. Sometimes we can obtain a good view by elevating the patient to a plane above that of the observer and holding the throat mirror almost horizontal, so that the light may be thrown upon it from below upward.

To expose the posterior wall of the larynx and the trachea, the patient's head should be kept erect, and the mirror must be held in a nearly horizontal position.

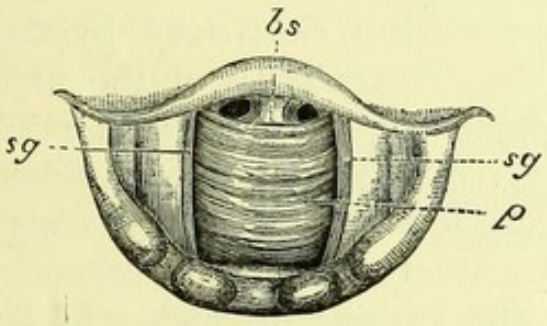


FIG. 75.—View of posterior wall of the trachea and bronchi. *b s*, bifurcation of trachea; *s g*, sub-glottic region; *p*, posterior wall of trachea. (Mackenzie.)

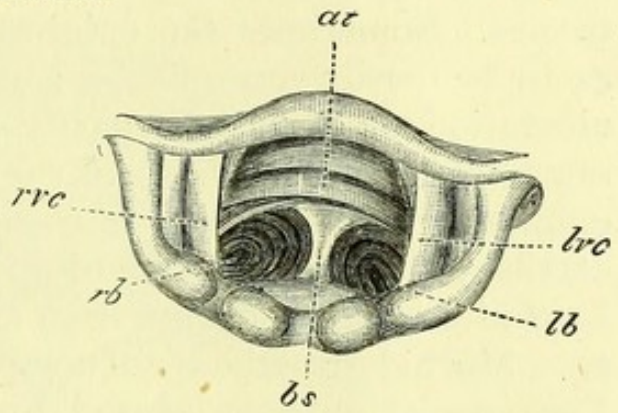


FIG. 76.—View of anterior wall of trachea and bronchi. *a t*, anterior wall of trachea; *r v c* and *l v c*, vocal cords; *r b*, right bronchus; *l b*, left bronchus; *b s*, bifurcation or bronchial spur. (Mackenzie.)

THE MAIN BRONCHI.—With a good light and a favorable condition of the larynx and trachea, the openings of the main bronchi can frequently be seen, and in some instances a few of their cartilaginous rings may be counted. To illuminate the bifurcation of the trachea, a good plan is first to obtain a view of the laryngeal surface of the epiglottis, and then, by gradually changing the obliquity of the mirror, direct the rays farther and farther downward along the anterior surface of the trachea until the deeper parts are brought into view.

This constitutes a description of a typical larynx, but considerable variety in the shape and movements of different parts of this organ may occur within the limits of health. This is especially the case with the epiglottis; but variations in the appearance of the arytenoid cartilages and of the commissures, and slight alterations in other parts of the larynx may occa-

sionally be found, as illustrated in Figs. 67–72 (page 293). The epiglottis may possess any of the various forms already spoken of. The super-arytenoid cartilages vary considerably in their size and form, as already mentioned. The position of the arytenoids varies constantly with respiration and phonation, and may be quite different in healthy individuals (Figs. 67–72, page 293)

In disease of the larynx, changes in its form and movements constitute the principal signs. There may be hypertrophy or swelling of its various parts, with more or less loss of movement, or ulceration may have destroyed more or less of the tissues. Sometimes the epiglottis is so swollen and wrinkled as to be hardly recognizable; its free edge may be injured by ulceration, or it may be partly or entirely destroyed by the same process. Swelling of the inner extremity of the ary-epiglottic folds and of the tissues surrounding the arytenoid cartilages is frequently found upon one side or upon both sides. Loss of movement occurs from cicatricial adhesions or paralysis. Morbid growths are of comparatively frequent occurrence. The special changes caused by the various diseases will be mentioned in a subsequent lecture.

THE VAULT OF THE PHARYNX AND NASAL CAVITIES IN HEALTH.

On account of the small size of the mirror, which we are generally obliged to use, and the limited space through which the rays of light can be reflected, it is impossible to obtain a complete image of this region in any single position of the mirror, but by slowly turning it from side to side, elevating or depressing the handle, and introducing the mirror first on one side of the uvula and then the other, part after part can be brought into view. We must discipline ourselves to combine mentally in one whole the partial views we are compelled to take in examining such small areas at each view. Very few students, or even physicians, are familiar with the appearance of the post-nasal space.

The natural condition of these parts should be thoroughly studied from diagrams or models, before an attempt is made to inspect them in the living subject, and the student should

make himself perfectly familiar with the descriptions of different parts. When the mirror is first carried into the throat, we usually see in it the image of the upper surface of the palate, or of the posterior surface of the uvula, or of the posterior wall of the pharynx. If either of the first two is brought into view, we then elevate the handle of the mirror, or if the last is seen we depress it, and thus bring into the field of vision the parts just above the soft palate. We then search for the septum narium, which is to be taken as a starting point for further inspection, as the vocal cords are taken as land-marks in laryngoscopy.

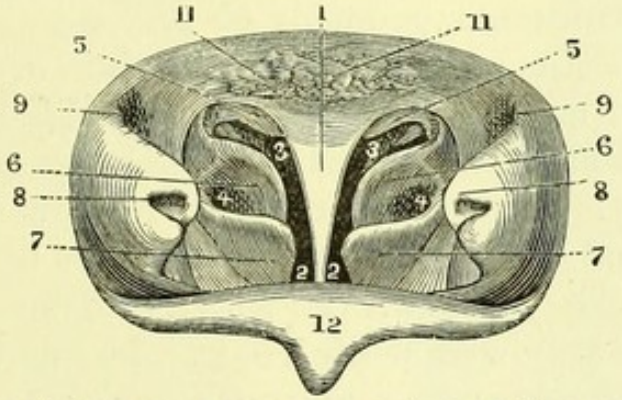


FIG. 77.—Rhinoscopic image. 1, vomer or septum; 2, free space of nasal passages; 3, superior meatus; 4, middle meatus; 5, superior turbinated bone; 6, middle turbinated bone; 7, inferior turbinated bone; 8, pharyngeal orifice of Eustachian tube; 9, upper portion of fossa of Rosenmueller; 11, glandular tissue at the anterior portion of the vault of the pharynx; 12, posterior surface of velum palati. (Cohen.)

Having found the septum, we trace it throughout its entire length from the narrow lower extremity, where it joins the palate, to its upper broad base which arches outward on either side at the top of the posterior nares. On either side of the septum the irregular outer border of the posterior opening of the nasal cavity should be traced from above downward past the projecting turbinated bones to the orifice of the Eustachian tube, and finally to the palate and lateral walls of the pharynx. The middle turbinated bone is the most prominent object on the outer border of the nasal opening; but it seems overlapped at its lower part by the inferior turbinated bone.

External to the *middle* turbinated bone, and just above that portion of the *inferior* turbinated bone which seems to overlap it, is a dark space known as the middle meatus; and slightly external to the latter is the orifice of the Eustachian tube.

Some physicians, instead of following this course in their

inspection, prefer to start from the Eustachian tube, but this is merely a matter of habit.

THE SEPTUM NARIUM divides the rhinoscopic view into halves. It forms a narrow, shining column below, near the palate, which gradually increases in breadth toward its upper part. At the lower part it appears of a pinkish, yellowish, or whitish color, according to the brilliancy of the illumination; but toward the upper part or base the color deepens to a red like that of the surrounding mucous membrane.* The sides of the septum, a considerable portion of which may be seen, are usually of a drab or ashy-red color, slightly darker in hue than the posterior edge, probably on account of being less perfectly lighted. The septum seldom occupies exactly the centre of the posterior nares, but inclines slightly to one side.

MIDDLE TURBINATED BONES.—These bones are easily found, as they are the most prominent objects in view on the external wall of the nasal cavity, of which they seem to constitute the greater part. They are covered with a thin mucous membrane of a pinkish or yellowish-white color. The middle turbinated bone sometimes resembles a mucous polypus, for which it may be mistaken by the student.

INFERIOR TURBINATED BONES.—These lie just below the preceding. They are considerably smaller than the middle turbinated bones, and do not approach so near the septum. They are of a darker color, probably from deficient illumination. Not infrequently they have the appearance of solid tumors.

THE EUSTACHIAN ORIFICE.—The Eustachian orifice on either side is found a little external and posterior to the inferior turbinated bone, usually on a level with the middle meatus, but sometimes slightly above or below it.

This opening has an irregularly triangular or crescentic shape. It usually measures about a quarter of an inch in its longest diameter, but it is sometimes large enough to admit the tip of the little finger. The opening looks downward, inward, and slightly forward; it is bounded by two more or less prominent projections called the anterior and posterior walls or lips of the

* The color of the parts, as here described, is that observed by means of artificial light. Natural light gives a paler color.

orifice; which are covered with a light-red or yellowish mucous membrane. The former consists mainly of the fibres of the levator palati muscle, and the latter of the cartilaginous extremity of the Eustachian tube. From the posterior or lower lip a prominent ridge, which is formed by the levator palati muscle, runs downward and inward to the soft palate. From the anterior or upper lip a dark groove runs upward and out-

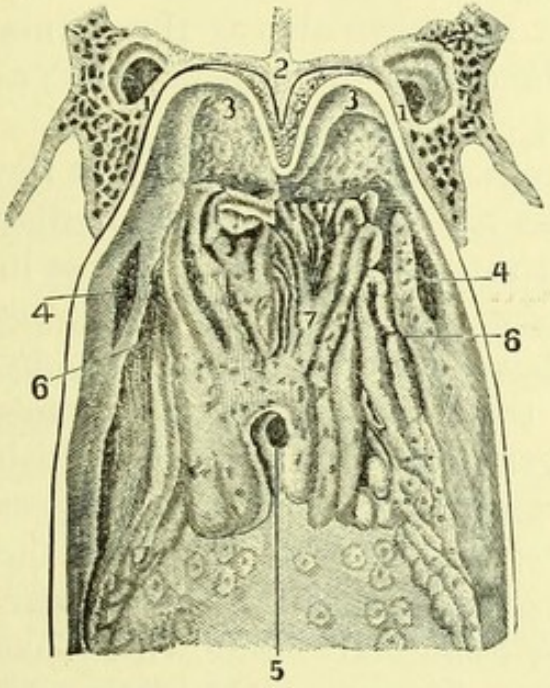


FIG. 78.—Adenoid tissue at vault of pharynx. Posterior wall of upper part of pharynx (Luschka). 1–1, pterygoid process; 2, section of vomer; 3-3, posterior portion of the vault of the nasal fossæ; 4–4, pharyngeal orifice of the Eustachian tube; 5, orifice of the bursa pharyngea; 6-6, recessus pharyngeus (fossa of Rosenmueller); 7, median folds formed by the adenoid substance of the nasal portion of the pharynx.

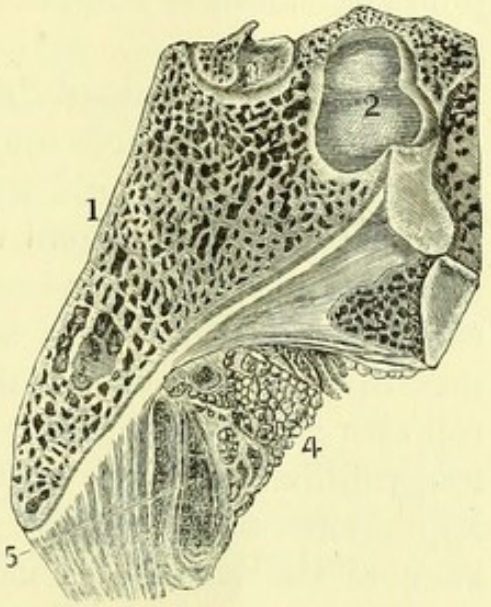


FIG. 79.—Pharyngeal bursa. Anteroposterior section (Luschka). 1, section of basilar process of the occipital bone; 2, body of sphenoid; 3, pituitary gland; 4, adenoid substance of the vault of the pharynx, behind which is seen, 5, the pharyngeal bursa.

N.B.—The line from 5 has accidentally been continued in the cut beyond the bursa.

ward toward the vault and the posterior walls of the pharynx. This groove is known as the FOSSA OF ROSENMUELLER or the RECESSUS PHARYNGEI.

THE SUPERIOR TURBINATED BONES are located at the upper part of the nasal fossæ and cannot be distinctly seen. They have the appearance of narrow triangular projections, the apices of which point downward and inward. Their color is dark-red, like that of the base of the septum.

SUPERIOR, MIDDLE, AND INFERIOR MEATUS.—These are the spaces found between the turbinated bones and the external wall of the nasal cavity. The superior one of these, which is the largest, appears as a large shadow at the upper part of the fossa, just below the superior turbinated bone. The middle meatus is seen as a dark opening near the middle part of the fossa external to the middle turbinated bone. The inferior meatus, if seen at all, generally appears simply as a dark line.

THE VAULT OF THE PHARYNX is known also as the fornix pharyngis, and is sometimes spoken of as the tonsilla pharyngeus.

This is that portion of the pharyngeal wall which begins at the posterior nasal orifices and extends backward along the basilar process of the occipital bone, and then downward to be lost in the posterior pharyngeal wall.

In the perspective view which we obtain of this part by rhinoscopy, it appears shorter than natural. The mucous membrane is of a light-red color, studded with minute whitish follicles and broken on its surfaces into irregular, more or less longitudinal fissures and ridges, which give it much the appearance of the surface of the palatine tonsil. This appearance of the surface is caused by glandular tissue which has received the name of TONSILLA PHARYNGEUS. Near the middle, at the lower part of this glandular tissue is an opening about the size of a pin's head, which leads up into a small *cul-de-sac*, known as the BURSA PHARYNGEUS. The posterior surface of the uvula, palate, and pillars of the fauces may be seen below the nasal fossa. The palate appears in the rhinoscopic image as a fleshy ledge running at right angles with the septum.

LECTURE XXVII.

DIAGNOSIS AND TREATMENT OF DISEASES OF THE FAUCES.

ACUTE SORE THROAT.

Synonyms.—Erythematous or catarrhal sore throat; Catarrhal tonsillitis; Cynanche pharyngea; Angina erythematosa; and Pharyngitis catarrhalis.

This is a simple inflammation of the mucous membrane of the palate, tonsils, or pharynx, or of all of these combined. It usually terminates in resolution; but repeated attacks lead to chronic pharyngitis.

SYMPTOMS.

This affection is attended with slight or considerable fever, dryness, and itching or pain of the throat. This pain is often acute and stinging, and radiates toward the ear, especially during the act of swallowing.

There is a tendency to hawk or hem, but cough is not likely to be present unless the uvula is elongated. Usually there is some difficulty in articulation, and the voice has a nasal sound. Hoarseness does not appear until late in the disease, when the larynx has become implicated.

SIGNS.

Hyperæmia of the mucous membranes is found, ranging from a bright-pink to a livid hue; and diffused over the entire throat or limited to patches. In severer cases, there is moderate swelling of the parts affected. The uvula is often swollen and elongated, and sometimes the mucous membrane of the pharynx, on account of its relaxed condition, lies in thick folds.

DIAGNOSIS.

The affection might possibly be mistaken for tonsillitis, but it is readily distinguished from the latter, after a few hours, by absence of any considerable amount of swelling.

TREATMENT.

The attack may often be aborted by the same means employed for this purpose in acute or subacute laryngitis or bronchitis (page 105). Six or eight drops of the tincture of opium, taken in the morning for its stimulant effect, may produce a similar result. Troches of opium will give great relief, and may cut short the disease (Form. 2). Astringent troches (Form. 25–27), and chlorate of potassium are often beneficial. A cloth wet in cold water and bound about the neck on going to bed will frequently cure the affection.

PHLEGMONOUS SORE THROAT.

Synonyms.—Suppurative pharyngitis; Acute tonsillitis; Amygdalitis; Quinsy; Angina tonsillaris, and Angina phlegmonosa.

This is a severer form of inflammation than simple sore throat, and is characterized by inflammation, not only of the mucous membrane, but also of the submucous tissues of the palate, base of the tongue, tonsils, epiglottis, and sometimes the fibrous sheaths of the muscles. As a result, the tissues become infiltrated with serum, and finally a circumscribed or diffused abscess occurs.

SYMPTOMS.

The affection usually begins with a rigor, which is followed after a few hours by marked fever, pain, dryness, a persistent sense of constriction in the throat and painful deglutition.

SIGNS.

All the structures of the throat, but especially the tonsils, are congested, swollen, and sensitive. The tonsils may be so swollen as to reach the median line. If both are involved there may be danger of suffocation.

DIAGNOSIS.

The physical appearances and the acute character of the attack, and the absence of certain other diseases, as, for example, scarlatina, will render the diagnosis easy.

TREATMENT.

Locally.—Early in the attack it may sometimes be cut short

by brushing the parts with a strong solution of nitrate of silver, grs. xl. or lx. to the ounce of distilled water. Inhalation of steam from water alone, or impregnated with such sedatives as watery extract of opium or of belladonna, lupuline, and compound tincture of benzoin (Form. 35–40) will often afford relief. Warm cataplasms are also useful. Scarification of the parts is often followed by good results.

When pus forms it should be evacuated at once.

Internally.—Early we get good results from the use of small and repeated doses of aconite. Later, saline laxatives should be given to keep the bowels soluble. These may be supplemented with quinine, gr. ii., and chlorate of potassium, gr. v. or x., every three hours, with anodynes when necessary.

ERYSIPELATOUS SORE THROAT.

This is a comparatively rare affection. When it does occur it is usually associated with facial erysipelas.

SYMPTOMS.

The principal symptoms are stinging pain, heat and dryness of the throat; high fever, and usually nausea and pain in the epigastrium. Dyspnœa and more or less difficulty in swallowing are usually present. If there be much œdema, there may also be regurgitation of fluid through the nose, accompanied by choking.

SIGNS.

By inspection we observe diffused dusky or purplish redness of the throat; which sometimes has a dry shining appearance. Occasionally vesicles are seen, and ordinarily there is moderate swelling.

DIAGNOSIS.

This must rest mainly on the presence of external erysipelas.

TREATMENT.

The remedies to be employed are essentially the same as for erysipelas of the skin. Quinine and tincture of iron are generally recommended. If gangrene occurs, gargles of chlorate or permanganate of potassium or of carbolic acid should be employed. If œdema of the glottis takes place, scarification and, in some cases, tracheotomy should be practiced.

RHEUMATIC SORE THROAT.

This is a form of acute sore throat, occurring in persons of a rheumatic diathesis, which is attended with severe local and constitutional symptoms.

These are: high temperature, rapid pulse, and aching pains in the neck, back, and limbs.

The local affection may pass off with rheumatic affection of the muscles, or it may be followed by articular rheumatism.

DIAGNOSIS.

The physical appearances are not different from those of simple catarrhal sore throat; therefore the diagnosis must rest upon a history of previous similar attacks, the severe symptoms, and the supervention of rheumatic pains in the muscles or joints.

TREATMENT.

Internally.—We may employ salicylic acid, grains x., every hour until sweating occurs, and subsequently less frequently, for twenty-four or thirty-six hours. Guaiacum in full doses is more effectual in other cases.

The common alkalies or iodide of potassium should be given later, and in some cases they answer well from the first. *Locally* sedative applications and guaiac lozenges are indicated (Form. 30).

SIMPLE MEMBRANOUS SORE THROAT.

Synonyms.—Herpetic sore throat; Aphthous sore throat; Angina membranacea; Herpes pharyngis; Herpes gutteralis.

This form of sore throat ordinarily results from exposure to cold, and is characterized by the formation of small blisters or herpetic patches, the exudation from which soon forms a sort of false membrane, similar to that which often covers herpetic eruptions on the lips.

SYMPTOMS.

The affection is usually ushered in with a chill, followed by more or less fever, and dryness, smarting, and pain in the throat.

The symptoms usually increase in severity for a short time, and high fever may supervene.

SIGNS.

The affection usually involves one tonsil only, but it may spread over the palate and affect both sides, and occasionally it attacks the posterior wall of the pharynx.

If the throat is examined early, a few small yellowish-white vesicles will be seen, isolated or gathered in patches and surrounded by congested areolæ. These may disappear in a couple of days without farther signs; but usually the vesicles rupture in a few hours, leaving an excoriated surface which soon becomes covered with a yellowish-white pultaceous membrane. This membrane can be easily removed, and the excoriated surface exposed. Two or three days later, if the membrane is displaced, the mucous membrane appears natural, the excoriation having healed.

DIAGNOSIS.

This affection is very likely to be mistaken for diphtheria. If seen in the vesicular stage, the error will not be made; but if the patient does not come under observation until two or three days later, the diagnosis may be very difficult or even impossible, especially if diphtheria is prevalent at the same time. However, in most cases the membrane in herpetic sore throat is thinner and more easily detached than in diphtheria, and the constitutional disturbance is much less.

In some cases an herpetic eruption on the lips will at once reveal the true nature of the disease.

TREATMENT.

Internally, quinine in moderate doses is indicated, with a mild laxative, and small doses of Dover's powder when there is much pain. *Locally*.—Good effects are often obtained from a gargle of chlorate of potassium; some of which may be swallowed with advantage. Hydrastin in powder, sedative and astringent lozenges, or astringent sprays and gargles are useful (Form. 61–65 and 12–14).

ACUTE FOLLICULAR PHARYNGITIS.

This affection is described by Mackenzie as one of the forms of herpetic pharyngitis; but as the inflammation is confined to

the same tissues as the chronic exudative follicular pharyngitis, I think its consideration, under the above name, more likely to lead to prompt recognition of the disease. It consists of an acute inflammation of the follicles, in the mucous membrane, on the posterior pharyngeal wall. The distended follicles finally rupture, and small ulcers occur, which ordinarily heal in a few days.

SYMPTOMS.

The common symptoms are high fever, soreness of the throat, and intense pain on attempting to swallow.

SIGNS.

On inspecting the pharynx early in the disease, a number of inflamed follicles are seen blocked with their own secretions and having the appearance of pustules. If the case is seen a little later, the membrane covering these follicles will have given way, the secretions will have escaped, and a small round ulcer will remain.

DIAGNOSIS.

The acute history and the appearances just described render an error in diagnosis almost impossible. However, in not a few instances, the seat of the difficulty will be overlooked unless the laryngoscopic mirror be used, for the inflammation may be confined to the follicles in the lower part of the pharynx where they cannot be seen by ordinary inspection.

TREATMENT.

Internally.—I would recommend saline laxatives, quinine in tonic doses, and chlorate of potassium in doses of grs. v. to xv. four times a day, if it does not cause too much smarting. Anodynes should be given if necessary.

Locally.—Morphia and carbolic acid (Form. 91) may be applied with a brush, and followed in a few minutes with a similar application of nitrate of silver, gr. lx. *ad* fl. ℥ i. of distilled water. The former application relieves the pain, and prevents much of the pain which would otherwise be caused by the caustic solution. The latter usually cures the disease promptly; but the application may need to be repeated daily for a few days. At first, sedative lozenges are useful for a few days. Later,

lozenges of an astringent or stimulating character are more beneficial (Form. 21–31).

ACUTE FOLLICULAR GLOSSITIS.

This affection is like the preceding, excepting that the inflamed follicles are located on one or both sides of the base of the tongue.

SYMPTOMS.

There is acute pain in swallowing which is referred principally to the ear or to a position corresponding to the inner orifice of the Eustachian tube. The inflamed follicles cannot be seen without the throat mirror; and even with it they are very apt to be overlooked, the physician supposing the cause of the trouble to be in the posterior nares, or deeper in the pharynx.

DIAGNOSIS.

During the first or second days of the disease, careful inspection of the sides of the base of the tongue reveals a number of white or yellowish-white elevated follicles. If the case is seen later, these will have ulcerated, and the ulcers may have coalesced so as to cover a large surface. A thorough inspection will at once settle the question of diagnosis.

TREATMENT.

I have always found one or two applications of a sixty-grain solution of nitrate of silver sufficient to effect a cure.

CHRONIC FOLLICULAR PHARYNGITIS.

Synonyms.—Clergyman's sore throat; Chronic catarrhal sore throat; Chronic pharyngitis; Granular pharyngitis; Glandular pharyngitis; Chronic catarrhal pharyngitis; Ulcerated sore throat, and improperly, Herpetic pharyngitis.

This is a chronic inflammation of the pharynx, mostly limited to the follicles; which are hypertrophied, and appear as elevated granular bodies, or which may be filled with a whitish secretion that causes them to appear as pustules.

The affection is caused by derangements of the digestive organs, the inordinate use of spices and hot drinks, and by

exposure to cold; but it is most frequently excited by improper use of the voice in the open air or in poorly ventilated halls, or during an acute inflammation.

SYMPTOMS.

The most prominent symptoms are: slight discomfort in the throat, with some hoarseness and a little pain after using the voice for a short time. Hearing is frequently impaired from inflammation of the mucous lining of the Eustachian tube, or from collections in its orifice of the secretions from the pharynx. Pain on swallowing is not uncommon. There is a frequent desire to hawk and clear the throat.

SIGNS.

The mucous membrane of the fauces may be uniformly congested; or the hyperæmia may be confined to the pillars of the

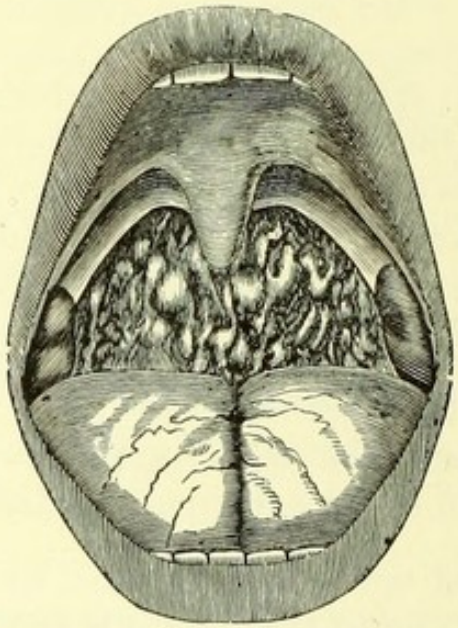


FIG. 80.—Chronic follicular pharyngitis. (Cohen.)

fauces, to the base of the posterior pillars, or to patches of the posterior pharyngeal wall.

Here and there enlarged blood-vessels may be seen. The follicles usually stand out like large red granulations surrounded with a congested areola, or as yellowish semi-transparent prominences closely resembling small blisters. In other instances the follicles, from being distended with their desiccated secretions, appear like pustules. Finally, ulceration of the follicles may occur, leaving small round excavations, which by extension may coalesce with others and thus form a large

irregular superficial ulcer. The mucous membrane is usually partially covered with mucus or small masses of greenish or yellowish muco-pus.

In some cases, termed *Pharyngitis Sicca*, the mucous membrane is atrophied, and has an abnormally dry or glazed appearance.

DIAGNOSIS.

Unless ulceration has taken place, the affection is not likely to be confounded with other diseases; but when ulcers are present it may be mistaken for secondary syphilis or acute tuberculous pharyngitis. In such cases the diagnosis must rest largely on the history and concomitant constitutional symptoms.

Acute tuberculosis of the throat is attended with grave constitutional symptoms and signs of pulmonary disease, which do not occur in this affection.

Secondary syphilis can generally be traced to a primary sore. The ulcers are preceded by mucous patches, and are often found in the anterior portion of the mouth, or arranged symmetrically on both sides of the mouth, which is not the case with the ulcers in chronic catarrhal sore throat.

TREATMENT.

The first indication in this as in other diseases is to remove the cause, if possible; or, if it has already disappeared, to remove the conditions which favor the continuance of the disease.

In this affection, we should attend first to the condition of the digestive organs, for which saline laxatives and bitter tonics are often necessary. A combination of quinine, gr. i., arsenious acid, gr. $\frac{1}{60}$, and extract of nux vomica, gr. $\frac{1}{4}$, in pill form, to be taken three times a day, is very beneficial. Alcoholic stimulants, hot drinks, highly spiced foods, and tobacco should be interdicted.

Locally.—Krameria or guaiac lozenges are useful (Form. 25 and 30). Sprays of chloride of ammonium, chlorate of potassium, or sulphate of zinc, in weak solutions, may be beneficially applied two or three times daily by the patient. If these fail, strong solutions of mineral astringents should be applied by the brush. When there is much thickening, a solution of iodine, gr. xxx., to glycerine, ℥ i., may be painted on the parts

with good effects. Where the parts are irritable, a good application consists of iodoform in solution in chloroform or ether, gr. xxx. to ʒi., or the same in powder, diluted with one or two parts of acacia, and applied with the insufflator. In mild cases, when the mucous membrane is not irritable, I have found the best results from a powder of hydrastin (Form. 110), which should be thrown into the vault of the pharynx by an insufflator. The application should be repeated in two or three days, or as soon as the effects of the first have entirely subsided. Lennox Browne recommends destroying the large blood-vessels which may be seen in the mucous membrane of the pharynx by means of the galvano-cautery, with which they may be burned across; or by cutting across them with a sharp lancet, and then pressing a pointed piece of caustic for a few seconds into the cut. Mackenzie destroys hypertrophied follicles with London paste. When the follicles are blocked up with secretions, he scrapes the mucous membrane covering them with a curette, empties the cavity of the follicle, and then touches it with a pointed stick of nitrate of silver.

SCROFULOUS SORE THROAT.

This is a disease of childhood which is characterized in a mild form by the physical appearances found in simple chronic sore throat, and in a severe form by ulcerations which cannot be distinguished from those found in debilitated subjects, whether of tuberculous, syphilitic, rheumatic, or arthritic origin. Dr. Cohen inclines to the opinion that these are common sore throats in subjects of a latent inherited syphilitic taint.

DIAGNOSIS.

There are no positive symptoms or signs which can enable us to differentiate the severe form from syphilitic ulceration, and it is hardly fair to base our diagnosis on the effects of treatment; because some cases, clearly syphilitic, are not benefited by specific treatment, and others not of specific origin are promptly relieved by iodide of potassium. The disease bears some resembles to tuberculous sore throat.

TREATMENT.

The treatment is principally that indicated for the constitu-

tional cause. Local stimulants and alteratives, especially iodine, sometimes prove beneficial. Astringent and stimulating lozenges will be useful in some cases.

ACUTE TUBERCULOUS SORE THROAT.

This is an acute miliary tuberculosis of the throat, which runs a rapid course, and terminates fatally in from eight to twenty-four weeks, on account of the attending pulmonic disease.

It is characterized by the constitutional symptoms of tuberculosis, and in the early stage, locally, by abundant gray granulations, of small size, beneath the epithelium. These granulations are usually grouped in patches. They bleed easily when touched, and, if very abundant and prominent, closely resemble the mucous patches of syphilis, but they lack the inflammatory areola of the latter. These granulations are located on the palate, palatine folds, and pharynx. Late in the disease they are found on the epiglottis and in the larynx. As the disease progresses they increase in size, lose their transparency, and become hidden by a purulent pultaceous covering. Finally superficial ulceration occurs.

SYMPTOMS.

We find intense local pain, and dysphagia increasing as the disease advances, with persistent fever.

SIGNS.

Inspection reveals the presence of the granulations just mentioned, usually associated with superficial ulceration. The ulcers are small and of lenticular shape, unless several ulcers have coalesced, and are covered with a grayish, pultaceous muco-pus. Their borders are not well defined, there being no distinct line of demarcation, and no surrounding inflamed areola.

DIFFERENTIAL DIAGNOSIS.

The disease is liable to be mistaken for syphilitic or scrofulous sore throat. The differential features are shown in the following tables:

Acute Tuberculous Sore Throat.	Syphilitic Sore Throat.
Symptoms and Signs.	
Much pain, marked febrile symptoms, especially in the evening.	Slight pain. Febrile symptoms are slight.
Inspection.	
Early, numerous small gray granulations, surrounded by a pale mucous membrane. These bleed easily. Later, ulcerations small and comparatively superficial.	Early, larger elevated mucous tubercles, which do not bleed when touched, and which are surrounded by a congested areola. Later, ulcers, which if superficial, as in secondary syphilis, are large; and which, if small, as in tertiary syphilis, are deep.

Acute Tuberculous Sore Throat.	Scrofulous Sore Throat.
Symptoms and Signs.	
Usually occurs in young adults.	Usually occurs in children under ten years of age.
Marked febrile reaction.	No fever.
Edges of ulcer not distinct.	Edges of ulcer well defined, everted and cord-like.
Ulceration superficial, but moderately active.	Ulceration more likely to involve the deeper structures, but very slow in its progress.

TREATMENT.

Anodynes, when required to relieve pain, are to be administered. Sedative lozenges will give considerable comfort. Whiskey, cod-liver oil and chloride of calcium may be given for their constitutional effects, but unfortunately we can do very little for these cases.

LECTURE XXVIII.

DISEASES OF THE FAUCES—Continued.

SYPHILITIC SORE THROAT.

Syphilis may affect the fauces in any one of its three stages, but the primary manifestations are seldom seen in the throat. The symptoms and signs of this affection vary according to the stage in which they appear.

SYMPTOMS AND SIGNS.

Primary syphilis affecting the fauces causes no symptoms, unless the chancre assumes a phagedenic form, in which case it is likely to cause pain and febrile symptoms. Physical examination may reveal a superficial ulcer or chancre, surrounded by a zone of swollen mucous membrane, and resting on an indurated base, as may be determined by the touch.

Phagedenic ulcers have a dirty grayish floor, and for a few days they extend rapidly.

These lesions are seldom observed, and when found they are very apt to be misinterpreted.

Secondary syphilis of the fauces is indicated by hyperæmia or mucous patches. The former usually causes a red band along the border of the soft palate and symmetrical erythematous patches on the sides of the mouth. The latter, known also as mucous tubercles or broad condylomata, are usually arranged symmetrically on each side of the throat. They have a circular or elliptic form, a pale surface, and are slightly elevated above the surrounding tissues, which are of a bright-red color. Later, these patches are the seat of superficial ulcerations which have a grayish-white surface and uneven borders. These ulcers usually cause considerable soreness.

When secondary syphilitic manifestations are of hereditary origin, they usually occur in the upper part of the pharynx or on the fauces soon after birth.

Tertiary syphilis in the fauces is accompanied by superficial

or deep ulcerations, or by gummata. The former most frequently appear on the palate or pillars of the fauces and spread rapidly to the surrounding mucous membrane. They are usually bathed in an unhealthy secretion. If this is removed by a bit of sponge or absorbent cotton, the base of the ulcer is found to be pale and smooth, or studded here and there with fungous granulations. These ulcers have an irregular outline with serrated edges, from which fissures sometimes extend a considerable distance into the surrounding mucous membrane.

The deep ulcers are not so large as the superficial, but they may involve all the deeper structures, affecting alike cartilage or bone. These ulcers usually appear first as a red spot, which soon acquires a whitish hue, due to the formation of a little abscess; this is shortly followed by perforation of the mucous membrane, and discharge of an ichorous pus.

From this time ulceration steadily progresses. It invades the deeper tissues more rapidly than the surrounding mucous membrane, and thus undermines the edges of the ulcer.

Usually patients in this condition suffer little or no pain, but the constitutional affection may cause serious loss of appetite, emaciation, and hectic fever, and may finally prove fatal.

Syphilitic gummata in the throat usually appear beneath the mucous membrane of the posterior part of the pharynx, but occasionally they are seen in the palate. They are observed, at first, as slight elevations which gradually increase in size and finally ulcerate, unless arrested by treatment. At first the mucous membrane covering these nodules is not affected, but after a time it becomes congested.

When these gummy tumors are situated in the palate, perforation is likely to occur, which gives the voice a nasal quality. This accident also causes the patient great inconvenience by allowing fluids or particles of food to escape from the mouth into the nasal cavity.

Tertiary syphilis of the throat, when hereditary, usually makes its appearance between the third and the fifteenth year, and causes ulcerations of the palate; these may heal, only to recur again and again.

Ulcerations of the posterior pharyngeal wall and of the soft

palate are often followed by cicatricial adhesions of the eroded surfaces, with consequent pharyngeal stenosis.

DIAGNOSIS.

Primary syphilis of the throat presents no characteristic appearances and can seldom be detected, except when a suspicious sore is coupled with a suspicious history; and even then the occurrence of secondary signs is often necessary before a positive diagnosis can be made.

The characteristic mucous tubercles or patches of the secondary stage, when associated with a syphilitic history, cannot be mistaken.

Tertiary ulceration might be mistaken for cancer or tuberculous ulceration.

Cancer is usually attended with more pain and thickening in the parts than syphilis. It also has a brighter redness of the mucous membrane and there is less destruction of the tissues.

Tuberculous ulceration causes more pain and the ulcers are smaller than the syphilitic sores.

TREATMENT.

Internally.—The constitutional treatment for syphilis is of prime importance after the primary stage.

Locally.—Phagedenic chancres should be cauterized with a solution of sulphate of copper, gr. xv.–fl. ℥ i., with acid nitrate of mercury, full strength, or diluted with from one to six parts of water, or with the galvano-cautery. Tertiary ulcerations may be treated in the same manner. Hyperæmic patches of the secondary stage may be brushed with a solution of chloride of zinc, gr. xxx.–fl. ℥ i. Mucous patches of this stage are best treated by the local application of tincture of iodine or solid nitrate of silver.

DIPHTHERIA.

This is a constitutional affection, the consideration of which more properly belongs to works on general diseases; but as it is attended by marked local manifestations which may be mis-

taken for those of membranous croup* or simple membranous sore throat, I will refer to it briefly.

The affection is characterized by great prostration, intense fever, and the formation of a dirty grayish or brownish false membrane.

This membrane rests on an ulcerated surface, and is most frequently seen on the mucous membrane of the fauces, but sometimes it is found in the larynx and nasal cavities.

DIAGNOSIS.

The characteristic membrane on the uvula and behind it removes from the category of diseases, which are likely to be confounded with it, everything excepting true croup and membranous sore throat. The differential features of these will be pointed out when we consider the latter affections.

TREATMENT.

Supporting and stimulating treatment is indicated from the first, viz., quinine and tincture of iron in moderate doses frequently repeated, and alcoholic stimulants in abundance. Jaborandi, or its active principle pilocarpine, has of late been highly recommended, but I have not observed any permanent effect from its use.

Locally.—When the patient does not resist, the false membrane should be pencilled two or three times a day with a strong solution of persulphate or pernitrate of iron. Good effects are also obtained from the use of a solution of benzoate of soda thrown into the throat by means of an ordinary steam atomizer every two or three hours, about one fluid ounce of the solution being used each time (Form. 68 and 72). Lactic acid, gr. xx.–fl. ʒ i. of water, may be used in the same manner.

ACUTE TONSILLITIS.

Synonyms.—Amygdalitis; Cynanche tonsillaris; Quinsy; Acute inflammation of the tonsil.

This affection consists of an acute inflammation of the parenchymatous portion of the tonsil, which may be general, or con-

* This is thought by many to be identical with diphtheria.

fined to a few follicles. Inflammation of the mucous covering of the gland is often included in this term, but it is more appropriately considered under the head of acute catarrhal sore throat. When the follicles alone are affected, the disease is often termed FOLLICULAR TONSILLITIS.

The affection is usually excited by exposure to cold or wet. It is most commonly met with in individuals subject to rheumatic or herpetic attacks.

SYMPTOMS.

Excepting in mild cases, there is high fever with a quick pulse, hot skin, headache, aching of the back and limbs. The patient has a sensation of dryness and stiffness in the throat, with pain radiating toward the ears, and exaggerated by swallowing. The senses of hearing, taste, and smell are more or less interfered with; and if both tonsils are affected, dyspnœa may become urgent with its attendant symptoms. Fluids are often regurgitated through the nose on attempts at swallowing. The voice is weak and nasal.

SIGNS.

The tonsil is red and swollen, so that it may project beyond the median line. In the follicular variety, its surface is studded with numerous yellowish-white spots, due to collection of the follicular secretions beneath the mucous membrane. The palate and uvula are generally congested and swollen, and the latter is elongated, and often seen sticking to one of the tonsils.

DIAGNOSIS.

Inspection of the throat usually settles the diagnosis at once, but sometimes it will be necessary to watch the case for a day or two before we can exclude scarlatina or diphtheria.

TREATMENT.

Guaiacum lozenges, containing three grains each, and taken every two hours, will seldom fail to check the disease if taken early (Form. 30). The ammoniated tincture of guaiacum may be used for the same purpose, or the same result may be obtained by painting the inflamed part with a solution of nitrate of silver, gr. lx.–℥ i. At first, small doses of aconite, frequently repeated, moderate the fever. Anodynes and cataplasms soothe the pain. Tonics are indicated. The bowels should be kept soluble.

CHRONIC TONSILLITIS.

Synonyms.—Hypertrophy of the tonsils; Enlarged tonsils.

This consists of chronic inflammation with an increase in the constituent structures of the gland. It is sometimes congenital, but it generally results from repeated acute inflammations, diphtheria, or the strumous diathesis.

It is frequently developed about the age of puberty, and in such instances it is supposed to be due to some sympathetic connection with the sexual organs. The permanent interference with respiration, caused by this affection, impairs the general health, and in proportion to the obstruction renders the patient liable to disease, especially of the respiratory organs.

SYMPTOMS.

We notice difficulty in respiration, causing noisy breathing, and snoring during sleep. The interference with nasal respiration causes the patient to breathe through the mouth, which is therefore kept partly open. The constitutional effects of continued imperfect respiration often give the individual a dull or stupid expression.

The swelling, by encroaching on the nasal cavities and orifices of the Eustachian tubes, causes thickness of the voice and partial deafness.

SIGNS.

The surface of the tonsil has a granular appearance, and is not infrequently *honeycombed* by the dilated lacunæ. The enlargement, which may vary from the size of a filbert to that of a walnut, is at once seen on inspecting the fauces. According to Lambron,* the obstruction to respiration causes a circular depression of the chest at the junction of its middle third with the lower third. This gives an appearance of abnormal bulging at the upper part of the thorax.

DIAGNOSIS.

No difficulty will be experienced in diagnosis.

TREATMENT.

The size of the tonsil may be slightly reduced by local as-

* Mackenzie's Diseases of the Throat and Nose.

tringent or stimulating applications; but the process is tedious and generally inefficient if the glandular structure is hypertrophied.

Injection into the growth of a few drops of a solution of iodine or of ergotine, by means of a hypodermic syringe, will sometimes reduce the size of the gland. Caustics or electrol-



FIG. 81.—Charrière's amygdalotome, with fenestra at right angles to handle.

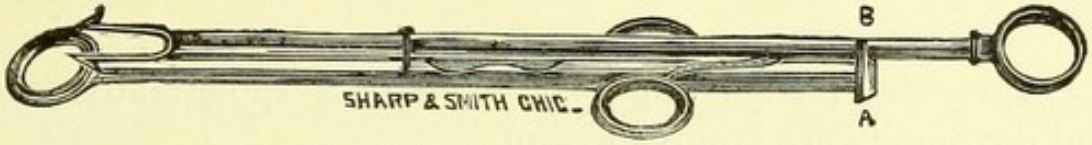


FIG. 82.—The same, fenestra placed obliquely.

ysis may be effectually employed, but excision is the speediest and usually the most satisfactory remedy. The general health should be improved by tonics, alteratives, and nutritive diet.

CONCRETIONS IN THE TONSIL.

Synonyms.—Foreign bodies or calculi in the tonsils.

Calculi in the tonsils result from blocking-up of the lacunæ and retention of the altered secretions of the follicles, which finally become inspissated and calcareous.

SYMPTOMS.

Usually a slight pricking sensation is present. If the calculi are numerous or large, there is more or less dysphagia. The concretions frequently predispose to repeated attacks of quinsy.

DIAGNOSIS.

The diagnosis can only be made with accuracy when the calculus protrudes, is expelled, or can be felt with the finger or with the probe.

TREATMENT.

The rational course is to remove the calculus. If the tonsil is much enlarged it must be excised.

FOREIGN BODIES IN THE FAUCES.

Foreign bodies which become lodged in the tonsil and pharynx are discovered by inspection, and require removal.

RETRO-PHARYNGEAL ABSCESS.

This consists of a collection of pus in the cellular tissue beneath the pharyngeal mucous membrane. It is a comparatively rare affection, usually dependent upon acute pharyngitis, specific fevers, or disease of the cervical vertebræ.

SYMPTOMS.

Deep-seated pain in the pharynx, with dysphagia, dyspnœa, and dysphonia are complained of.

SIGNS.

When located high in the pharynx, the swelling may be seen on simple inspection. If deeper seated it may be seen with the laryngoscope, or felt with the finger.

DIFFERENTIAL DIAGNOSIS.

This affection may be mistaken for œdema of the larynx or for croup. Laryngoscopic inspection, when possible, will at once establish the diagnosis. In young children, palpation with the finger introduced into the throat will usually answer the same purpose.

Œdema of the Larynx.—In this affection lifting the larynx by external manipulation does not relieve the dyspnœa as it does in retro-pharyngeal abscess.

Croup.—In croup the voice is soon lost instead of being simply altered, and there is no dysphagia, as in retro-pharyngeal abscess.

TREATMENT.

Until pus forms, sucking bits of ice or its external application are the best remedies. As soon as pus collects it should be evacuated by a free incision. The head should be thrown promptly forward as soon as the incision is made, to prevent the matter from running into the larynx. Supporting measures and tonics are also indicated.

NEUROSES OF THE PHARYNX.

These affections may involve either the nerves of sensation or of motion. They may result either from central or peripheral lesions or irritations.

ANÆSTHESIA.

Anæsthesia of the pharynx is rarely met with. When it does occur it is principally of importance as an early sign in some cases of *progressive bulbar paralysis.*

TREATMENT.

We must rely mainly on strychnia and galvanism, but in most cases we cannot hope for a cure.

HYPERÆSTHESIA.

Hyperæsthesia of the pharynx is of frequent occurrence. It almost always attends acute inflammations, and it constitutes one of the principal obstacles to laryngoscopic examinations.

TREATMENT.

Sedative applications are useful to relieve pain, but farther than this no treatment will be required other than that for the disease with which it may be associated. Of the sedative applications recommended in the Appendix, those for use by the steam atomizer will be specially beneficial when acute inflammation exists.

PARÆSTHESIA.

Morbid sensations in the throat may occur in hysterical women without any special exciting cause, but they most frequently follow the removal of foreign bodies. These are usually pricking or scratching sensations, which are sometimes felt for months after the offending substance has been removed.

TREATMENT.

When the paræsthesia is due to a small ulcer caused by a foreign substance, it is generally relieved by a few applications

of a mild caustic or of a strong astringent. When it is due to hysteria, treatment should be directed to the latter disease.

NEURALGIA.

This is a rare affection of the throat, which has not been thoroughly described.

TREATMENT.

Anti-neuralgic remedies are indicated internally. Mackenzie has found the greatest benefit from brushing the parts three or four times a day with tincture of aconite root.

SPASM.

Spasm of the pharynx is so rarely observed as to need no special description.

The neuroses of sensation which have just been described are usually recognized without difficulty.

PARALYSIS.

There are four varieties of paralysis of the palate and pharynx. "First. The affection which is a frequent sequel of diphtheria and occasionally met with after common angina. Second. Slight paralysis which is sometimes associated with facial paralysis. Third. Paralysis of the constrictors of the pharynx, which is always associated with a similar condition of the œsophageal muscles. Fourth. The loss of power, which is one of the most marked phenomena of progressive bulbar paralysis." *

DIPHTHERITIC PARALYSIS of the fauces usually makes its appearance in from ten to fifteen days after convalescence from diphtheria. It may terminate in recovery or end in general paralysis, or in paralysis of the heart.

SYMPTOMS AND SIGNS.

The patient first notices some difficulty in swallowing fluids which may regurgitate into the nostrils, or which owing to paralysis of the depressors of the epiglottis, may flow into the

* Mackenzie, Diseases of the Throat and Nose.

larynx and cause paroxysms of suffocation and cough. Pricking sensations are sometimes noticed in the parts. The voice acquires a nasal twang, and there is an inability to articulate certain nasal sounds. The power of expectoration may be lost. The sense of taste is somewhat obtunded. The palate is seen to hang loosely, and the patient is unable to elevate it; or one side may be completely paralyzed, and the muscles of the other side may retain their power wholly or but partially.

TREATMENT.

Tonics, strychnia, and electricity are indicated. Semi-solid foods should be given. Fluids must be prohibited or administered through a stomach tube, or per rectum, in order to avoid the evil consequences which would follow their accidental passage into the larynx.

In the second variety of paralysis, the uvula usually deviates to the healthy side and scarcely moves in phonation. No special treatment is required.

PARALYSIS OF THE CONSTRICTORS OF THE PHARYNX.—The third variety is characterized by dysphagia; swallowing being accomplished slowly, and most easily in the erect position. Solids are swallowed more easily than fluids and large boluses with less difficulty than small particles. Usually saliva flows constantly from the mouth in consequence of the difficulty in swallowing.

DIAGNOSIS.

The diagnosis must be made from the symptoms just enumerated.

TREATMENT.

Strychnia should be given for its tonic effects. In marked cases foods must be introduced through a stomach tube or per rectum. Electricity is sometimes useful, sometimes hurtful, and sometimes even dangerous.

PROGRESSIVE BULBAR PARALYSIS.—The fourth variety of paralysis of the pharynx is the most characteristic phenomenon of the so-called progressive bulbar paralysis. This is usually the first manifestation of general progressive paralysis due to structural lesion of the medulla oblongata.

SYMPTOMS.

This affection is characterized by difficulty in mastication and

by dysphagia. There is also an inability to pronounce the labials, as *b*, *w*, *m*, *p*, *f*, or the dentals, as *t*, *d*, *n*, *ch*. Dyspnœa is always present. Fluids regurgitate through the nostrils in attempted deglutition. There is an inability to retain the saliva. The voice becomes nasal and finally aphonic. With the further progress of the disease, the respiratory muscles become involved and finally death terminates the patient's miserable existence.

DIAGNOSIS.

The diagnosis is based upon the history of the case, the foregoing symptoms, and the physical evidences of paralysis in the muscles of the lips, tongue, palate, pharynx, and larynx.

TREATMENT.

The physician's efforts should be directed mainly to promoting the patient's comfort. Strychnia and galvanism have been recommended, but no treatment has as yet been found curative.

SWALLOWING OF THE TONGUE (So Called).

This is an extremely rare accident. Most of the cases seem to have occurred in children suffering from whooping cough. A case which I reported to the American Laryngological Society at its annual meeting, 1880, occurred in a lady suffering from hysteria. It was characterized by a spasmodic action of the hyo-glossus and probably also the stylo-glossus muscles; which drew the tongue into the pharynx in such a position as to prevent respiration. There was no cough.

TREATMENT.

The tongue should be drawn forward to prevent suffocation. Subsequently the primary disease should receive appropriate treatment.

DISEASES OF THE VALECULÆ AND PYRIFORM SINUSES.

These sinuses are liable to ulceration from the irritation set up by foreign bodies, as bits of food, or from inflammation of the muciparous glands.

SYMPTOMS AND SIGNS.

Ulcerations of the pyriform sinus cause cough, and pricking sensations with pain, especially on swallowing, and frequently hoarseness. Ulcerations of the valeculæ cause similar pricking sensations and more or less pain. Upon a laryngoscopic examination, the sinus is usually found partially filled with mucus. When this is removed by a bit of sponge, the ulcerated surface or the foreign body which has caused the disturbance will be brought into view and the diagnosis settled.

TREATMENT.

Foreign bodies should be removed with forceps. Ulcers usually heal promptly under the influence of topical applications of nitrate of silver in strong solutions.

LECTURE XXIX.

DISEASES OF THE LARYNX.

SIMPLE ACUTE LARYNGITIS.

Synonyms.—Acute catarrhal laryngitis; Cynanche laryngea; Angina laryngea; Angina epiglottidea; Inflammation of the larynx.

This consists of a simple inflammation of the mucous membrane of the larynx, frequently with more or less implication of the submucous tissues. In children, resolution generally occurs, and no sequelæ are left; but in adults the disease may pass into a chronic form of inflammation, or it may cause fatal œdema of the larynx.

SYMPTOMS.

It is characterized by dyspnœa, dysphonia or aphonia, stridulous breathing, cough, and pain. When not of traumatic origin this affection usually approaches insidiously, preceded by a slight coryza, subacute laryngitis or bronchitis, and finally it is ushered in with a slight chill, followed by fever.

The patient complains of roughness or tickling in the throat, with a scratching or burning pain aggravated by coughing or speaking, together with a constant disposition to cough, dryness and constriction of the throat, and some difficulty in swallowing.

In severe cases all these symptoms are aggravated. There is a sense as of a foreign body in the larynx, with spasm of the glottis and great dyspnœa, which causes the patient to clutch at the bed-clothes or surrounding objects, in his efforts at inspiration.

At first the countenance is flushed and the eye bright, but as obstruction at the glottis increases, there is anxiety in the expression, with congestion and cyanosis of the countenance, lividity of the lips, and an ashy pallor of the skin. The eye-

balls protrude and are surrounded by a dark halo. The pulse, which at first was full and bounding, now becomes weak, rapid, and irregular. The voice, which was hoarse and hollow or shrill, is emitted with considerable difficulty or with actual pain, and becomes feeble and may finally be lost. Respiration is labored in proportion to the narrowing of the glottis.

At first the dyspnœa is not present except when the patient is agitated, and it is hardly ever very marked in children, though in the adult it may be more distressing. Finally, in severe cases, the arms are fixed, the head raised, and the chest heaves in violent efforts at respiration; the inspiratory act, which at first was wheezing and slightly increased in length, ultimately becomes stridulous and greatly prolonged. The respirations are diminished in frequency, and finally gradual asphyxia or sudden spasm of the glottis may terminate the case. Sometimes the patient dies in a comatose condition, from carbonic-acid poisoning.

The cough is painful and convulsive. At first it is clear and shrill, but later it becomes hoarse, hollow, or brazen, like the cough of croup. Finally, in severe cases, the movements of coughing may be observed without any sound being produced. The laryngeal secretion is tenacious, consisting usually of small pellets of glairy mucus, often streaked with blood. These are thrown out with great difficulty. In favorable cases the secretions become more abundant, and of a muco-purulent character. As the inflammation progresses, all the symptoms of the early part of the disease become more and more aggravated.

SIGNS.

Upon laryngoscopic examination, in mild cases, we observe bright-red hyperæmia, with occasionally enlarged blood-vessels coursing over the epiglottis or vocal cords. In some cases an effusion of serum beneath the mucous membrane speedily occurs, causing transparent œdematous swelling, which more or less encroaches upon the opening of the larynx (Fig. 86). When the epiglottis is much inflamed, it is enlarged and pendent, so as greatly to interfere with inspection of the lower parts of the larynx, and its laryngeal surface cannot be seen. When the ary-epiglottic folds are inflamed, they become very irregular in outline, and greatly swollen. The ventricular

bands are sometimes highly turgid and protrude so as to hide the vocal cords, only a small portion of the posterior part of which can be seen during phonation. When the vocal cords are inflamed, they are slightly swollen and of a bright-red color, especially at their posterior extremities.

When considerable dysphonia exists, gaping of the glottis is ordinarily observed, due to paresis of the vocal cords. In other cases, the gaping is confined to the posterior part of the glottis, and is due to paralysis of the arytenoideus. In still other instances, there is bulging of the central portions of the cords, with gaping anteriorly and posteriorly (Fig. 120, page 388). Occasionally small erosions, which leave no cicatrices on healing, are seen on the surface of the mucous membrane, most frequently along the lip of the epiglottis.

DIAGNOSIS.

A combination of the symptoms already mentioned with these physical appearances leaves no room for doubt as to the diagnosis; but the disease is liable to be mistaken, by those who depend on symptoms alone, for laryngismus stridulus, membranous croup, chronic laryngitis, or paralysis of the laryngeal muscles.

Laryngismus Stridulus.—Acute laryngitis may be distinguished from laryngismus stridulus by its different history and by the laryngoscopic appearances.

Acute laryngitis is usually preceded by slight catarrh, and is ushered in by chills and fever. Upon inspection the larynx presents the signs of active inflammation of the mucous membrane. Laryngismus stridulus is sudden in its accession, being preceded by no chill or fever, and it is not attended by inflammation. In children under five or six years of age it is very difficult, if not impossible, to make a laryngoscopic examination, but in older children inspection may generally be accomplished by tact and patience.

Croup.—In young children the diagnosis between laryngitis and croup will have to rest upon the history and symptoms. In those who are older a laryngoscopic examination determines the nature of the disease at once, unless a case of croup should happen to be seen before exudation has taken place. The differential features between these two diseases are shown in the following table:

Acute Laryngitis.	Membranous Croup.
Attack preceded by slight catarrh, and ushered in with a chill and fever.	Accession is gradual, febrile symptoms slight.
Frequently pain in the larynx.	Little or no pain.
Respirations quick and sonorous, but usually no marked dyspnœa in children.	Respirations slow and labored, with great dyspnœa.
Cough painful and paroxysmal, but not necessarily croupy.	Cough croupy, *i. e.*, metallic, brazen, or shrill.
Sputum scanty, tenacious, and glairy; but not characteristic.	Sputum characteristic if it contains shreds or lumps of false membrane.
No exudation of inflammatory lymph in the fauces or larynx.	False membrane sometimes found in the fauces, and always in the larynx.

The disease is distinguished by the history from simple chronic, or tuberculous, or syphilitic laryngitis.

Paralysis of the Vocal Cords.—It is distinguished from paralysis of the vocal cords by the history and by the physical appearances. The neurotic affections are usually sudden in their accession, and they cause no hyperæmia of the parts.

TREATMENT.

At first we can often abort the attack by administering ten grains of Dover's powder. Small doses of aconite (Form. 1) may be given, together with sedative vapors or inhalations of opium, belladonna, benzoin, or lupulin (Form. 36–40), and sedative troches (Form. 21–24). Large doses of bromide of potassium and the belladonna vapors are especially useful if there is much tendency to spasm of the glottis. Saline laxatives are generally useful. Hot compresses or poultices to the throat are very beneficial. A moist atmosphere of uniform temperature should be secured. The use of the voice should be restricted. The use of tobacco must be interdicted.

Late in the affection astringent and stimulant inhalations and pigments are very useful (Form. 47–52 and 94–98). Stimulant and astringent troches are also beneficial, but they do harm early in the attack.

In children it is well to commence the treatment with a calomel purge, and to follow it with the same treatment recommended for croup. If œdema supervenes, an attempt should be made to relieve it by the internal administration of full doses of jaborandi. If this fails, scarification of the swollen parts or rupturing the mucous membrane with the finger, must be practiced; or if both of these are impracticable or unsuc-

cessful, tracheotomy must be performed as soon as dyspnœa becomes urgent. For several weeks after an attack great care should be taken to prevent a recurrence of the disease.

SUBACUTE LARYNGITIS.

Subacute laryngitis consists of congestion or mild inflammation of the laryngeal mucous membrane. It is far more common than acute laryngitis, and it is nearly always present in what is known as a common cold.

SYMPTOMS.

The symptoms are tickling with slight pain and dryness of the throat and inclination to cough, with hoarseness but little or no fever. All of these symptoms vary according to the congestion or swelling of the vocal cords; they are usually slight as compared with those of acute laryngitis. The cough is hacking and laryngeal, and the expectorated matter consists of a small amount of glairy mucus.

SIGNS.

Upon inspection of the larynx, we find congestion with slight œdema, especially at the posterior part of the vocal cords. There can be no difficulty in making a diagnosis.

TREATMENT.

The milder measures recommended for acute laryngitis should be resorted to first. Troches containing borax or chloride of ammonium are often useful.

TRAUMATIC LARYNGITIS.

Traumatic laryngitis may result from the irritation caused by foreign bodies, from the inhalation of irritating gases, or from mechanical injury in operations; but most commonly it occurs in children from swallowing boiling liquids or inhaling steam, as for example, in attempting to drink from a tea kettle.

SYMPTOMS.

After this accident the inflammation comes on almost instantaneously, with acute pain, and œdema of the epiglottis and deeper portions of the larynx which causes great dyspnœa.

SIGNS.

The tongue and throat are red and angry, or white from detachment of the epithelial layer of the mucous membrane or from plastic exudation. The œdematous epiglottis can often be seen standing up behind the base of the tongue, without the aid of the laryngoscope. It is seldom possible to make a laryngoscopic examination.

DIAGNOSIS.

The diagnosis will be easily made from the history and from the appearance of the mouth and fauces.

TREATMENT.

The affection can sometimes be aborted by painting the parts with a strong solution of nitrate of silver. However, this application is not devoid of danger from spasm of the glottis. Full doses of jaborandi may be tried. Constant applications of ice to the neck, and sucking of ice, should be practiced; or in its stead hot applications or inhalations of steam. The parts usually become œdematous in spite of these measures, and then scarification or tracheotomy must be promptly performed.

CHRONIC LARYNGITIS.

Synonyms.—Laryngitis chronica; Chronic catarrh of the larynx.

This affection is characterized by hoarseness or loss of voice, and more or less cough, with frequent inclination to clear the throat. It sometimes follows acute laryngitis or repeated attacks of the subacute affection, but more often it comes on independently.

SYMPTOMS.

We usually find that the patient, otherwise in good health, has noticed for some time a sense of something wrong in the throat. There has been occasionally hoarseness and dryness, especially after slight exposure to cold, and now and then he has expectorated little pellets of glairy viscid mucus. Sometimes he is suddenly awakened by a sense of suffocation, as though something had fallen into the larynx. This feeling, however, is readily relieved by swallowing saliva or water.

A somewhat peculiar form of laryngitis, attended with more or less hoarseness and other symptoms attributable to the throat and larynx, often occurs in persons from twenty to thirty years of age. Generally the sensations are not marked, but often there is tickling in the throat and sometimes pain, which is occasionally aggravated by deglutition or phonation. There is also frequent desire to clear the throat, due to the congestion and altered secretions.

In mild cases there are generally no constitutional symptoms, but occasionally fever, night-sweats, and emaciation may be observed.

In protracted or severe cases, especially those attended with considerable cough or with ulceration, the constitutional symptoms become marked. There are hectic fever, night-sweats, broken rest, emaciation, and in some instances dysphagia or absolute inability to swallow either fluids or solids on account of the pain.

Impairment of the voice, varying in degree from slight hoarseness to complete aphonia, is a most common symptom. In the incipient stages of the disease the hoarseness is usually worse early in the morning or after resting or eating. The voice improves by use, owing to quickened capillary circulation and stimulation of the nerves. Sometimes the voice is clear in ordinary tones, and discordant only under exertion, as in singing or shouting. In other instances the hoarseness is less marked in singing or shouting than in ordinary conversation.

Respiration is not affected.

The cough usually consists of a slight hawk or hem; but it is sometimes frequent and very troublesome, especially at night, so as to interfere with the patient's rest. The expectoration is scanty, a great deal of cough being required to remove a small amount of viscid mucus. The sputum may be clear, yellowish, or brownish in appearance, and it is usually expectorated in small pellets or lumps. The expectorated matter is sometimes stained with dark spots of pigment, or it may be streaked with blood. It is never abundant unless bronchitis co-exists.

Usually the tongue is red and thick, with prominent papillæ, and covered with a yellow pasty or creamy fur.

The mucous membrane of the throat and palate is relaxed and puffy, and usually redder than normal.

The appetite is not generally affected.

The bowels are usually constipated, and occasionally the individual suffers from dyspepsia.

Exceptional.—In a few rare instances, termed fetid chronic laryngitis, the excretions are very viscid, exceedingly offensive, and are only coughed up at long intervals of from one to three or four days. They consist of yellowish, grayish, or brownish crusts, due to desiccation or to decomposition.

SIGNS.

On inspection, the entire mucous membrane of the larynx is generally congested and puffy, but in some instances this condition is limited to circumscribed portions, the redness gradually fading off into healthy tissue. Tumefaction is not so great as in acute laryngitis.

When the inflammation is limited to a part of the larynx, it occurs as regards frequency of situation in the following order: first, on the supra-arytenoid cartilages; second, on the ventricular bands; third, on the epiglottis; fourth, on the vocal cords; lastly, on the ary-epiglottic folds.

When the epiglottis is affected it is frequently flaccid, so that its edges are rolled together during acts of retching. When the vocal cords are inflamed they are of a pink or reddish hue, and their edges are occasionally uneven or granular. The minute blood-vessels on the epiglottis are frequently turgid, and may be seen crossing from the base towards its free edge. Often blood-vessels may be seen running longitudinally along the vocal cords, especially at their attached borders. The congestion of the cords may be uniform, or limited to their attached borders or posterior extremities. One cord may be congested and the other of a normal white appearance.

Streaks or pellets of mucus are frequently seen adhering to the walls of the larynx, especially upon the inter-arytenoid commissure, or upon the ventricular bands or vocal cords. Mucus is sometimes observed temporarily sticking the vocal cords together; or stretching in strands from one to the other in inspiration.

In cases of long standing, the larynx sometimes has the appearance of being dilated, and the surface is covered with secretion, but in other instances the mucous membrane is dry and glistening. Usually the vocal cords are not perfectly approximated during phonation, owing to congestion, or thickening of the connective tissue, or to atrophy of the muscles. Sometimes tumefaction and hypertrophy of the muscular portions of the cords, especially on their under surface, causes the

inferior portions of the cords to project into the larynx just beneath the glottis in irregular longitudinal welts or folds, so as nearly to occlude the calibre of the larynx, and cause such dyspnœa as to render tracheotomy necessary. The mobility of the cords is frequently impaired, either by the mechanical effects of the inflammatory exudation or by paresis of the muscles.

The glands at the base of the tongue are sometimes greatly hypertrophied.

When ulceration has taken place, the destruction of tissue seldom involves more than the epithelial layer, though necrosis of the whole depth of the mucous membrane or even of the cartilages is said to occur in rare instances.

In simple chronic laryngitis one or more superficial ulcers are frequently found at the posterior extremity of the vocal cords, and upon the inner surface of the arytenoid cartilage, or of the inter-arytenoid commissure. They are also found occasionally on the ary-epiglottic fold. When indolent these are usually covered with a grayish or ashy colored secretion, of pulpy or membranous appearance; the separation of which, by means of a bit of sponge or pledget of lint, causes slight bleeding. Healthy ulcerations are covered with laudable pus, and the processes of repair are indicated about their edges.

The deeper ulcerations are nearly always associated with phthisis or syphilis. Accumulations of mucus are usually found in the glosso-epiglottic or pyramidal sinuses, and ulcers may occur in the same localities.

DIFFERENTIAL DIAGNOSIS.

Simple chronic laryngitis is liable to be mistaken for paralysis of the vocal cords, œdema of the larynx, and tuberculous or syphilitic laryngitis. An accurate diagnosis can only be made upon careful laryngoscopic examination, though the symptoms and history are also of great importance.

Paralysis.—In the dysphonia due to paralysis the voice is clearest in the morning or after rest, but it gradually becomes hoarse upon use. This is rarely the case in chronic laryngitis, in which the voice is usually hoarse in the morning, but improves with use. Paralysis of the vocal cords causes loss of

motion, which may be easily detected by the laryngoscope. This at once determines the nature of the disease.

Œdema of the larynx causes pyriform swelling of the supra-arytenoid cartilages and ary-epiglottic folds, or of the epiglottis. This does not occur in chronic laryngitis. The light color and semi-transparent appearance of this swelling differs materially from the appearance of the chronic induration and thickening due to phthisis or syphilis.

Tuberculous Laryngitis.—In phthisis pyriform thickening of the arytenoid or supra-arytenoid cartilages soon occurs upon one side or upon both sides, and this is considered a characteristic sign. The mucous membrane is apt to be anæmic, but it may be nearly natural in color or slightly congested. The lesions in the larynx are usually found upon the same side as the physical signs in the lung.

Ulcers are much more frequent in tuberculous than in simple chronic laryngitis, and in the former they are not so likely to heal as in the latter. The diagnosis rests on the history, the symptoms of constitutional disease, and the pyriform swelling of the supra-arytenoid cartilages.

The discovery of tubercles in the laryngeal mucous membrane would seem according to some authors to be a valuable sign, but expert laryngologists differ regarding the visibility of these neoplasms in this situation.

Syphilitic Laryngitis is distinguished from simple chronic laryngitis with ulceration by the history, by the presence of cicatrices in the fauces or upper portion of the larynx, and by the dirty grayish surface and undermined edges of the ulcers. The ulcerations of simple chronic laryngitis are usually superficial, and they do not cause the extensive destruction of tissue, or leave the prominent scars which result from specific disease.

TREATMENT.

We should make use of stimulant or astringent applications of chloride of zinc, sulphate of zinc, or persulphate of iron (Form. 94–97). These should be accurately applied with a laryngeal brush to the affected parts. As a rule these applications should be made daily for the first week, every second day during the second week, and subsequently every third day.*

* Mackenzie's Diseases of the Throat and Nose.

But all cases cannot be treated alike. It is best to begin with mild applications, the strength of which should be gradually increased until the susceptibility of the part is ascertained. When we have thus ascertained what the individual will bear, the applications should be continued daily until considerable inflammatory reaction is set up, and then they should be made less frequently, time being allowed for the effects of each application to subside fully before another is made. In the mean

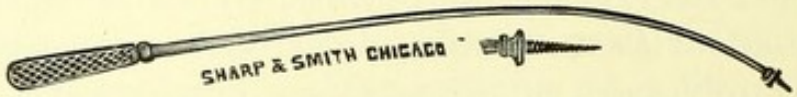


FIG. 83.—Rappaner's brush holder, one third size. The point is screwed into an ordinary camel's-hair brush, and the stem may be bent at any desired angle.

time weak solutions of the mineral astringents should be used by the patient, either with the hand-ball, or the steam atomizer (Form. 61–65), or, in place of these, stimulating vapors of the oil of white pine, oil of cloves, iodine, or carbolic acid can be used with benefit (Form. 43, 54, 55, and 49). When secretion is excessive, turpentine or tannic acid is most useful; but when scanty, carbolic acid or chloride of ammonium is preferable. Stimulating troches are serviceable in many cases (Form. 28–31). When ulcers occur, iodoform in solution or in powder is useful (Form. 111).

Excessive cough should be relieved by troches containing small doses of morphia, by cough mixtures, or by sedative inhalations. Paroxysmal coughing is most promptly checked by a few inhalations of chloroform. For this purpose half a drachm of chloroform should be turned on a bit of sponge placed at the bottom of a wide-mouthed bottle—such as a morphia bottle. The bottle should be closely corked and kept on hand for the time of need. When a paroxysm comes on, the patient removes the cork and takes a few inhalations from the bottle. There is no danger in allowing patients to use chloroform in this manner.

If the general health suffers, as it often does, tonics and alteratives will be useful. Change of climate cures many cases.

PHLEBECTASIS LARYNGEA.

This term is used to designate a varicose condition of the laryngeal veins. The cause of the affection is unknown.

SYMPTOMS AND SIGNS.

The condition is usually manifested by slight hoarseness, a sensation of something wrong in the larynx, and occasional cough. Enlarged, dark-colored blood-vessels may be seen on the epiglottis, arytenoid cartilages, and ventricular bands.

TREATMENT.

Topical applications of strong astringents may give some relief, but the most effectual treatment is the destruction of the veins by the galvano-cautery.*

TRACHOMA OF THE VOCAL CORDS.*

Synonym.—Chorditis tuberosa. This apparently arises from a partial dermoid metamorphosis of the mucous membrane. It is sometimes found after persistent chronic laryngitis; and is most frequently noticed in singers.

This condition is characterized by roughness of the surface of the cords with more or less alteration of the voice.

TREATMENT.

The treatment is tedious, but a cure may generally be effected by the prolonged use of mineral astringents or mild caustics. Perchloride of iron or nitrate of silver in strong solutions are particularly recommended.

CROUP.

Synonyms.—Pseudo-membranous croup; Exudative laryngo-tracheitis; Laryngo-tracheal diphtheria (Mackenzie); Hives (Rush); Angina trachealis.

This disease consists of an inflammation of the mucous membrane and the muciparous glands of the upper air passages,

* Mackenzie's Diseases of the Throat and Nose.

especially of the larynx, with an exudation, which, becoming organized, forms a false membrane. It is attended in some cases by spasm of the glottis, or with paralysis of the abductors of the vocal cords.

The disease is most frequently met with in children between the ages of two and seven years, but it may occur at any age.

SYMPTOMS.

The well-marked symptoms of the affection are usually preceded, for from two to five days, by the symptoms of slight catarrh, coryza, or bronchitis. At length marked hoarseness is observed in the evening, and during the succeeding night the child is attacked by a severe paroxysm of suffocation, due partially to the swelling of the mucous membrane and exudation on its surface, and partially to spasm of the glottis. Subsequently the voice continues hoarse, the cough ringing and metallic, and respiration becomes more and more obstructed. These symptoms continue throughout the interval between the paroxysms; which are apt to recur from time to time with increasing frequency and severity, for one or two days. Finally, owing to increased obstruction to inspiration, the face, losing its flush, becomes pallid and of an ashy hue; the lips become livid; sinking-in of the chest is seen at its lower portion and above the clavicles during inspiration, and at last a sudden paroxysm or gradual closure of the glottis by the false membrane causes death.

SIGNS.

Inspection with the aid of the laryngoscope reveals the presence of false membrane in the larynx.

DIFFERENTIAL DIAGNOSIS.

Croup is liable to be mistaken for diphtheria, acute laryngitis, or for laryngismus stridulus. Diphtheria having been excluded by the history and symptoms and the absence of any considerable amount of exudation in the fauces, the differential diagnosis is determined at once by the detection of false membrane in the larynx. Expectoration of patches or lumps of false membrane, or detection of this membrane in the larynx enables us to distinguish croup from acute laryngitis. The

following table indicates the principal points in the differential diagnosis between croup and diphtheria.

CROUP.	DIPHTHERIA.
Accession gradual; slight fever; spasmodic element prominent.	Accession more sudden; high fever; usually no spasmodic element.
Little or no exudation in the fauces. Exudation in the larynx is always present, and it occurs comparatively early in the attack.	Abundant exudation in the fauces. Exudation in the larynx seldom present, and usually it does not occur until late in the attack.

Laryngitis.—The differential diagnosis between croup and laryngitis in young children was pointed out in the last lecture.

Laryngismus stridulus.—Membranous croup differs from laryngismus stridulus in its more gradual accession, and in the persistence of more or less dyspnœa and aphonia between the paroxysmal attacks. The latter disease comes on suddenly, often without a moment's warning, and no dyspnœa remains after the paroxysm has subsided.

TREATMENT.

The patient should be kept in a moist atmosphere, at a temperature of 80° or 85° F.

Locally.—Early, before false membrane has formed, the child should constantly suck bits of ice; and ice-bags should be applied constantly to the neck. At the same time, cold spray inhalations of lactic acid, gr. xx. to ʒi., should be employed. As soon as membrane is believed to have formed, a non-depressing emetic, as alum, gr. xxx. to lx., should be given.* This will remove a portion of the membrane and give considerable relief, but the membrane is likely to be quickly reproduced. In this stage, inhalation of the vapor of lime-water propelled by a steam atomizer has sometimes proven efficient. The spray should be kept up constantly near the bed, and every hour the patient should inhale directly from it for five or ten minutes. If this fails, inhalations of bromine (Form. 70) with the steam atomizer should be tried, or the two may be used alternately. Insufflation of sulphur has been lately recommended.

Internally.—At the same time liquor potassæ in full doses largely diluted is thought by some to be very useful. Perman-

* Mackenzie's Diseases of the Throat and Nose.

ganate of potassium is beneficial in some cases. Quinine and strychnia in moderate doses are also indicated. As soon as dyspnœa becomes urgent, tracheotomy must be performed.

Half a century ago, large doses of calomel frequently repeated were highly recommended, and there is reason to believe that the remedy thus given has been curative in many cases. In the memoirs of the Rev. Sidney Smith it is stated that when his little daughter, six months of age, had a severe attack of croup, he sent for Dr. Hamilton, then one of the most prominent physicians in Edinburgh. Dr. H. could not come, but sent back word, "Persevere in giving two grains of calomel every hour; I have never known it to fail." My own experience with this remedy in large and repeated doses is limited, but so far as it goes it is favorable. In two cases where the remedy was thus given for twenty hours, the dyspnœa disappeared apparently as the result of treatment. I cannot recommend a treatment of which I know so little, but it seems to me worthy of trial when ordinary means do not succeed.*

PHLEGMONOUS LARYNGITIS.

Synonyms.—Submucous laryngitis; Diffused abscess of the larynx; Laryngitis phlegmonosa; Laryngitis submucosa purulenta; Laryngitis sero-purulenta.

This is a rare affection, in which inflammation attacks the submucous tissues, causing suppuration and necrosis, with the formation of diffused or circumscribed abscesses which are generally located in the upper portion of the larynx, at the base of the epiglottis, or in the aryteno-epiglottidean folds. The affection sometimes involves the ventricular bands, and rarely the vocal cords.

SYMPTOMS.

The symptoms of the disease are pain, dysphagia, hoarseness, cough, expectoration of mucus and subsequently of pus, dyspnœa, and later in the attack, delirium.

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* Some weeks after this was sent to press, my friend, Dr. David Dodge, of this city, to whom I had suggested this treatment, informed me that he had found it beneficial n several cases.

SIGNS.

When a laryngoscopic examination can be made, hyperæmia and local tumefaction of the parts indicated will be observed, and later fluctuation in the submucous areolar tissue of the neck and chin will sometimes aid us in the diagnosis.

TREATMENT.

Early the best remedies are leeches and warm applications to the neck, with steam inhalations, or, instead of the latter, constant sucking of bits of ice. As soon as there is œdema or a collection of pus, scarification is indicated.

Internally.—Quinine and sulphate of strychnia in medium doses and chlorate of potassium in full doses are indicated, together with nourishing diet and the free use of stimulants. Remedies and food should be given by enema if the patient cannot swallow. Urgent dyspnœa demands tracheotomy.

ERYSIPELATOUS LARYNGITIS.

This is an erysipelatous inflammation of the larynx, usually associated with erysipelas of the tongue and palate. It sometimes results from metastasis of cutaneous erysipelas, or from its extension along the mucous membrane of the nose, mouth, or ear. The inflammation soon terminates in extensive suppuration and sloughing in the intra-laryngeal or peri-laryngeal tissues.

SYMPTOMS.

The symptoms are fever, local pain and swelling, with difficulty in speaking, dyspnœa, and great prostration. In severe cases, these symptoms are usually succeeded by vomiting and finally by delirium.

SIGNS.

Early in the disease the laryngoscopic appearances are simply those of laryngitis; subsequently sloughs or extensive ulcers will be observed.

DIAGNOSIS.

The diagnosis must be based upon the symptoms and the evidence of inflammation of the same type, affecting the skin or the mucous membrane of the mouth.

TREATMENT.

The general treatment should be the same as for erysipelas in other localities. Quinine and tincture of iron are the most useful medicines. Nourishing diet is essential, and stimulants are indicated early.

Locally.—In hopes of aborting the attack, ice may be sucked constantly for the first few hours. Gibb reports a case in which applications of a strong solution of nitrate of silver (gr. lxxx. *ad* ℥ i.) every six hours cut short the disease. Steam inhalations and anodynes will be useful in relieving pain.

Tracheotomy will naturally suggest itself, but it is of doubtful propriety.

LECTURE XXX.

DISEASES OF THE LARYNX—Continued.

ABSCESS OF THE LARYNX.

This consists of a circumscribed collection of pus, due to inflammation of the soft tissues. It is very rarely a primary affection. It occurs not infrequently as the result of inflammation of the cartilages or perichondrium following typhoid fever or pyæmia, or dependent upon tuberculosis, syphilis, or local injuries.

Abscesses, occurring as the result of typhoid fever, are generally found during the second or third week of the fever. The smaller of these appear just beneath the mucous membrane, and the larger ones beneath the perichondrium.

SYMPTOMS.

The symptoms of abscess of the larynx are: pain which is aggravated by pressure, cough, difficulty in swallowing, and dyspnœa.

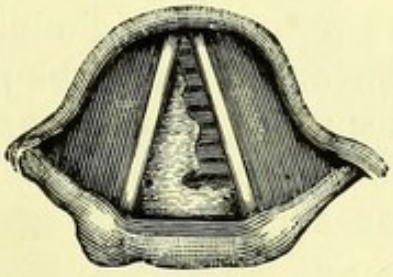


FIG. 84.—Infra-glottic abscess of larynx, due to syphilis. Great dyspnœa.

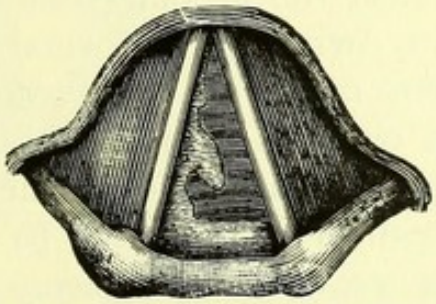


FIG. 85.—The same twelve hours after spontaneous opening of abscess.

SIGNS.

Upon laryngoscopic examination, the abscess appears as a glistening swelling, red at its base, and either red or yellowish at its apex. It is usually located on the inner surface of the larynx, either at the base of the epiglottis, upon the arytenoid or supra-arytenoid cartilages, or in the aryteno-epiglottidean folds.

DIAGNOSIS.

In children the disease is liable to be mistaken for croup or retro-pharyngeal abscess, and the diagnosis is sometimes attended with great difficulty. But in adults the laryngoscopic appearances are characteristic if the abscess points; otherwise it is not always possible to distinguish it from simple inflammatory swelling. This condition can usually be distinguished from œdema by the greater transparency of the swelling in the latter.

TREATMENT.

When the abscess can be reached, the pus should be evacuated by means of the laryngeal lancet. When this cannot be accomplished, the patient must be carefully watched, and if dyspnœa becomes threatening, tracheotomy must be performed. Subsequently, with the trachea completely stopped by a large canula, renewed efforts should be made to open the abscess.

ŒDEMA OF THE LARYNX.

Synonyms.—Œdematous laryngitis; Submucous laryngitis; Supra- or infra-glottic dropsy; Angina laryngea infiltrata; (incorrectly) Œdema glottidis.

This consists of a sero-sanguinolent or sero-purulent infiltration into the areolar tissue beneath the mucous membrane, which, owing to the formation of the parts, at once diminishes the size of the air tube, causing dyspnœa, and unless the process is checked or promptly relieved, speedily induces suffoca tion. A spasmodic element frequently co-exists with the mechanical interference to respiration, and thus adds greatly to the gravity of the case.

SYMPTOMS.

Acute œdema usually comes on suddenly, and the symptoms increase in severity, with great rapidity, giving rise to frequent suffocative attacks, with intervals of less impeded respiration. These intervals grow shorter and shorter until relief is obtained or death occurs.

When œdema follows chronic diseases, the progress of the case is more gradual. At first, symptoms due to slight obstruction present themselves. These gradually increase in

severity, until finally a suffocative paroxysm occurs, which usually subsides after a short time, to recur after a few hours, and again and again at shorter intervals, as in the acute affection, until it proves fatal. The symptoms referable to the larynx are slight local tenderness, with a sense of dryness, heat, and constriction in the throat, hoarseness, aphonia, dyspnœa with labored and sometimes stridulous respiration, and more or less difficulty in swallowing. The inspiratory act is chiefly obstructed, expiration being comparatively free, and this is an important point in the diagnosis.

SIGNS.

Upon inspection, the fauces are sometimes found to be œdematous, and by the aid of the laryngoscope the epiglottis, or aryteno-epiglottidean folds, or both, are found to be greatly swollen, and occasionally the ventricular bands or vocal cords

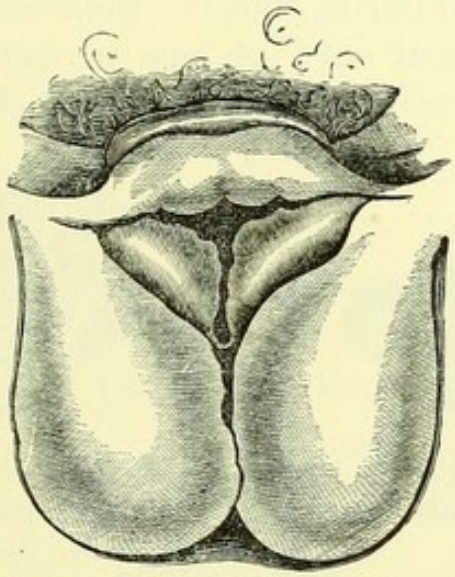


FIG. 86.—Œdema of larynx (Cohen).

are also affected. The swollen parts are translucent, of a pinkish or yellowish color, and closely resemble, in their general appearance, an œdematous eyelid or prepuce. The epiglottis has the appearance of a roll-like body or ridge, and the aryteno-epiglottidean folds are globular or irregular in form, and usually project from both sides; though occasionally only one side is involved, and at other times the swelling is greater on one side than on the other.

Exceptionally the œdema is limited to the parts below the vocal cords.

The swelling may narrow the upper orifice of the larynx to a mere slit.

DIAGNOSIS.

The diagnosis can sometimes be made by passing the finger over the base of the tongue, where the œdematous epiglottis or the aryteno-epiglottidean fold may be felt. This method, however, must be practiced with great care and very gently, as it might induce a dangerous suffocative paroxysm. Lifting the larynx by external manipulation does not relieve the dyspnœa, as it would in retro-pharyngeal abscess. This is therefore a valuable sign when the disease occurs in young children.

A laryngoscopic examination will at once settle all questions as to diagnosis, for there are no other affections presenting similar appearances.

Chronic infra-glottic œdema, or thickening of the inferior surface of the vocal cords, causes a pinkish-white fold immediately below the vocal cord on one or both sides, and sometimes around the entire circumference of the glottis.



FIG. 87.—Chronic swelling of the under surface of the vocal cords (Ziemssen).

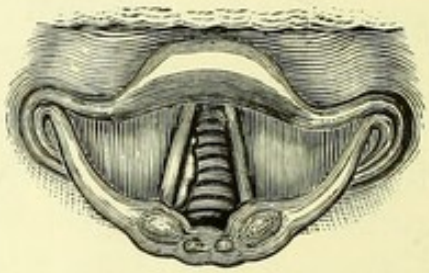


FIG. 88.—Slight subglottic œdema in a phthisical patient.

TREATMENT.

I have obtained prompt and complete relief by the administration of a drachm dose of the fluid extract of jaborandi. This remedy is very uncertain in its action, or rather in its quality. A good preparation given in this dose will cause profuse salivation or diaphoresis, or both, in about twenty minutes, but unfortunately most of this medicine is worthless. By trying different preparations, first from one drug store and then from another, we can usually find an efficient article, and when found we should keep a few ounces of it for cases of emergency. The medicine often causes vomiting after two or three hours, but this result is also favorable in œdema of the larynx. If we

fail with this remedy, scarification of the larynx is the best treatment. If this does not afford relief, tracheotomy must be performed.

Chronic œdema of the larynx should be treated by scarification, followed by the stronger stimulating or astringent pigments, as chloride of zinc, or nitrate of silver. When the œdema is located below the vocal cords, very little can be accomplished by topical applications. Schroetter's method of dilating the larynx* by means of hard-rubber tubes has been very successfully employed in cases of this kind. If dyspnœa becomes marked, tracheotomy must be performed.

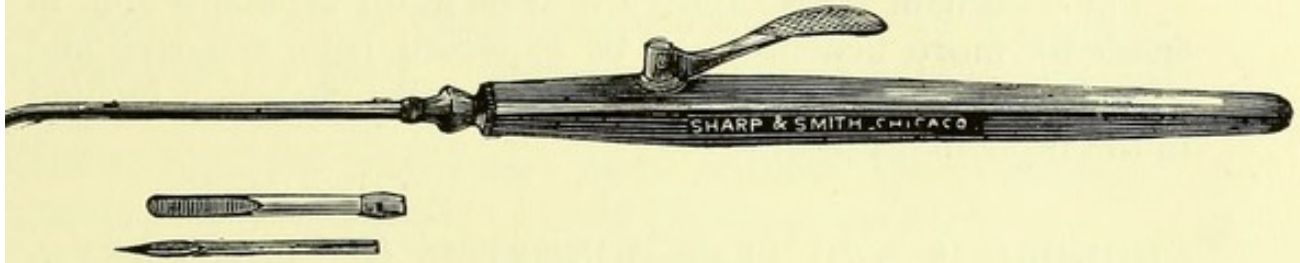


FIG. 89.—Mackenzie's laryngeal lancet—$\frac{3}{5}$ of ordinary size.

TRACHEITIS.

This is an inflammation of the trachea, which is frequently associated with subacute laryngitis, or with bronchitis; but occasionally it occurs independently.

SYMPTOMS.

The principal symptoms are pain in the neck and beneath the upper portion of the sternum, with a slight hacking, but sometimes a paroxysmal and peculiar brazen, cough.

SIGNS.

The mucous membrane of the trachea is of a bright red or purplish hue, and in chronic cases it is often partially covered with masses of tenacious mucus. Care must be taken, when inspecting the trachea, not to be led into error by the illumi-

* See stenosis of larynx, p. 363.

nation. We must always remember that a poor illumination gives it a darker-red appearance than it has when examined with a bright light. Occasionally small ulcers may be detected, but these are so closely simulated in appearance by lumps of mucus that we must be guarded in our opinion.

DIAGNOSIS.

The disease may readily be distinguished from laryngitis or bronchitis by the laryngoscopic appearances and by absence of the auscultatory signs of the latter affection.

TREATMENT.

The treatment is essentially the same as for bronchitis, but in tracheitis more benefit is to be expected from sedative and stimulating inhalations, than when the inflammation is located in the bronchial tubes.

CHONDRITIS AND PERICHONDRITIS OF THE LARYNGEAL CARTILAGES.

This is an inflammation of the cartilages or perichondrium of the larynx, with more or less caries of the cartilages. In mild cases the remaining portions of the cartilage may become slightly enlarged. In severe cases the whole cartilage may be destroyed and thrown off, or the resulting abscess may cause suffocation.

The disease sometimes occurs as a primary affection, but it is usually associated with tuberculosis or syphilis, or it follows typhoid fever.

SYMPTOMS.

The inflammation of these tissues gives rise to more or less pain, dysphagia, hoarseness and dyspnœa, and usually to the formation of an abscess.

SIGNS.

When of primary origin the inflammation usually begins in the perichondrium or in the cartilage; but when secondary these tissues are generally affected by the extension of an ulcerative process from the mucous membrane. Laryngoscopy reveals the signs of inflammation, viz., more or less tumefaction and loss of motion, with ulcerations or abscesses. If the aryte-

noid cartilages are affected, the movements of the vocal cords will be restricted. If an abscess forms, involving the cricoid, it will project in a tumid fold just beneath the vocal cords; if it affects the arytenoid cartilages it will be seen above the glottis, or if it springs from the thyroid it will usually be seen below the vocal cords, unless it should point externally.

DIAGNOSIS.

Primary perichondritis may be suspected when the patient complains of a dull aching or boring pain, and laryngoscopic examination reveals enlargement of some of the cartilages without much congestion of the parts.

Secondary perichondritis may escape notice on account of swelling of the parts. Late in the affection abscesses are formed, the movements of the vocal cords become impaired, distortion of the larynx may occur without the presence of cicatricial tissue, and often a fetid discharge takes place.

TREATMENT.

Whether the disease is of primary or of secondary origin, the patient's general health must receive our principal attention. When an abscess forms it must be opened, or tracheotomy must be performed to prevent suffocation.

TUBERCULOUS LARYNGITIS.

Synonyms.—Laryngeal phthisis; Phthisis laryngea; Laryngophthisis; Helcosis laryngis; Throat consumption, etc.

This affection causes chronic thickening and ulceration of the laryngeal tissues, attended with hoarseness, aphonia, dysphagia, and dyspnœa; with persistent increase of temperature and progressive emaciation. It is generally preceded by pulmonary phthisis, but it is occasionally primary.

SYMPTOMS.

The history and symptoms of the disease are sometimes simply those of the pulmonary affection with which it co-exists; but in most instances it occasions the laryngeal symptoms just referred to, together with pain in the throat, which is aggravated by pressure and by phonation or by efforts at deglutition. It often causes stridulous respiration.

There is usually a tickling sensation in the throat, giving rise to frequent and severe paroxysms of cough.

If the larynx alone is affected, the expectoration is comparatively scanty, but when the lungs are involved, or when bronchitis exists, the sputum is abundant.

Even in cases where the larynx is the only part affected, patients may suffer from persistent elevation of temperature, with hectic exacerbations, night-sweats, progressive emaciation, and indeed all the symptoms of pulmonary phthisis.

SIGNS.

The essential signs are: extreme pallor of the larynx at first, which is soon followed by a semi-solid pyriform swelling of the inner extremity of one or both ary-epiglottic folds (Fig. 90). These are usually associated with signs of pulmonary disease.

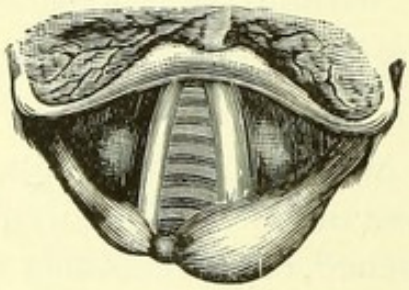


FIG. 90. — Tuberculous laryngitis, showing pyriform swelling of left ary-epiglottic fold and paresis of left vocal cord.

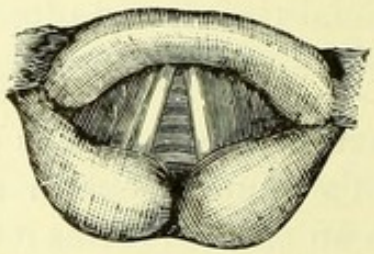


FIG. 91. — Tuberculous laryngitis, showing pyriform swelling of both ary-epiglottic folds and thickening of epiglottis.

On auscultation over the larynx or trachea, râles may usually be heard. Upon inspection of the larynx we usually observe, early in the case, a characteristic anæmia, which may be followed by circumscribed hyperæmia, with exudation into the ary-epiglottic folds, about the supra-arytenoid cartilages of one or both sides. When both ary-epiglottic folds are affected, they resemble two large pyriform tumors, the large ends of which are together. The inter-arytenoid fold or commissure is usually absorbed into these swellings, which then have a smooth uniform surface; but at first the cartilages cause projections beyond the surrounding tissues. When only one side is affected, the swelling is usually found upon the same side that the phthisical changes are taking place in the chest. These swellings are usually of a pale pinkish hue; but they may be much congested.

Early in the disease the inter-arytenoid fold is usually red and swollen, with irregular projections on its laryngeal surface, which gradually acquire the appearance of acuminated or condylomatous submucous tumors. The epiglottis is sometimes flaccid, in other cases it is thickened to two or three times its ordinary size, and hangs so low over the larynx as to prevent inspection of the parts below. In addition to the thickening it is frequently curled backward, so that its edges cannot be seen. Thickening of the arytenoids is common, and finally irregular ulceration occurs in various parts of the larynx. The ulcers are most frequently found at the point of two opposing surfaces, and they are generally multiple; but they may be confined to any portion of the walls of the larynx, as, for example, the inner surface of the arytenoid cartilages, the inter-arytenoid fold, the ventricular bands, the base or edge of the epiglottis, or to the vocal cords. Thickening or ulceration of

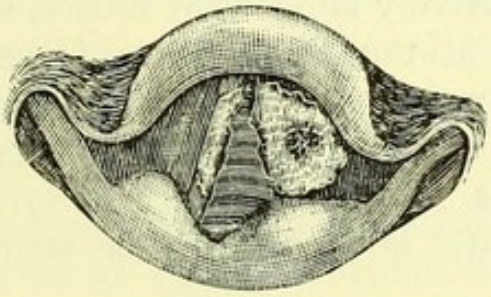


FIG. 92.—Tuberculous laryngitis, showing thickening of the epiglottis and supra-arytenoid cartilages, with ulceration of the vocal cords and left ventricular band.

the posterior extremity of the ventricular bands, owing to their position, frequently escapes detection until the morbid process has become quite extensive.

When the vocal cords are affected, ulceration usually occurs at the vocal process; but the free edge of the cord may be more or less affected, so as to give it a notched appearance. Occasionally, vegetations on the cords become ulcerated, adhesive inflammation is set up, and the two may be bound together by a cicatricial web, similar to that more frequently found in syphilis.

The aspect of tuberculous ulcers is not characteristic, though they are usually deeper than those of simple chronic laryngitis, but not so deep as those of syphilis. They have little tendency to heal, and therefore cicatrices will seldom be found in this disease.

Ulcerations of the trachea often occur, but owing to the position they can seldom be satisfactorily inspected.

Late in the disease perichondritis or chondritis, with greater or less destruction of the cartilages, is likely to occur. This feature in the case is indicated by local swelling, and pain on phonation or deglutition, with tenderness upon local pressure or external manipulation of the larynx. The position of resulting abscesses would indicate the cartilages affected. When there is doubt as to whether it be the arytenoid or the cricoid cartilages, the supra- or infra-glottic position of the abscess will determine.

DIAGNOSIS.

This affection is likely to be mistaken for syphilitic laryngitis, simple chronic laryngitis with ulceration, or for chronic œdema. The most important points in the formation of the diagnosis are the extreme anæmia and the presence of several small and comparatively superficial ulcers, which are situated on a pale ground at the lower part of the larynx, or which may have gradually extended from that position upward; with pyriform swelling of the ary-epiglottic folds, and a history of pulmonary phthisis. The distinctive features between tuberculous and syphilitic laryngitis will be seen in the following table:

Tuberculous Laryngitis.	Syphilitic Laryngitis.
History of phthisis. Swelling of arytenoids uniform. Ulcers usually multiple, small, and superficial, with a whitish base, surrounded by pale mucous membrane. The ulceration beginning at the lower portion of the larynx.	History of syphilis. Swelling irregular. Ulcers usually single, deep, and excavated, with rounded undermined edges, having a dirty grayish base. The ulcers are surrounded by an inflamed areola, and they usually begin in the pharynx and gradually extend to the upper portion of the larynx.
When the epiglottis is attacked, its laryngeal surface is most deeply involved. The entire valve is seldom destroyed.	When the epiglottis is attacked, its lingual surface is usually most deeply involved. The entire valve is frequently destroyed.
Ulceration of the arytenoid cartilages, ventricular bands, or anterior commissure of the vocal cords is *common*. Both vocal cords are generally ulcerated if either is involved.	Ulceration of the arytenoid cartilages, ventricular bands, or anterior commissure of the vocal cords is *rare*. Often only one vocal cord is involved.
Development of ulcers slow. Ulcers often very painful.	Development of ulcers acute. Ulcers seldom painful.

Tuberculous Laryngitis.	Syphilitic Laryngitis.
Ulcers do not ordinarily heal, consequently no cicatrices.	Ulcers generally heal; cicatrices may usually be observed in the pharynx and upper portions of the larynx.
Treatment has little effect.	Appropriate constitutional and local treatment causes speedy improvement.

Tuberculosis and syphilis frequently co-exist in the same case, and then a diagnosis may be impossible.

Chronic catarrhal laryngitis is not likely to be mistaken for this disease excepting when ulcerations have occurred, and then the character of the ulcer, which is generally a simple abrasion, together with hyperæmia instead of anæmia and absence of a phthisical history, will ordinarily render the diagnosis easy. But it must not be forgotten that non-tuberculous ulcers may sometimes supervene in phthisical patients.

Chronic œdema may ordinarily be distinguished from tuberculous laryngitis by the greater transparency of the tissues in the former; however, œdema frequently occurs with the tuberculous affection, and causes swelling of the supra-arytenoid cartilages and epiglottis.

TREATMENT.

The general treatment should be the same as for pulmonary phthisis. It consists of chloride of calcium, alcoholics, and cod-liver oil or maltine, with such other remedies as concomitant symptoms may suggest.

Locally.—Soothing inhalations of lupulin, benzoin, or belladonna sometimes give great relief (Form. 36, 37, 39). Coughing may be relieved by small doses of morphia given in troches (Form. 21). Severe paroxysms of cough may be relieved by a few inhalations of chloroform or ether. When the secretion from the larynx is excessive, the insufflation of tannin should be tried (Form. 107). If tannin proves too irritating, iodoform or iodoform combined in various proportions with tannin or bismuth may be beneficially employed (Form. 111 and 112). To soothe the cough and relieve the pain, morphia and bismuth are useful (Form. 113). Sedative troches are also indicated (Form. 21–24). To promote healing of ulcers, pigments of chloride of zinc, perchloride of iron, iodoform, or strong solutions of nitrate of silver are most beneficial (Form. 99–105).

To prevent the pain in deglutition and enable the patient to eat, nothing has proven so useful in my experience as the pigment of morphia, carbolic acid, and tannin (Form. 91). The local anæsthesia produced by this will continue several hours, and will often last for two days.

SYPHILITIC LARYNGITIS.

This is a local manifestation of syphilis; the laryngeal phenomena of which vary at different epochs of the constitutional disease. The primary sore cannot occur in this locality. *In secondary* syphilis, chronic hyperæmia and superficial ulcerations are often met with, but condylomata form the most characteristic condition. These are usually from an eighth to a quarter of an inch in diameter, and round or oval in form, with a smooth surface, and of a yellowish color. They are generally located on the epiglottis or in the inter-arytenoid commissure.

SYMPTOMS.

We usually obtain symptoms similar to those of chronic laryngitis. Pain seldom occurs, though it is present in a few instances. The absence of this symptom is a valuable point in the differential diagnosis. Dysphonia, aphonia, dyspnœa, and dysphagia are more or less marked. Expectoration is usually slight; sometimes the sputum has a peculiar odor, and this, by some authors, is considered characteristic of the disease.

SIGNS.

The fauces generally present evidences of the specific affection, and upon inspection of the larynx general hyperæmia is observed, which, however, does not differ essentially from that of chronic catarrhal laryngitis. Small-sized, superficial ulcers are often found in the fauces and upon the epiglottis, which usually occur between the sixth and twelfth month after the primary affection.

Condylomata are found upon the epiglottis, vocal cords, or inter-arytenoid fold in about one fifth of all the cases.

DIAGNOSIS.

The affection is liable to be mistaken for tuberculous laryngitis or chronic catarrhal laryngitis. The diagnosis must

depend mainly upon the history, the symptoms, and the progress of the case. When hyperæmia is the only sign, it is at first impossible in some cases to decide whether it is due to this disease, or to simple catarrhal or tuberculous inflammation. A little time will decide such cases.

It is claimed that narrow bands of hyperæmia, running along the edge of the velum of the palate on both sides and terminating at points equidistant from the base of the uvula, together with symmetrical hyperæmic patches in the mouth, are almost unfailing signs of specific disease.



FIG. 93.—Condyloma on the upper surface of the epiglottis (Mackenzie).

The erosions of catarrhal inflammation usually heal in a few days, and those of syphilis in a few weeks, but those of tuberculosis seldom take on the reparative process.

Tertiary Syphilis.—In tertiary syphilis, besides the history and symptoms of the secondary stage, we will observe rapid, deep and extensive ulceration, or gummata or cicatricial stenosis. Often the first sign of this condition is obstinate superficial ulceration of the vocal cords. Erelong deeper tissues are involved, and usually destruction of a part or even of all of the epiglottis occurs, and the process may involve the deeper portion of the larynx.



FIG. 94.—Syphilitic ulceration of epiglottis. Hypertrophy of left ventricular band and ary-epiglottic fold (Mackenzie).

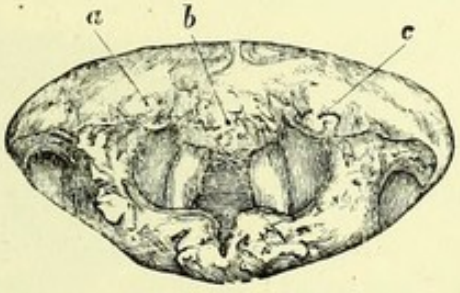


FIG. 95.—Syphilitic ulceration (Türck). *a*, *b*, *c*, remnants of epiglottis.

These deep ulcers usually occur three or four years after the primary sore, but they have been known to make their appearance twenty, thirty, or forty years later, without the occurrence of intermediate symptoms.

The voice and the respiration are usually more disturbed

than in the secondary stage. Swallowing may become almost impossible from destruction of the epiglottis (Fig. 95). However, there are cases on record in which this lesion has not materially interfered with deglutition. The ulcerative process is often associated with œdema, and morbid growths frequently occur on the inter-arytenoid fold or over the arytenoid cartilages.

Gummata are occasionally found in this stage. They usually occur as smooth round elevations of a yellowish tint or covered with mucous membrane of normal color. They are generally multiple. These growths are most frequently located on the anterior surface of the posterior wall of the larynx. The ulcerations which follow them are of the most destructive kind.

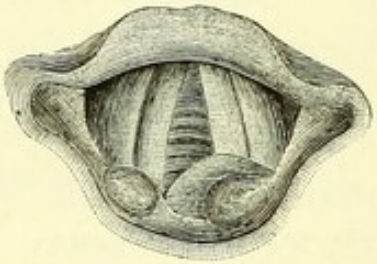


FIG. 96.—Gumma (Mackenzie).

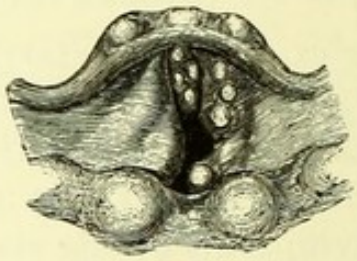


FIG. 97.—Multiple gummata (Mandl).

As cicatrization occurs, the larynx may be greatly distorted the ulcerated surfaces may become adherent to each other, and sometimes the vocal cords will be bound together by a web of cicatricial tissue. The resulting stenosis may necessitate tracheotomy.

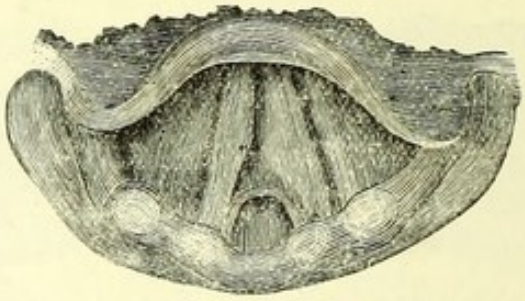


FIG. 98.—Web between vocal cords following syphilitic ulceration (Mackenzie).

DIAGNOSIS.

The diagnosis can usually be easily made, excepting in the cases of simple hyperæmia already mentioned. Deep ulcerations of the tertiary stage may be mistaken for the ulcerations of tuberculous or cancerous disease. The distinctive features between syphilitic and tuberculous laryngitis were pointed out

when speaking of the latter (page 356). The essential points in the differential diagnosis between this disease and *cancer* of the larynx are pointed out in the following table:

Syphilitic Laryngitis.	Cancer of the Larynx.
Ulceration is often the first sign.	Ulceration is generally preceded by a morbid growth.
Development of ulcer acute, often occupying but a few *days*.	Development of ulcer slower, usually requiring a few *weeks*.
Often more than one ulcer.	Ulcer solitary.
Inflammatory areola surrounding the ulcer, not so marked as in cancer.	Ulcer surrounded by an areola of marked inflammation.
Ulcers irregularly round or oval, and seldom more than one fourth to one half an inch in diameter.	Ulcer very irregular in outline, and larger than syphilitic ulcers.
Ulcers speedily improve under anti-syphilitic treatment.	No improvement results from specific treatment.
History of syphilis and usually absence of pain.	Usually, though not always, the history of cancer in other localities. Severe lancinating pains are nearly always present.

TREATMENT.

The constitutional disease requires the exhibition of iodide of potassium or bichloride of mercury or the two combined. It is best to commence the use of the iodide in five-grain doses. Its effects should be watched, and when the patient will bear it the dose should be largely increased, unless improvement speedily occurs. In severe cases the best results have been obtained from doses of ten, twenty, thirty, or even sixty grains, given, largely diluted, three or four times a day. Extract or tincture of nux vomica may be given at the same time to prevent coryza. Fowler's solution may be administered to prevent the cutaneous eruption which is likely to follow the free use of this remedy.

Locally.—Ulcers, if simply indolent, may be touched with some of the strong stimulant pigments, as iodine, nitrate of silver, or sulphate of copper (Form. 105, 102, 100). If the ulcers are extending, they should be cauterized with the solid nitrate of silver, with sulphate of copper, gr. xx. ad fl. ℥ i., or acid nitrate of mercury in full strength or diluted with two or three parts of water, or with the galvano-cautery. Waldenburg and others highly extol an atomized solution of bichloride of mercury, gr. ss. to gr. i. ad fl. ℥ i., for promoting

the healing of syphilitic ulcers. Vicious adhesions of the vocal cords to each other should be broken up with the cutting forceps or the galvano-cautery; permanent stenosis should be treated by dilatation. Dr. W. MacNeill Whistler reports two cases of stenosis which he successfully treated by means of his almond-shaped dilator and laryngotome.* Tracheotomy may be necessary.

STENOSIS OF THE LARYNX AND TRACHEA.

Stenosis or stricture of the larynx is most often the result of syphilis. It may follow chondritis or perichondritis, and may be due to organized inflammatory exudation, cicatricial constriction, vicious adhesions, or chronic tumefaction. Stricture of the trachea frequently occurs near its bifurcation, but is also observed near its upper extremity.

SYMPTOMS.

The symptoms are those due to mechanical obstruction to the entrance of air, and they necessarily vary with the amount of constriction. Phonation may or may not be impaired. Dysphagia is sometimes present when the upper portion of the larynx is involved. Inspiration is usually prolonged and stridulous. If dyspnœa is marked, it will be followed eventually by all the symptoms and signs of imperfect aëration of the blood.

SIGNS.

Upon inspection, alterations in the larynx which diminish its calibre are usually detected. The vocal cords may be partially adherent to each other, the ventricular bands may be hypertrophied or bound together, the inner surfaces of the arytenoid cartilages may have become permanently fixed to each other, or the epiglottis may be adherent to the aryteno-epiglottidean folds. Sometimes the stenosis is due to submucous infiltrations or to hyperchondrosis, and in other instances two or more of these conditions may be combined.

DIAGNOSIS.

The diagnosis rests partly upon the history and partly upon the laryngoscopic appearances. Tracheal stenosis cannot al-

* Archives of Laryngology, Vol. I., p. 326.

ways be detected by inspection. In such cases it must be diagnosticated by the symptoms and by the exclusion of obstructions in the larynx. Explorations with sounds and bougies may sometimes aid us in its diagnosis.

TREATMENT.

Tracheotomy should be performed to relieve the dyspnœa, after which efforts should be made to dilate the canal by means of Mackenzie's, Navratil's, Schroetter's, or Whistler's instruments. Schroetter has recently been very successful in dilating strictures of the larynx by means of hard-rubber tubes without having first done tracheotomy. These tubes are from eight and a half to nine and a half inches in length, and have about the same curvature as Mackenzie's laryngeal forceps.

The laryngeal portion of the tube is somewhat triangular, corresponding to the normal shape of the glottis, and it is slightly wedge-shaped at its tip, which is supplied with fenestra through which the patient may breathe when the instrument is in position.

In the series now used by Schroetter there are twelve of these tubes, varying in size from about three eighths to seven eighths of an inch from before backward, and from one fourth of an inch to five eighths of an inch transversely.

Dr. J. D. Arnold* describes the operation as follows: "The tube, which is always best introduced under the guidance of the mirror, is grasped firmly by the middle and index fingers above, and thumb below, and passed so deep into the larynx as to press with its tip upon the true cords. Here the operator rests until the cords open during inspiration when, with considerable force, if necessary, the tube is pushed through the stenosis into the trachea to such depth that all its fenestra shall be beyond the constricted portion. Except in cases where dyspnœa is a very urgent symptom, the mere passage of the stricture is all that should be attempted at the first trial; the period of retention to be prolonged as the parts become more tolerant of the instrument."

Subsequently the instrument may be introduced two or three times daily if thought best, and it may be allowed to remain in position from five to thirty minutes.

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* Archives of Laryngology, Vol. II., page 231.

If the cicatricial tissues do not yield to simple dilatation, they may be nicked with a knife or with Whistler's laryngotome, or touched with the galvano-cautery. Stenosis of the trachea

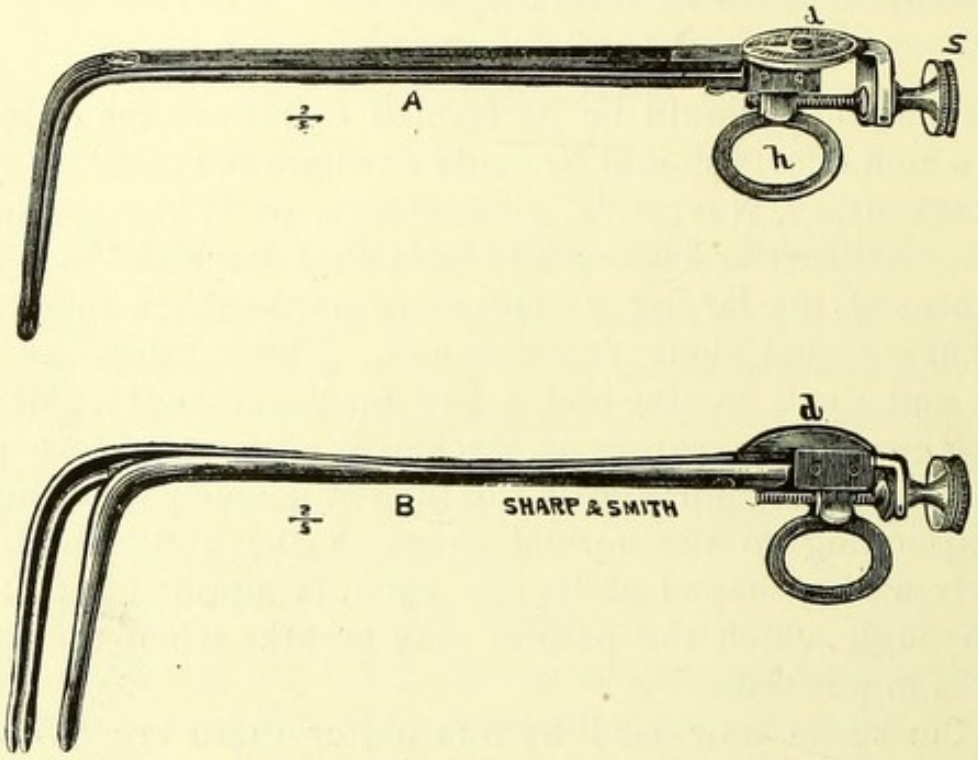


FIG. 99.—Mackenzie's laryngeal dilator.

A, closed. B, open. The blades may be separated by turning the screw *s*, and the extent of the separation will be registered on the dial *d*.

is not amenable to treatment unless the stricture is located near the upper part of the tube and is not extensive. In the article above alluded to, Dr. Arnold records a case where the same laryngologist successfully dilated a stricture of the trachea by means of catheters without tracheotomy.

LECTURE XXXI.

DISEASES OF THE LARYNX—Continued.

LUPUS.

Lupus of the larynx has been occasionally detected, but laryngoscopy reveals no special characteristics. The appearance is similar to that which might be caused by tuberculosis, syphilis, or carcinoma. The diagnosis must rest upon the presence of disease externally.

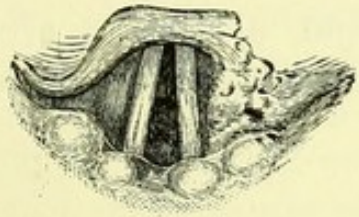


FIG. 100.—Lupus of larynx (Ziemssen).

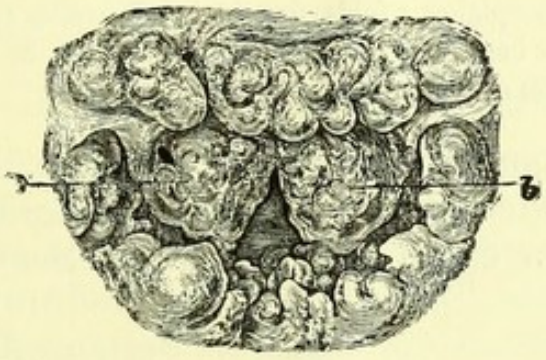


FIG. 101.—Lupus of larynx (Türck). *a*, *b*, epiglottis.

TREATMENT.

The ulcer should be touched with the solid nitrate of silver, and care must be taken to cauterize only a small surface each time. If this caustic is too severe, milder remedies should be employed. *Internally.*—Cod-liver oil is highly recommended in these cases.

LEPRA.

Elephantiasis, when involving the larynx, causes catarrhal inflammation, and more or less deformity with dysphonia and dyspnœa.

DIAGNOSIS.

The diagnosis is easily made, on account of the external manifestations. In the only case which has come under my

observation, the mucous membrane of the larynx was of a peculiar reddish-yellow color, and the vocal cords had the grayish appearance which has been described by Prof. Elsberg. The epiglottis, supra-arytenoid cartilages, ventricular bands, and vocal cords were nodulated, as seen in the drawing (Fig. 102) which I made for Dr. Hyde in illustration of the case. In

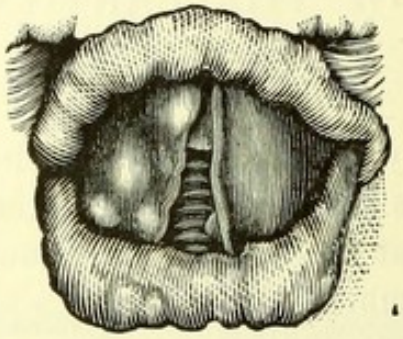


FIG. 102.—Lepra of larynx. Besides the irregular thickening of the epiglottis and ary-epiglottic folds, five distinct tubercles can be seen on the vocal cords and ventricular band, and one is indistinctly seen on the anterior surface of the infraglottic portion of the larynx.

some cases, the nodulation, deformity, and ulceration are extensive, and differ considerably from the changes found in the case just referred to. See Fig. 103.

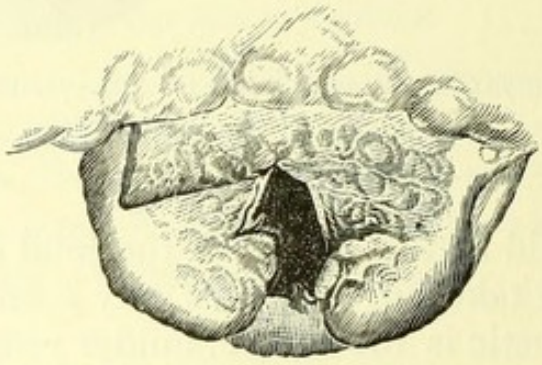


FIG. 103.—Leprosy of larynx (Elsberg).

TREATMENT.

The case reported by Dr. Hyde was given internally an emulsion of chaulmoogra oil in gradually increasing doses from five to sixty minims daily. At the same time, an ointment containing the same oil was applied to the surface. This ointment was made of one part of chaulmoogra oil to four or five parts of lard. After several months of this treatment, the patient reported that his voice was becoming clearer and the tubercles upon the skin were diminishing in size. Several

months later he again reported constant improvement. In the case of this patient's leprous daughter, a complete cure followed the use of this remedy.

HYPERTROPHY OF THE LARYNX.

Dr. J. Solis Cohen mentions one case to which he has given this name. In that instance, all the tissues of the larynx seemed hypertrophied, so as to necessitate tracheotomy for the relief of dyspnœa. There was no alteration in the color of the mucous membrane.

TREATMENT.

No special treatment can be recommended.

SECONDARY DISEASES OF THE LARYNX.

The larynx is frequently involved in the acute eruptive fevers. I have seen one case associated with and evidently dependent upon chronic eczema.

SMALL-POX.—In small-pox, the laryngeal mucous membrane may be affected with a mild eruption; or by severe inflammation with exudation and the formation of false membrane, which may have the same effect as the similar membrane in true croup.

MEASLES.—In measles, catarrhal laryngitis may precede the eruption for a day or two, or it may occur when the eruption has nearly disappeared. In the latter case it often proves obstinate, and, judging from my own experience, it frequently leaves permanent impairment of the voice, due in some cases to thickening of the ventricular bands.

In other instances, from the third to the sixth day after the eruption, exudative or croupy inflammation of the larynx occurs, which is very likely to prove fatal.

In young children, the diagnosis of this form of laryngitis must depend upon the history and the symptoms, but in those who are older the laryngoscopic appearances may aid us.

SCARLET FEVER.—Scarlatina is sometimes, though rarely, complicated with œdema or croupy inflammation of the larynx, which, in young children, will be indicated only by the symp-

toms of croup or œdema; in those who are older the condition may be readily diagnosticated by the aid of the laryngoscope.

TREATMENT.

The treatment of the secondary throat affection in these diseases is essentially the same as that of simple catarrhal sore throat. Compressed pills of chlorate of potassium are useful in many cases, and sedative troches may give great relief. Obstruction of the larynx calls for tracheotomy. The primary disease must receive our principal attention.

MORBID GROWTHS.

Tumors in the larynx consist of growths of several varieties similar to those found in many other portions of the body. A great majority of these are benign; and of these, the most frequent are papillary or warty formations which constitute about seventy-five per cent of all laryngeal tumors. Fibrous tumors are next in frequency. Next to these are fibro-cellular growths which, though constituting only five per cent of all of the intra-laryngeal tumors, are more frequent than cystic, sarcomatous, or lipomatous tumors, or malignant epithelial and encephaloid growths.

SYMPTOMS.

The symptoms caused by a tumor in the larynx depend upon its size and position, and they are essentially the same whatever its nature. The usual symptoms, which vary of course with the size of the growth and the part of the larynx involved, are: cough, dysphonia or aphonia, dyspnœa, dysphagia, and occasional pain.

Cough is not apt to be troublesome unless the growth is large or involves the glottis, or has a tendency to bleed. When it does occur, it is often paroxysmal and of a croupy character.

Hoarseness, or even complete loss of voice, will occur when the growth is located on the vocal cords, or when from its position or the concurrent inflammation it interferes with their free vibration. Not infrequently the aphonia is intermittent, coming or disappearing suddenly with changes in the patient's position.

Dyspnœa occurs whenever the neoplasm is sufficiently large to materially obstruct the respiratory passages.

Dysphagia.—Difficulty in swallowing is not a common symptom, but it may be troublesome whenever the tumor involves the epiglottis or posterior laryngeal wall, or when it is so large as to encroach upon the pharynx.

Pain.—Acute pain is not common, although patients often complain of aching or discomfort, as though there were a foreign body in the throat, and in occasional instances there are severe paroxysms of pain. In one of the malignant cases which have fallen under my observation, severe pain was for a long time one of the most prominent symptoms. In some cases which I have treated, even of small growths on the vocal cords, patients have noticed slight pain, especially during deglutition.

SIGNS.

A laryngoscopic examination will usually at once reveal the presence of the morbid growth, but it is impossible to be certain as to its character until some portion of it has been subjected to microscopic examination. Even then the diagnosis is not always certain, for laryngeal tumors of a malignant histological appearance have often possessed a non-malignant history from first to last.

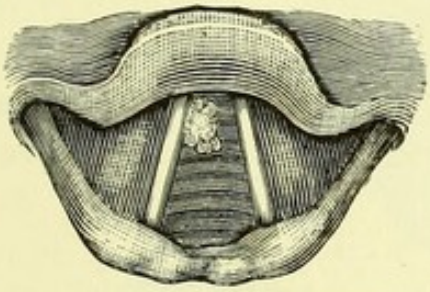


FIG. 104.—Papilloma of right vocal cord.

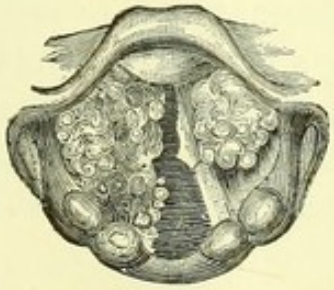


FIG. 105.—Multiple papilloma (Mackenzie).

PAPILLOMATA are warty growths which spring from the mucous membrane. They usually have an irregular, cauliflower, or raspberry-like surface, of a pale pink or whitish color, but sometimes they are intensely red. They are usually about the size of a pea, but they may not be larger than a small seed; however, a few attain the size of a filbert. These are most commonly found on the upper surface or free margin of the vocal cord, but they may spring from its under surface or

occasionally from other parts of the larynx. These tumors are nearly always sessile, but occasionally pedunculated. The surrounding mucous membrane may be either healthy or inflamed.

FIBROMATA.—Fibrous tumors, the second in frequency of occurrence, are usually seen as small round or oval pedunculated tumors, of a red or grayish color, attached to the anterior extremity of the vocal cord. They vary in size, but seldom exceed the dimensions of a large pea. When touched with a probe they are found firm and resisting. They are developed from the submucous connective tissue.

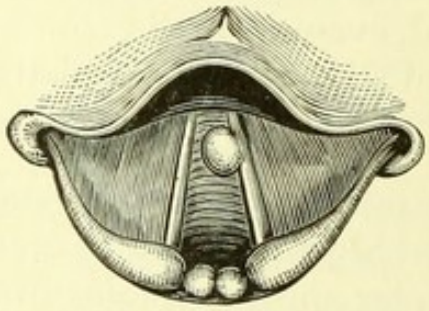


FIG. 106.—Fibroma of left vocal cord.

FIBRO-CELLULAR tumors consist of more or less perfectly developed fibrous growths having a serous-like fluid diffused through their substance. By Mackenzie these are classed as soft fibromata. These are small pyriform or globular growths, having a smooth or slightly irregular surface, of a pale pinkish or reddish hue. They are usually pedunculated, but may be sessile. They are generally attached to the vocal cords or laryngeal surface of the epiglottis.

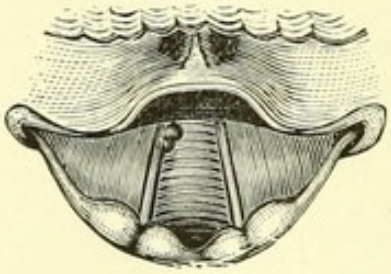


FIG. 107.—Fibro-cellular tumor on right vocal cord.

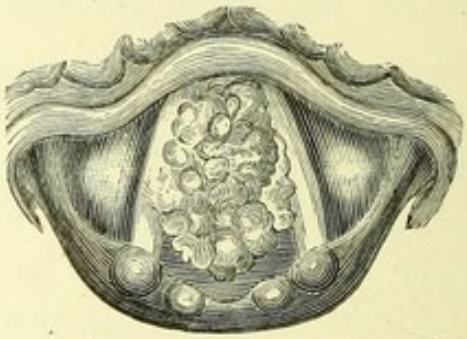


FIG. 108.—Myxoma (Mackenzie).

MYXOMATA or true mucous tumors are extremely rare in the larynx. When found they closely resemble fibrous tumors,

but they are softer to the touch and they may be translucent (Fig. 108).

CYSTIC GROWTHS.—Cystic tumors of the larynx are usually of a white or reddish color, and surrounded by a zone of congested mucous membrane. They vary from the size of a millet seed to that of a small cherry. They are generally sessile and globular in form. They usually grow from the laryngeal surface of the epiglottis or from one of the ventricles. They are ordinarily filled with semi-fluid sebaceous-like material.

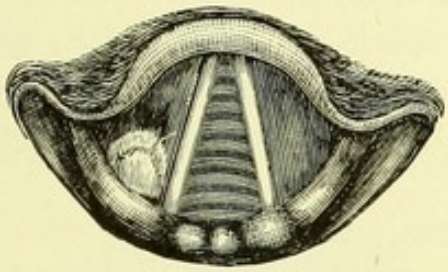


FIG. 109.—Cystic growth in right ventricular band.

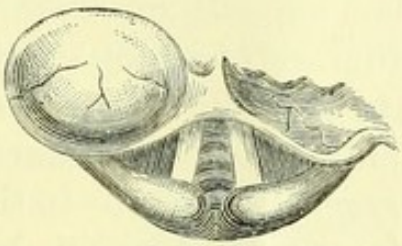


FIG. 110.—Cyst of epiglottis (Mackenzie).

FASCICULATED SARCOMATA, ADENOMATA, AND LIPOMATA possess no characteristic appearances and are extremely rare.

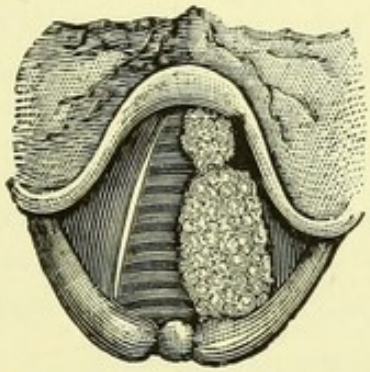


FIG. 111.—Mixed sarcoma.

This tumor was found in a man, about fifty years of age, who had been troubled with dysphonia for about two years, and with some dyspnœa for a few months. The growth was so firm as to resist attempts at evulsion or crushing. Prof. I. N. Danforth made a microscopic examination of some portions which I removed, and pronounced it a mixed sarcoma.

ANGIOMATA or vascular tumors are also exceedingly rare. They may be recognized by their dark color and their tendency to bleed when touched.

DIAGNOSIS.

The affections most likely to be mistaken for benign growths

in the larynx are: syphilitic or tuberculous laryngitis, malignant tumors, lepra, lupus, and fibrous cartilaginous or lymphoid outgrowths, and eversion of the ventricle.

Syphilitic condylomata are comparatively rare; they generally follow the inoculation in five or six weeks. They consist of slightly raised irregular prominences, of a whitish color, and situated on a congested mucous membrane. The history of the case is therefore different from that of tumors; the prominences in syphilis are not so conspicuous as tumors; they are situated on a congested membrane and usually at the back of the larynx, neither of which features is common with any of the tumors of which we have been speaking. Again, condylomata speedily disappear under the influence of astringents and antisyphilitic treatment.

Laryngeal Phthisis.—In this affection, small warty excrescences are frequently formed, but the history of the case and the presence of ulcers should prevent errors in diagnosis.

Lepra appears never to attack the mucous membranes primarily, therefore the condition of the skin will prevent error.

Lupus.—In this affection, the thickening much resembles that of syphilis, and it is soon followed by destructive ulceration, in which respects it differs from non-malignant laryngeal tumors.

Outgrowths are at once distinguished from tumors by the absence of any demarcation between the growth and the surrounding tissues.

Eversion of the ventricle is a very rare affection, and therefore not likely to be mistaken for tumors.

Carcinoma.—It is sometimes extremely difficult to distinguish between non-malignant and malignant tumors of the larynx. The differential features will be pointed out presently when speaking of cancer.

Care must be taken not to confound these various growths with the fungous granulations, which are sometimes observed in ulceration of the larynx. The treatment of these growths will be considered together with that of cancer of the larynx.

CANCER OF THE LARYNX.

Cancer of the larynx usually affects only one side at first, but

it gradually increases in size until all the surrounding tissues may become involved.

SYMPTOMS.

Pain, dyspnœa, and dysphagia are usually present. The pain is generally confined to the larynx until ulceration has taken place, after which it may radiate to the ears, orbits, or forehead.

SIGNS.

Early in the disease, the case may present simply the signs of catarrhal inflammation; but soon a circumscribed tumor, which is more or less regular in outline, appears beneath an apparently healthy mucous membrane, which, however, soon becomes vascular or livid.



FIG. 112.—Cancer of the larynx.
This growth was supposed to be a simple papilloma, but a microscopic examination showed it to be of a semi-malignant character. About four weeks after its removal, the disease appeared in the ventricular band and ary-epiglottic fold, and ran a rapid course.

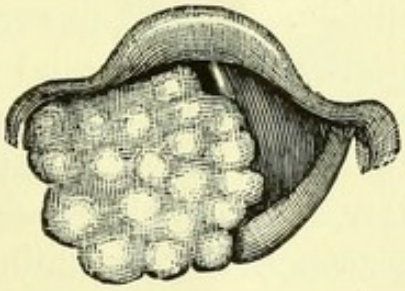


FIG. 113.—Cancer of the larynx.
This drawing was made from the larynx of a man, about sixty years of age, who had been troubled with his throat for about four months. A diagnosis of cancer frightened the patient away, and I did not see him again for two months, by which time ulceration had taken place and considerable deformity had occurred from the continued growth of the tumor.

As the irregular thickening progresses, the epiglottis or other portions of the larynx may be crowded far from their normal position, and erelong ulceration occurs, with great destruction of tissues, so that the parts finally become almost unrecognizable.

In the encephaloid variety, the tumor appears as a single nodule, which soon ulcerates. Vegetations then spring from the surface of the ulcer, but they do not involve the surrounding mucous membrane and the ulcer extends but slowly.

In the epithelial variety, which is by far the most frequent, as soon as an ulcer occurs vegetations spring up about its margins, which in their turn speedily ulcerate and thus cause rapid extension of the original ulcer.

Scirrhus at first appears much like a papillary or fibrous tumor, but its surface and the surrounding tissues soon become inflamed, and the larynx becomes distorted by its irregular growth.

DIAGNOSIS.

At first the diagnosis may be very difficult, but the history of the case, the absence of syphilis, the patient's age—past middle life—the appearance of the growth, and in some instances the peculiar lancinating pains, render the diagnosis comparatively clear. The occurrence of an irregular dirty gray or red swelling on one of the ventricular bands presently places the diagnosis almost beyond the possibility of error. When ulceration begins, the irregular tumor, and the fungous character of the ulcer which is bathed in pus or bloody muco-purulent matter, leaves little room for doubt. Finally the microscopic appearances and the failure of anti-syphilitic treatment exclude benign growths, syphilis, and tuberculosis, and make the diagnosis certain. Small ulcerated cancers of the epiglottis, or other portions of the larynx, may be mistaken for tuberculous or syphilitic ulcers; but as the disease is usually secondary to cancer in other situations, the history and concomitant symptoms and signs will nearly always determine the nature of the case.

TREATMENT.

Operative procedures are not advisable when tumors are small and cause the patient no special inconvenience, but, as most of these growths are caused by chronic catarrhal inflammation, we should employ the treatment recommended when speaking of catarrhal laryngitis (page 339). This treatment will frequently cause a diminution in the size of the tumor, and it will occasionally effect a cure. Benign tumors, which interfere with the voice so as to cause serious inconvenience, and tumors causing dyspnœa, should be removed. The operation may be done *internally* through the upper orifice of the larynx, aided by the laryngeal mirror; or *externally* by direct incision;

or both these methods may be employed. When a laryngeal tumor seriously interferes with respiration, unless it can be promptly removed, tracheotomy must be performed to prevent suffocation. Tumors, except those of cystic character, may be torn away in many cases by common laryngeal forceps or by tube forceps. They may be crushed and more or less completely torn away by the same instruments; or they may be removed by scissors, guillotines, knives, snares, the galvano-

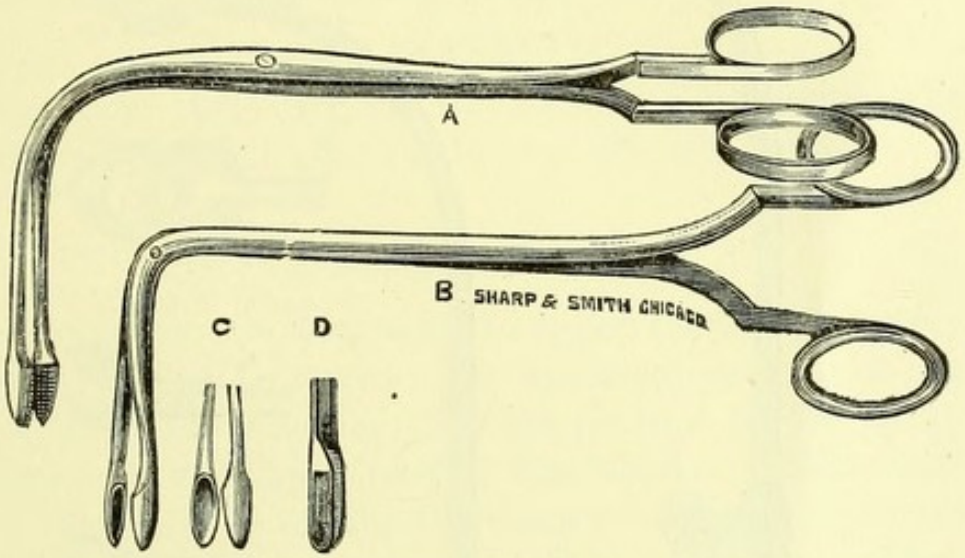


FIG. 114.—Mackenzie's common laryngeal forceps. $\frac{2}{3}$ ordinary size. *A*, lateral forceps. *B*, antero-posterior forceps. *C* and *D*, cutting forceps.

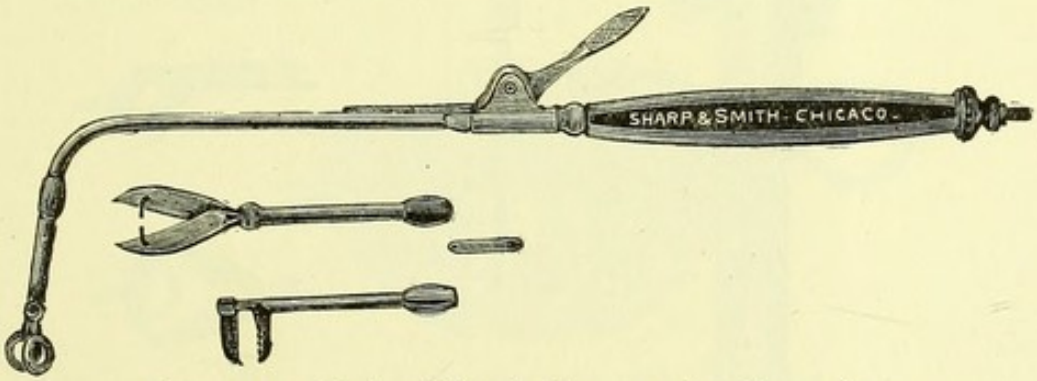


FIG. 115.—Mackenzie's tube forceps. $\frac{1}{3}$ ordinary size.

cautery, or cutting forceps. After removal of the growth, its base should be thoroughly cauterized to prevent repullulation.

Cystic growths should be incised, emptied as completely as possible, and the sac thoroughly cauterized.

Malignant growths are necessarily fatal, and should not be disturbed unless they interfere with respiration. In many cases, life may be prolonged by removing portions of the growth, or by performing tracheotomy.

The entire larynx may be extirpated; but, even if successful, the operation can add a few months only to the patient's miserable existence, and therefore it seems to me cruel to counsel it. Tracheotomy usually lengthens life several months.

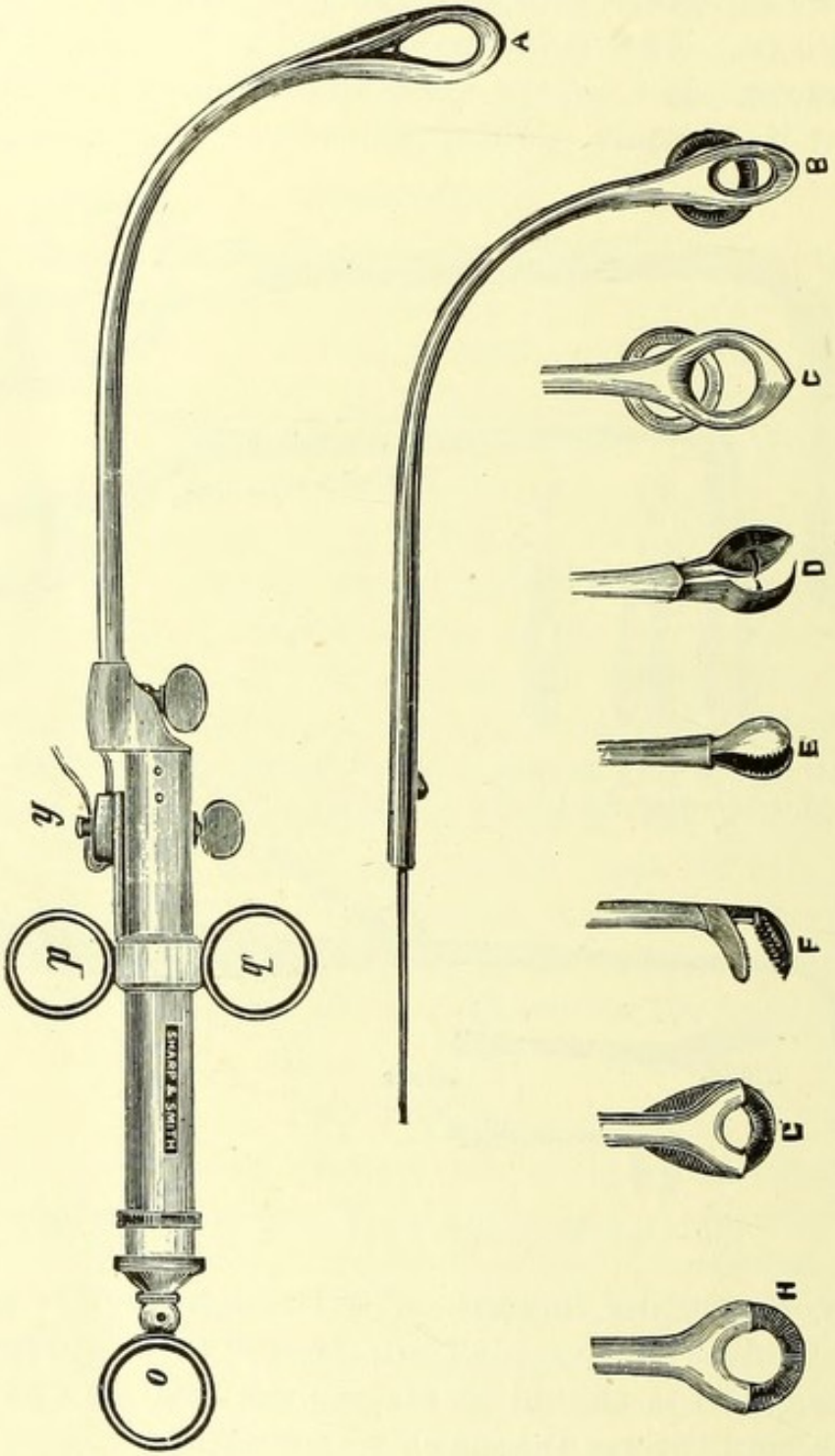


FIG. 116.—Stoerk's instruments. A, ecraseur. B, C, G, and H, guillotines of various size and form. D, E, F, forceps blades of different kinds.

Dr. Seiler has modified this instrument, and rendered it more universally useful by substituting for the tube a coiled wire spring, which moves over an internal rod of copper which may be bent at any angle.

EVERSION OF THE VENTRICLES.

This is of very rare occurrence. I am not aware that more than three such cases are on record. One of these was diagnosticated before death by Dr. Lefferts, of New York, but the others were not detected until the autopsy. Therefore we are unable to give any distinctive signs. This condition is likely to be mistaken for a morbid growth.

TREATMENT.

In the case recorded by Dr. Lefferts, thyrotomy was performed, and the everted sacculus cut off with scissors.

TRACHEAL TUMORS.

Tumors in the trachea, near it supper extremity, may generally be seen by laryngoscopic examination, but it may be difficult to decide whether they are located below the cricoid cartilage or in the lower part of the larynx. Great care must always be observed in the diagnosis of disease of the trachea, otherwise we are liable to be misled by imperfect reflection of the light. A poor illumination may apparently reveal objects that do not exist.



FIG. 117.—Tumor in upper part of trachea.

This tumor occurred in a patient about sixty years of age, but owing to the large size of his trachea it gave him very little inconvenience, and therefore he declined to have any attempt made for its removal. The symptoms in the case were hoarseness and moderate dyspnœa.

TREATMENT.

It is very difficult to reach subglottic tumors with the forceps introduced through the mouth, but it may occasionally be accomplished. Tracheal tumors must generally be removed after tracheotomy or thyrotomy.

INVOLUTION OF THE TRACHEA.

Internal bulging of the trachea from external pressure causes the appearance of a morbid growth. The diagnosis will depend upon the discovery of its cause.

TREATMENT.

The treatment consists of such remedies or operative procedures as will remove the growth which causes the compression. When these are of no avail, and dyspnœa becomes urgent, tracheotomy may be performed, and one of König's long flexible canulæ introduced.

TRACHEOCELE.

This consists of a hernial protrusion of the mucous membrane of the trachea between its cartilaginous rings. Several cases have been reported by Larry, under the title of aërial goitre. The internal orifice may sometimes be detected by laryngoscopy.

TREATMENT.

Some mechanical contrivance should be so applied as to prevent distention and growth of the sac.

FOREIGN BODIES IN THE LARYNX.

Foreign bodies are usually introduced into the larynx through the mouth during deglutition; but they sometimes enter through wounds, and occasionally they pass up from the trachea or œsophagus. The foreign bodies which are most commonly found in this position are pins, fish-bones, particles of food, nuts, shells, coins, pebbles, buttons, or artificial teeth with their plates.

SYMPTOMS.

The symptoms vary according to the size, shape, and location of the foreign body. If the body becomes fixed, and is very large, so as to close the rima glottidis, death immediately follows.

Smaller bodies or bodies differently located cause sensations

of discomfort or pain. There will be cough and more or less alteration of the voice, which may be attended with suffocative paroxysms, due to spasm of the glottis or to inflammation and swelling caused by irritation from the foreign substance.

SIGNS.

Excepting in children, the position of the foreign body can usually be discovered at once upon laryngoscopic examination.

DIAGNOSIS.

The history of the case and the laryngoscopic examination will generally settle the question of diagnosis. In young children the history alone must suffice, and this is sometimes so imperfect that the diagnosis cannot be made.

Hysterical patients often imagine the presence of a foreign body in the larynx, but in these cases the history and symptoms and evidence discovered by inspection will usually reveal the true nature of the disease.

TREATMENT.

The foreign body should be removed at the earliest possible moment by means of laryngeal forceps, if time is allowed and the conditions are favorable; otherwise tracheotomy should be performed at once, to prevent suffocation. After tracheotomy the foreign substance may be removed, sometimes through the wound in the trachea, sometimes *per vias naturales*, by the aid of forceps, or occasionally by simply shaking the patient with his head downward.

FOREIGN BODIES IN THE TRACHEA.

Foreign bodies gain access to the trachea in the same manner as to the larynx. The bodies themselves are usually small, otherwise they would be caught in the larynx.

SYMPTOMS.

If the body is large, or if considerable fluid has entered the trachea with it, speedy suffocation may ensue. Otherwise the body may remain in the trachea or pass into one of the main bronchi—usually the right—or into some of the subdivisions of the bronchus, where it may remain for a variable time, causing

more or less dyspnœa and cough, or exciting inflammation of the surrounding tissues.

SIGNS.

The foreign substance may sometimes be seen with the laryngoscope. If it blocks up one bronchus more than the other, diminished vocal fremitus and a feeble vesicular murmur, with perhaps sonorous râles, will generally be detected over that portion of the lung which is supplied by the obstructed bronchial tube, or the respiratory murmur may be wholly absent in this region.

DIAGNOSIS.

The history and symptoms, taken in connection with part or all of the signs just mentioned, usually render the nature of the case certain. A laryngoscopic examination, even though it should not enable us to detect the foreign body, is very important for the purpose of excluding other affections.

TREATMENT.

If the symptoms are severe, tracheotomy must be performed immediately. When the trachea has been opened, if the lips of the wound are held apart, the offending material will often be coughed out. If it is not at once expelled it should be extracted with forceps, if possible.

Shaking the patient, with his head downward, will often dislodge the foreign body, and cause its removal. If the dyspnœa is not great, this plan should be tried before tracheotomy; the surgeon meanwhile having everything in readiness for the operation at any instant, in case there is spasm of the glottis. After tracheotomy there can be no danger from spasm in this attempt. If, after opening the trachea, the object cannot be secured, the lips of the wound should be stitched to the surrounding tissues, and no canula introduced.

LECTURE XXXII.

DISEASES OF THE LARYNX—Continued.

SPASM OF THE LARYNX.

Synonyms.—Laryngismus stridulus; Spasmus glottidis; Suffocative laryngismus; Spasm of the glottis; Spasmodic croup, and Cerebral croup.

This is a condition in which there is a temporary, complete or incomplete, spasmodic closure of the glottis or vestibule of the larynx, preventing free inspiration. It is characterized in the former case by cessation of the respiratory movements, and in the latter by stridulous respiration, almost identical with that of true croup or whooping cough.

It is a purely nervous disease, and was formerly believed always to result from cerebral disorders. It is now known to be due also to direct or reflex peripheral irritation from a great variety of causes, for example, pressure on the recurrent laryngeal nerve, the presence of irritating substances in the alimentary canal, or irritation of the gums due to dentition.

SYMPTOMS.

The attack usually comes on suddenly in the night. The child awakens in fright from great dyspnœa or temporary suspension of respiration. After a few respirations it cries out and soon falls asleep as though nothing had occurred. In severe cases the symptoms are more violent: the breathing suddenly becomes difficult, inspiration is prolonged and stridulous, and in a few moments the respiratory movements cease, in consequence of the complete closure of the glottis; the face, which was flushed, becomes pallid, and this is speedily followed by lividity; the eyes roll, the veins in the neck become turgid, and there are spasmodic contractions of the hands and feet.

In mild cases the attacks often do not recur again until the following night. The severer the paroxysms the greater will

be the rapidity and violence with which they succeed each other.

DIAGNOSIS.

This disease is not likely to be mistaken for any other except true croup, from which it may be diagnosticated by the absence of fever and the intermittence of symptoms between the paroxysms.

TREATMENT.

During the paroxysm, flagellation, or dashing cold water in the face, are the most common remedies.

To terminate the spasm and prevent its recurrence, in the majority of cases nothing is better than fifteen or thirty-drop doses of the compound syrup of squills, which should be repeated every fifteen minutes until vomiting occurs. Turpeth mineral is given for the same purpose in doses of half a grain to two grains, or even more. Teaspoonful doses of powdered alum act promptly and efficiently.

The cause of the spasm must be sought for and removed. It is most commonly found in some derangement of the digestive organs associated with slight catarrhal laryngitis. The spasm may be caused by an enlarged thymus gland, especially in young children. It has been known to be produced by irritation of the prepuce. It is not infrequently caused by hysteria or cerebral or cerebro-spinal disease. Subsequent to the paroxysm, vegetable tonics, cod-liver oil, and the bromides are generally beneficial.

IRRITATIVE COUGH.

This is a dry, hacking, and sometimes paroxysmal cough, apparently of nervous origin.

SYMPTOMS AND SIGNS.

The cough is most frequent in the morning. It is usually referred to the region of the trachea.

Hyperæmia may or may not be present. The cough may be associated with disorders of the digestive organs or of the uterus, and it is sometimes very violent during dentition.

TREATMENT.

Inflammation of the larynx should receive appropriate treatment. Antispasmodics will be required to check the tendency to cough.

SPASMODIC COUGH.

We occasionally observe a peculiar spasmodic cough, which occurs independent of any appreciable lesion, to which this name is applied. This variety of cough is most frequent in hysterical females, but it also occurs in males. The cough usually has a characteristic tone, resembling the cry of some of the lower animals, most frequently the yelping of a small dog.*

TREATMENT.

No very satisfactory method of treatment can be recommended, though electricity has proven effectual in some cases.

ANÆSTHESIA OF THE LARYNX.

This, as the name indicates, is a loss of sensibility of the mucous membrane of the larynx.

It is usually caused by diphtheria or bulbar paralysis, but partial anæsthesia sometimes exists in hysteria. The insensibility may be confined to the supraglottic mucous membrane, or it may extend into the trachea. Sometimes it is confined to one side of the larynx. It may be partial or complete. In the latter case, it is usually associated with more or less paralysis of the depressors of the epiglottis, which prevents proper closure of this valve during deglutition; consequently particles of food find their way into the larynx, from which, owing to the insensibility of the mucous membrane, they are not coughed up. These particles are likely to descend into the bronchial tubes, where they set up an irritation which may eventuate in pneumonia.

SYMPTOMS.

Dysphagia is commonly the only prominent symptom.

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* Cohen, Diseases of the Throat.

SIGNS.

The laryngeal mucous membrane has a normal appearance, but it is found more or less completely insensible when touched with a probe.

TREATMENT.

Locally.—The daily application for five or ten minutes at each sitting of galvanic or faradic currents of electricity, sufficiently strong to cause discomfort but not pain, has been recommended. *Internally.*—Tonics, especially strychnia, are indicated. The patient should be fed through the œsophageal tube, if necessary, to prevent food from entering the larynx.

HYPERÆSTHESIA OF THE LARYNX.

This consists of an abnormal sensibility of the mucous membrane of the larynx, or of regularly intermittent neuralgia, unaccompanied with visible changes in structure. This abnormal sensitiveness of the larynx is most frequently caused by hysteria or excessive use of the voice. Rheumatism may be another cause. Neuralgia in this locality is often produced by exposure to cold.

SYMPTOMS.

These are: great irritability of the parts with various sensations, as burning, pricking, etc. There is often the sensation as of a foreign body in the throat.

SIGNS.

There is a normal appearance of the mucous membrane and excessive irritability and intolerance of instrumental manipulation.

DIAGNOSIS.

The diagnosis will rest upon the peculiar intolerance of manipulation and the absence of visible structural changes.

TREATMENT.

Internally.—Remedies are indicated which are calculated to overcome the constitutional disorder, as, tonics for hysteria; iodide of potassium or guaiacum for rheumatism; also the bromides for their peculiar local effect. *Locally.*—The parts

may be brushed daily or on alternate days with a solution of morphia, carbolic acid, and tannin (Form. 91).

MOTOR PARALYSIS.

The various forms of paralysis of the larynx may result from tumefaction of the muscles or adjacent tissues, or from compression of morbid growths or foreign bodies. They also result from deficient innervation, which may result from traumatic injuries, or from other lesions of the laryngeal nerves, or from cerebral disease.

Motor paralysis from lesions of the nerve-trunks may exist alone, or it may be associated with paralysis of sensation. It may be partial or complete, and unilateral or bilateral, and it may involve one or several muscles. The larnyx alone may be involved, the pharynx and palate may be similarly affected, or the disease may be associated with general paralysis.

Unilateral paralysis is generally due to local affections, or to injury of the nerve-trunk.

Paralysis affecting the muscles of both sides is more often the result of cerebral disease or of functional disturbance. In order to be able to diagnosticate the various forms of motor paralysis and to detect their causes, you must be familiar with the origin of the laryngeal nerves and the arrangement of the laryngeal muscles.

Nerves.—All of the muscles of the larynx—except the crico-thyroids and possibly the thyro-epiglottic and ary-epiglottic, which are supplied by the superior laryngeal nerve—receive their motor nervous supply from the recurrent laryngeal branches of the pneumogastric nerve.

Muscles.—All of the muscles concerned in the movements of the larynx, excepting the arytenoideus, occur in pairs.

They are the crico-arytenoidei postici, known also as the abductors of the vocal cords; the crico-arytenoidei laterales and the single arytenoideus muscle which are the adductors of the vocal cords; also the thyro-arytenoidei externi and interni or vocal muscles, sometimes called the laxors of the vocal cords; and besides these the crico-thyroidei or tensors of the vocal cords, and two other pairs which constrict the upper orifice of the larynx, viz., the thyro-epiglottici or depressors of the epi-

glottis, and the ary-epiglottici or compressors of the sacculi laryngis.

PARALYSIS OF THE THYRO-EPIGLOTTIC AND ARY-EPIGLOTTIC MUSCLES—(Depressors of the Epiglottis).

This affection is most commonly caused by diphtheria, but it also occurs in general paralysis, and it is one of the phenomena of progressive bulbar paralysis.

SYMPTOMS.

The symptoms are mainly due to the escape of fluid or particles of food into the larynx during deglutition, with consequent paroxysms of pain, coughing, and dyspnœa. The latter do not occur if anæsthesia is also present.

SIGNS.

Upon inspection with the laryngoscope, the epiglottis is seen to remain erect during the imperfect acts of deglutition, which may be made with the mouth open and the tongue protruded. When the affection follows diphtheria, it is usually associated with paralysis of the palate or of the pharynx, and anæsthesia of the larynx.

DIAGNOSIS.

The diagnosis can be made with accuracy only by laryngoscopic examination and discovery of the signs just mentioned.

TREATMENT.

The treatment indicated is usually the same as that for anæsthesia of the larynx.

PARALYSIS OF THE CRICO-THYROID MUSCLES—(External Tensors of the Vocal Cords).

This form of paralysis generally occurs on both sides, but it is occasionally unilateral. It generally results from diphtheria or exposure of the neck to cold draughts, or from overstraining the voice in singing or shouting, especially during inflammation of the throat. It has been produced by injury to a small branch of the superior laryngeal nerve in ligating the

common carotid artery. Complete paralysis of the crico-thyroid is very rare. It is sometimes associated with paralysis of the adductors and laxors of the cords.

SYMPTOMS.

Besides the symptoms due to co-existing anæsthesia, persons affected with this form of paralysis lose control of the voice, so that frequently they are unable to command the high notes. Sometimes during ordinary conversation, there is a peculiar sliding rise in the pitch of the voice which cannot be prevented. Prolonged use of the voice is sometimes fatiguing or even painful.

SIGNS.

In moderate cases, the diagnosis must rest largely on the foregoing symptoms, but in some instances there is some congestion, and in others a pearly translucent appearance of the vocal cords, which are seen to be relaxed longitudinally, so that the glottis presents a wavy outline (Fig. 118). Complete

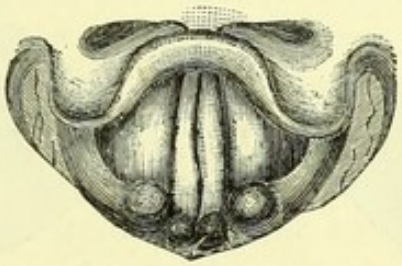


FIG. 118.—Bilateral paralysis of the crico-thyroid muscles (Mackenzie).

paralysis of the crico-thyroid may be easily detected by placing the finger on the outer portion of this muscle during the act of speaking, when, if paralysis exists, there will be absence of tension of the muscle.

TREATMENT.

Internally.—We should administer strychnia and other tonics. *Locally.*—The daily use of faradic or galvanic currents of electricity is sometimes beneficial. When anæsthesia co-exists, food should be introduced through the œsophageal tube to prevent its passage into the larynx.

PARALYSIS OF THE THYRO-ARYTENOID MUSCLES—

(Laxors of the Vocal Cords).

The affection may be either unilateral or bilateral. This form of paralysis is of common occurrence. It is often associated with paralysis of the crico-thyroid muscles and the adductors of the cords. It usually results from straining the voice, especially when the larynx is inflamed, or during the change of voice at the period of adolescence.

SYMPTOMS.

The symptoms are harshness and high pitch of the voice, with fatigue and sometimes pain upon talking. When associated with paralysis of other muscles, the voice may be feeble or aphonic.

SIGNS.

Upon inspection, the vocal cords are seen to gape during phonation throughout their entire extent (Fig. 119). If only

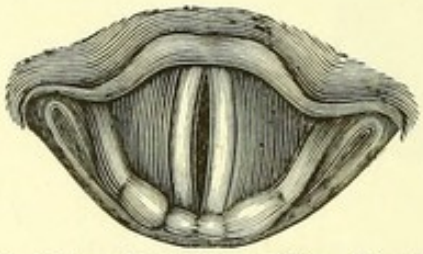


FIG. 119.—Acute laryngitis. Paralysis of the thyro-arytenoid muscles.

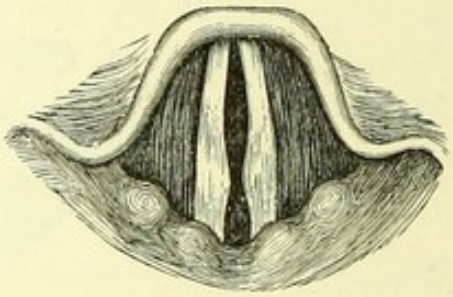


FIG. 120.—Paralysis of the thyro-arytenoid muscles and partial paralysis of the arytenoid.

one side is affected, the gaping will be less. The vocal cord upon that side will be relaxed and concave, and will sag downward in the middle, but the free edge of the opposite cord will remain straight. When the arytenoid muscle is also affected the ellipse will be incomplete at the vocal processes, as the cartilaginous portion of the glottis also gapes, causing the appearance represented in Fig. 120.

DIAGNOSIS.

The diagnosis will be readily made from the symptoms and the appearance of the vocal cords during phonation.

TREATMENT.

Internally.—We should give strychnia, and other tonics if necessary. *Locally.*—Good results often follow the use of the galvanic or faradic currents for a few moments daily. The patient should carefully and systematically exercise the voice.

BILATERAL PARALYSIS OF THE LATERAL CRICO-ARYTENOID MUSCLES—(Adductors of the Vocal Cords).

Synonyms.—Paralysis glottidis; Functional aphonia; Aphonia.

This is a condition in which, owing to the non-approximation of the vocal cords, there is partial or complete loss of the voice. It is often associated with paralysis of the arytenoid, and sometimes with paralysis of the posterior crico-arytenoid muscles.

The affection is most commonly caused by hysteria, but it frequently results from acute inflammation, the paralysis remaining after the hyperæmia has disappeared.

Not infrequently it follows excessive use of the voice in professional elocutionists or singers. In rare instances it is observed as an intermittent affection, caused by malaria, and it sometimes results from cerebral lesions.

SYMPTOMS.

The patient speaks in a fatigued whisper. When the paralysis is partial, there is dysphonia or intermittent aphonia, and no sound is produced when the patient attempts to laugh.

When the paralysis is complete, both the voice and the cough are aphonic; but in most cases coughing and sneezing are accompanied with sound.

SIGNS.

The larynx is usually paler than natural, and upon attempts at phonation the vocal cords remain in the respiratory position, being but slightly approximated to each other. In complete paralysis, the glottis remains widely dilated without even the slightest movement of the vocal cords when an attempt is made at phonation. In cases where the abductor muscles are also

paralyzed, the cords maintain the cadaveric position midway between phonation and inspiration. Sometimes this form of paralysis is associated with a loss of voluntary control over the diaphragm, and then not only is the loud voice lost, but the patient is also unable to whisper.*

DIAGNOSIS.

The history and symptoms of the case, together with the respiratory or cadaveric position of the vocal cords during attempts at phonation, leave no room for doubt as to the diagnosis.

TREATMENT.

Internally.—We should administer quinine, arsenic, iron and strychnia in tonic doses, with nutritious diet. *Locally.*—Faradization of the muscles with one electrode within the larynx, and the other external, will frequently greatly expedite recovery.

When the patient has become thoroughly impressed with the remedial properties of the treatment, indifferent methods will often succeed in this affection; such as inhalations of stimulating vapors, or the simple introduction of the throat mirror. The cure of all hysterical affections is greatly aided by strong mental impressions, which accounts for most of the "cures" performed by ignorant charlatans and magnetic healers.

UNILATERAL PARALYSIS OF THE LATERAL CRICO-ARYTENOID MUSCLE—(Lateral Adductor of the Vocal Cord).

In this form of paralysis, one cord is not drawn to the median line on attempted phonation, and therefore the voice is much impaired or it may be lost.

The affection usually results from local injury of the recurrent laryngeal nerve, or from malignant disease, or from compression of this nerve by aneurismal or other tumors. It is occasionally caused by lead or arsenical poisoning, by exposure to cold, by rheumatism, phthisis, and accidental or surgical wounds. When accompanied with paralysis of the same side of the tongue or palate, it originates in serious cerebral disease.

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* J. Solis Cohen's Diseases of the Throat, second edition.

SYMPTOMS.

The symptoms found in this affection are slight impairment of the voice with loss of volume, and in rare cases aphonia. The sounds produced by singing, coughing, or laughing are more or less altered, and are sometimes the first to be affected.

SIGNS.

In phonation, the affected cord remains at the side of the larynx, while its fellow is drawn to the median line or, as happens in some instances, so far beyond that point that the cords meet at the side of the larynx (Fig. 122). In this instance the

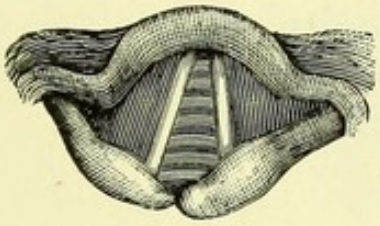


FIG. 121.—Unilateral paralysis of the left lateral crico-arytenoid muscle. Due to the pressure of an aneurism on the left recurrent laryngeal nerve.

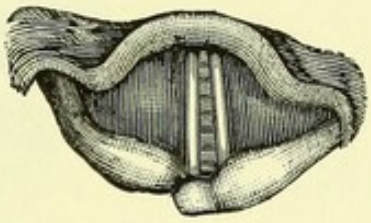


FIG. 122.—The same in phonation.

supra-arytenoid cartilages cross each other, the one from the sound side passing in front. The mucous membrane covering the affected cord is usually congested. Signs of a tumor may generally be obtained in the upper sternal region.

DIAGNOSIS.

The diagnosis is at once settled by a laryngoscopic examination, but the cause of the difficulty must be searched for with great care.

TREATMENT.

The cause must be removed if possible. Local treatment is useless.

PARALYSIS OF THE ARYTENOID MUSCLE—(Central Adductor of the Cords).

In this condition, owing to the non-approximation of the inner surface of the arytenoid cartilages in phonation, there is gaping of the posterior or inter-cartilaginous portion of the

rima glottidis, with consequent impairment of the voice. It is most frequently the result of acute or subacute laryngitis.

SYMPTOMS.

These are: hoarseness, and fatigue in talking.

SIGNS.

Inspection reveals a triangular opening, during phonation, at the posterior part of the rima glottidis. There is usually hyperæmia of the mucous membrane of the larynx.

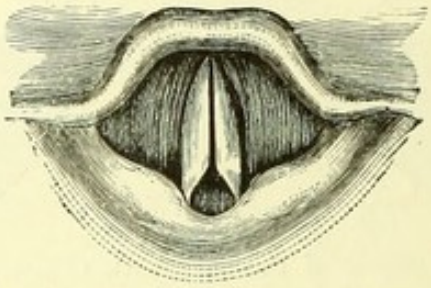


FIG. 123.—Paralysis of the arytenoid muscle (Ziemssen).

DIAGNOSIS.

The diagnosis is not attended with difficulty.

TREATMENT.

The treatment indicated is that for acute laryngitis.

BILATERAL PARALYSIS OF THE POSTERIOR CRICO-ARYTENOIDS—(Abductors of the Vocal Cords).

In this condition, the vocal cords are not drawn aside during inspiration, but remain in the median line, closing the glottis and causing stridulous respiration and great dyspnœa, without altering the voice. Sometimes, associated with this paralysis, there is a spasmodic tendency in the adductors, which adds greatly to the danger of suffocation. This affection is usually caused by disease of the central nervous system, but it may be produced by morbid processes which involve both pneumogastric nerves, or their branches the recurrent laryngeal nerves. Occasionally it is of hysterical, catarrhal, or syphilitic origin. I have observed it in one case of cancer, involving the anterior wall of the œsophagus and implicating both

recurrent laryngeal nerves. It may depend upon simple atrophy of the muscles.

SYMPTOMS.

The symptoms are stridulous respiration, especially during sleep, and great dyspnœa on the slightest exertion. The voice remains natural or suffers only slight alteration, excepting in its force, which is apt to be feeble. Suffocative paroxysms occur, not only on exertion, but occasionally from spasmodic action of the adductors of the cords. The cough is croupy. Inspiration is difficult and stridulous, especially during sleep, but expiration is usually quiet.

SIGNS.

On inspecting the larynx, the vocal cords are seen very near the median line. During respiration the rima glottidis will measure from one to two lines in width (Fig. 124 and 125).

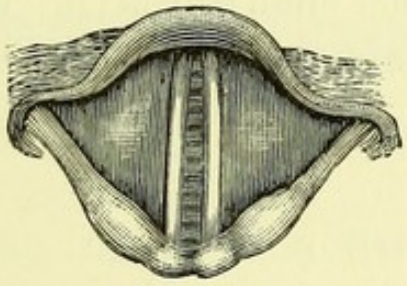


FIG. 124.—Bilateral paralysis of the posterior crico-arytenoid muscles—Inspiration.

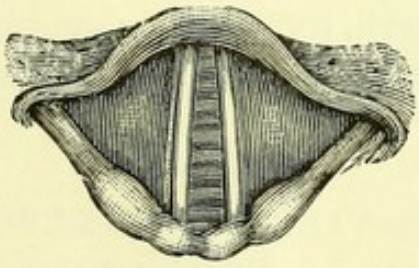


FIG. 125.—Bilateral paralysis of the posterior crico-arytenoid muscles—Expiration.

On inspiration, the lips of the glottis are sucked downward and inward below their normal plane, and with expiration, they are blown upward and the glottis is somewhat dilated, so that the air escapes freely. The vocal cords and the mucous membrane of the larynx may be of a normal color, or slightly congested.

DIAGNOSIS.

In adults, the true nature of the case is at once suggested by permanent inspiratory stridor. The characteristic appearance of the glottis, on inspection, leaves no doubt as to the diagnosis, excepting between this condition and adhesion of the inner surfaces of the arytenoid cartilages, which sometimes so closely resembles it that, in the absence of a previous history,

the differential diagnosis may be impossible. Spasm of the adductors causes symptoms which closely resemble those of this affection, but in cases of spasm the inspiratory dyspnœa is temporary; it is diminished instead of being increased during sleep; and the vocal cords are constantly varying in their degree of adduction instead of being immobile.

TREATMENT.

Tracheotomy should be performed, unless widening of the glottis can be speedily secured. This operation is necessary to prevent suffocation; which is liable to occur at any moment from slight spasm of the adductors. If the patient cannot be closely watched, or if the tendency to spasm is marked, the operation should be done at once; though under more favorable circumstances it is safe to delay it for a short time, as it has been found that some cases will recover without opening the trachea.

Internally.—Strychnia should be employed. *Locally.*—Electricity should be tried, though it is not often beneficial. When catarrh, hysteria, or syphilis seem to be the cause, they should receive appropriate treatment.

UNILATERAL PARALYSIS OF THE POSTERIOR CRICO-ARYTENOID MUSCLE (Abductor of the Vocal Cord).

In this affection, one vocal cord remains in the median line during inspiration, with consequent dyspnœa and stridulous respiration. The affection is due to lesions similar to those which cause bilateral paralysis; but it most frequently results from peripheral causes, as, for example, catarrhal inflammation, or the implication of one pneumogastric or recurrent laryngeal nerve by malignant disease, aneurisms, or other morbid growths.

SYMPTOMS.

The symptoms are: obstructed inspiration, stridor, and dyspnœa, with very slight alteration of the voice. There are also present more or less irritative fever and the symptoms of the disease which has caused the paralysis.

SIGNS.

On inspection, the affected cord is seen to remain stationary at or near the middle line, while the movements of the other cord are normal or slightly excessive.

DIAGNOSIS.

The symptoms and laryngoscopic appearances leave no question about the diagnosis.

TREATMENT.

The cause should be sought for, and if possible removed. *Locally.*—Faradism and galvanism should be resorted to. In applying electricity within the larynx, the electrodes shown in Figures 126 and 127 will be found most convenient.

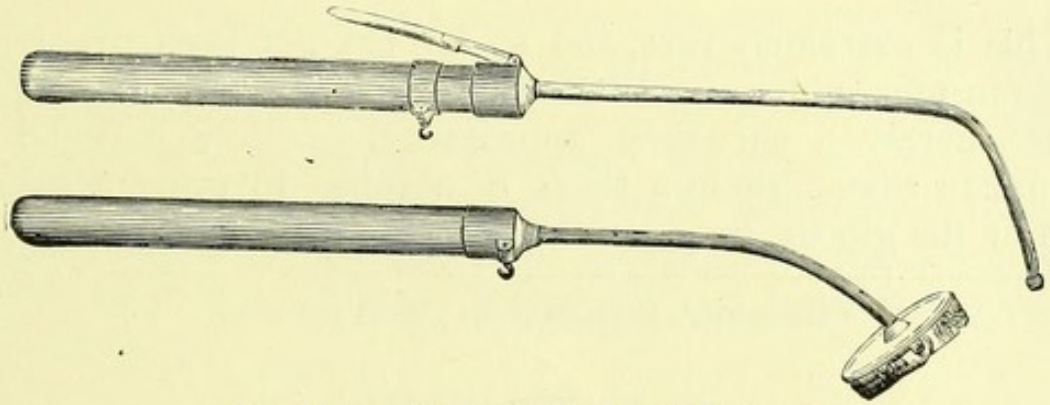


FIG. 126.—Mackenzie's laryngeal electrodes.

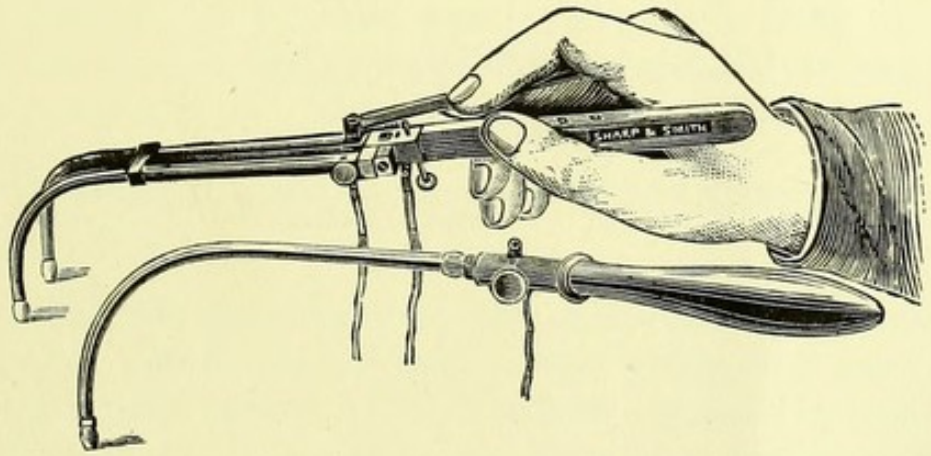


FIG. 127.—Ziemssen's double and single electrodes.

ANCHYLOSIS OF THE ARYTENOID CARTILAGES.

This is a rare affection, of which only a few cases have been recorded. The diagnosis is likely to be attended with great

difficulty, as the affection may closely simulate paralysis, either of the abductors or of the adductors of the vocal cords. The affection should be suspected whenever we find immobility of one or of both cords, with distortion of the cartilages. It should always be looked for when patients convalescing from typhoid fever complain of the symptoms of laryngeal disease.

TREATMENT.

If this condition interferes with respiration, attempts should be made at dilatation of the larynx, though they are likely to be unsuccessful.

ATROPHY OF THE VOCAL CORDS.*

This is extremely rare, and so far has not been proved by post-mortem evidence. When there is wasting, the cords may have merely a shrunken appearance, or they may be so shrunken that, although there is nothing to prevent inspection of the glottis, they cannot be brought into view.

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* Mackenzie's Diseases of the Throat and Nose.

LECTURE XXXIII.

DISEASES OF THE NASAL PASSAGES.

HAY ASTHMA.

Synonyms.—Hay fever; Rose cold; Autumnal catarrh.

Hay asthma is considered with diseases of the nose, because its most prominent and persistent symptom is due to irritation of the nasal mucous membrane.

This affection usually attacks its victims annually, at the same time of the year, and frequently on the same day of the month. It may occur in the spring or summer, but it is far the most common in the latter part of August or during the month of September. It usually continues about six weeks. The disease is characterized by congestion or inflammation, of the mucous membranes of the nasal passages, frontal sinus, and throat; and often of the conjunctivæ and bronchial mucous membrane.

SYMPTOMS AND SIGNS.

The prominent features of this affection are frequent and violent sneezing, a profuse watery secretion from the nasal mucous membrane, and more or less asthmatic dyspnœa.

DIAGNOSIS.

The diagnosis is based on the history and symptoms.

TREATMENT.

Irrigating the nasal cavities with a solution of quinine, gr. ij. to ℥ i. of water, two or three times daily, will cure some cases and benefit others. Relief will be obtained in other cases by insufflation of a powder composed of morphia, one part; quinine, one part; bismuth, twenty parts, and acacia, thirty-eight parts. A weak galvanic current is said greatly to relieve the frontal headache in some cases. The ordinary treatment for asthma will more or less relieve the dyspnœa. Determina-

tion on the part of the patient not to sneeze or use the handkerchief, except to gently wipe the nose, will greatly benefit mild cases. Sneezing may be prevented by pressing firmly on the upper lip when the inclination is felt.

The most effective remedy is change of climate. From this locality patients usually go to the northern parts of Michigan or of Wisconsin, or to Minnesota, where they obtain complete immunity from the disease. Sometimes a slight change, as from the city to the country, or *vice versa*, is sufficient.

ACUTE CORYZA.

Synonyms.—Acute cold in the head; Acute nasal catarrh; Acute rhinitis.

This is an acute inflammation of the mucous membrane of the nasal passages, which is usually caused by exposure to cold; or to the atmosphere of overheated and poorly ventilated rooms.

The inflammation at first causes engorgement of the mucous membrane, with swelling and dryness, which is followed in a few hours by a profuse thin secretion. After two or three days the secretion becomes thicker and muco-purulent.

SYMPTOMS.

Irritation or pain and fullness of the nasal passages, with more or less loss of the sense of smell and taste are present. There is some anorexia, and often considerable fever, especially if the inflammation extends to the throat.

SIGNS.

The mucous membrane is swollen and congested.

DIAGNOSIS.

The history, symptoms, and signs are too familiar to every one to permit of error in diagnosis.

TREATMENT.

At the onset it may usually be aborted by the administration of quinine, gr. x.; Dover's powder, gr. x.; a hot sling at bedtime; carbonate of ammonium, gr. xxv.; or tincture of belladonna, ℥ xx. Inhalations of the fumes of iodine from the

metalloid, of tincture of camphor, or of camphor and iodine, of carbolic acid, or of nascent chloride of ammonium quite continuously used for two or three days will often cut the cold short. Smearing the nasal passages with vaseline will be very useful in soothing the irritation. When the disease has become fully established, the remedies indicated consist of small doses of morphia, grs. $\frac{1}{30}$ to $\frac{1}{16}$, or of tincture of belladonna, ♏ i., or tincture of aconite, ♏ ss.–i., every half-hour for three or four hours, and subsequently less frequently; conjoined with quinine, gr. ij., and chlorate of potassium, gr. v. to x., every three hours.

Warm drinks and other means of promoting diaphoresis, and laxatives, generally hasten the recovery.

CHRONIC CORYZA.

Synonyms. — Chronic nasal catarrh; Chronic rhinorrhœa. This is a chronic inflammatory condition of the nasal mucous membrane, characterized by thickening of the membrane with more or less abundant muco-purulent secretion, which escapes through the nostrils and pharynx.

It is often the result of inherited syphilis or scrofula, and in such cases ulceration usually occurs.

Occasionally the mucous membrane becomes atrophied, as the result of prolonged inflammation.

SYMPTOMS.

The patient complains of obstructed nasal respiration with abundant muco-purulent discharge, from the nostrils, or into the throat. The discharges are often streaked with blood, and if allowed to desiccate and decompose in the nostrils they become extremely offensive. When the discharges are offensive, the affection is termed ozæna.

SIGNS.

Upon inspection of the nasal cavities, anteriorly and posteriorly, the mucous membrane is found congested and thickened uniformly or in patches, and more or less covered with altered secretions. When the cavities have been thoroughly cleaned, ulcerations may often be detected, and sometimes warty growths or polypoid excrescences will be discovered.

DIAGNOSIS.

No difficulty can be experienced in the diagnosis, though care must be exercised to ascertain whether it is simply an idiopathic inflammation, or whether it is dependent on the syphilitic or strumous diathesis.

TREATMENT.

It is all-important in this affection to employ such constitutional remedies as may be necessary to improve the patient's general condition. *Locally.*—The parts should be cleansed once or twice daily by means of the nasal douche, or by snuffing fluids into the nasal cavities; using weak solutions of the chloride or carbonate of sodium, for example half a teaspoonful or a teaspoonful to the pint of tepid water. In using the

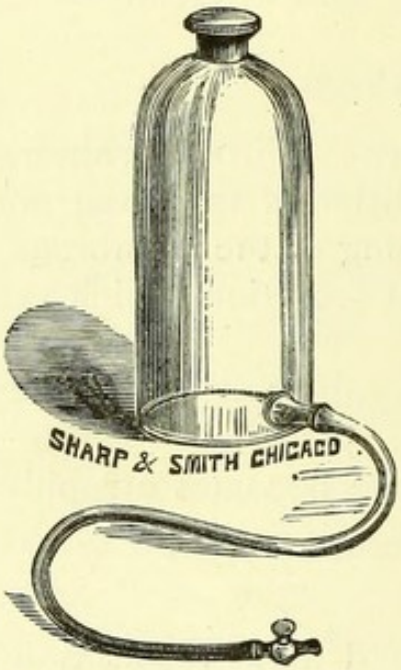


FIG. 128.—Nasal douche.

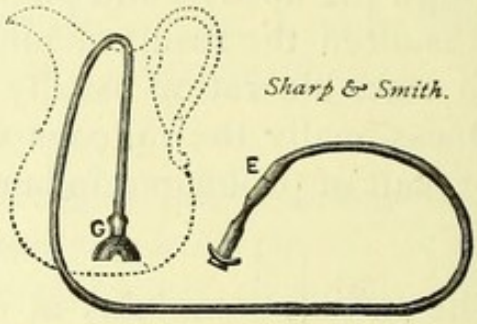


FIG. 129.—Travelers' nasal douche.

nasal douche, the patient should exercise great care not to swallow during the operation, as this act might allow some of the fluid to pass into the Eustachian tubes and cause inflammation of the middle ear.

The parts having been thoroughly cleansed, sedative or stimulating applications should be made according to the condition of the mucous membrane—sedative applications when the parts are irritated and sore, and stimulating applications when the inflammation is clearly of an indolent character.

The treatment should always be commenced with mild

applications, as the nasal mucous membrane is sometimes very sensitive.

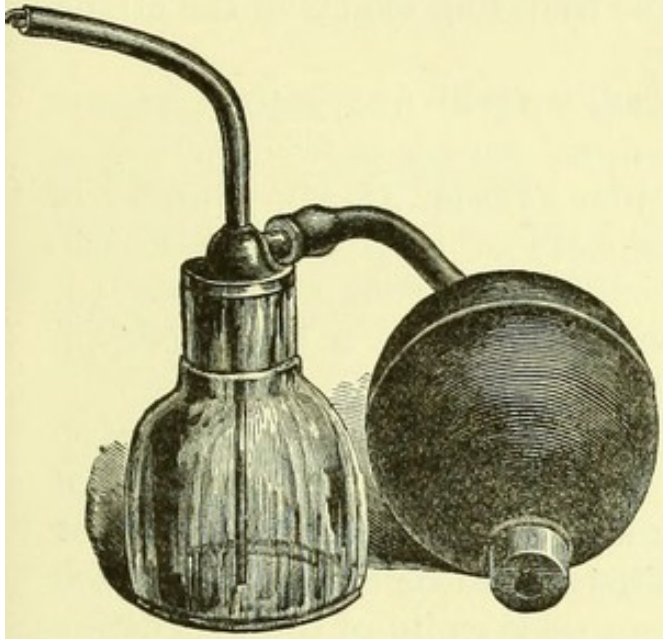


FIG. 130.—Spray producer for applications to nasal passages or fauces.

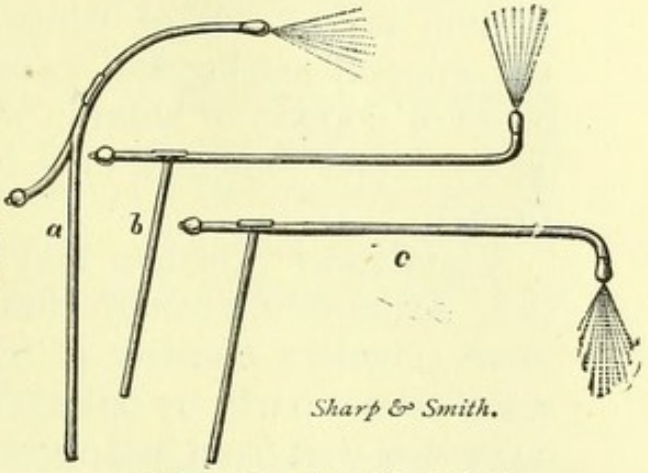


FIG. 131.—Atomizer tubes.

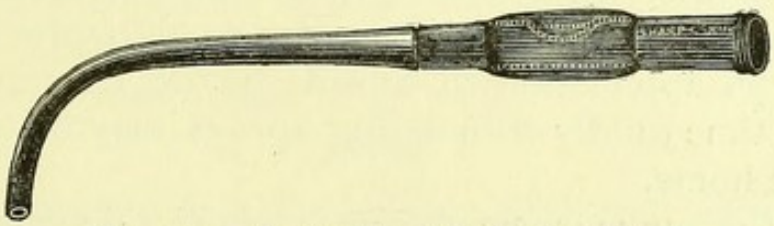


FIG. 132.—Hard-rubber tube for insufflator.

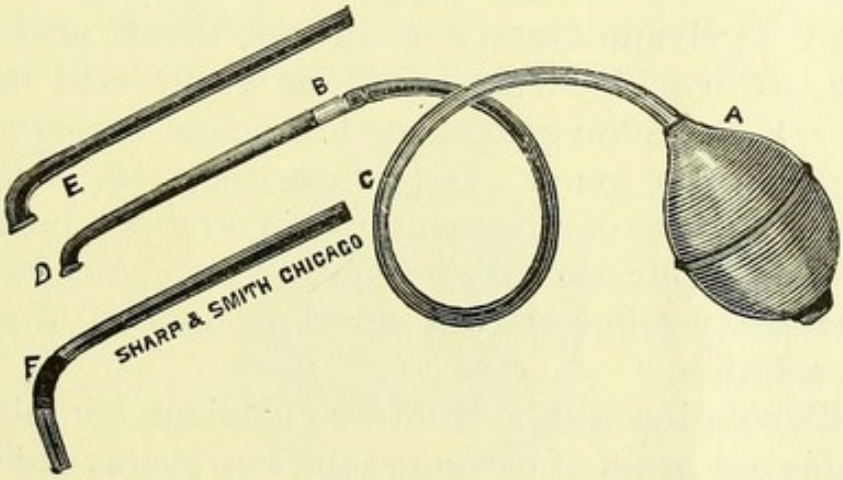


FIG. 133.—Insufflator. *A*, bulb. *B*, powder in glass tube ready for insufflation. *D* and *E*, short bends for posterior nares. *F*, a piece of rubber tubbing, which has been slipped over the glass to prevent accident in case the glass tube should be broken while in the throat.

For a sedative effect we may use vapors or sprays of conium, opium, stramonium, or benzoin (Form. 37 and 39); or oint-

ments of the same or of iodoform; or powders of bismuth, morphia, or iodoform (Forms. 111–113). Smearing the parts with vaseline protects them from the irritating effects of the atmosphere and thus favors recovery.

When stimulation is required, we will find useful: vapors of iodine, chloride of ammonium, camphorated tincture of opium, tar, or oil of white pine (Form. 43–56). Sprays of the mineral astringents, as sulphate or chloride of zinc, sulphate of copper, or alum in weak solutions may be employed, or the same remedies may be applied with a brush (Form. 61–65).

Stimulating powders may be blown into the nasal cavities, preferably through the posterior nares. The best of these powders consists of hydrastine, one part, to acacia or starch, three parts, by bulk. This should be employed in such quantities that from half a grain to one grain of the hydrastine will be used at each application. The applications should be repeated at intervals of two or three days or more, according to the effect. Care should be taken to allow the stimulating effects of an application to subside before its repetition. In the mean time mildly stimulating sprays may be used by the patient at home.

When the mucous membrane is much thickened over the turbinated bones, it must be partially destroyed. For this purpose the galvano-cautery, nitrate of silver, acid nitrate of mercury, nitric acid, chromic acid, or acetic acid may be employed. Of these the glacial acetic acid, as recommended by Bosworth, I have found most satisfactory. It is applied by means of a pledget of absorbent cotton wrapped on a flattened probe. The application causes considerable pain, but this may be immediately relieved by a spray or douche of some mild alkaline solution.

Dobell's solution will be found convenient for this purpose. It contains one grain of carbolic acid, two grains each of borate and bicarbonate of soda, and one drachm of glycerine, with seven drachms of water in each ounce of the solution.

The caustic application may be repeated in from seven to fourteen days. Ulcerated surfaces may be dusted over with iodoform, or touched with solutions or the solid stick of nitrate of silver. If these applications do not cause them to

heal, they should be slightly seared from time to time with the galvano-cautery.

ADENOMA AT THE VAULT OF THE PHARYNX.

Synonyms.—Hypertrophy of the pharyngeal tonsil; Adenoid vegetations in the naso-pharyngeal cavity.

This, as the name implies, consists of increased growth in the glandular tissue at the upper part of the pharynx. It is characterized by an increased secretion which mostly finds its way behind the palate into the mouth. There is also more or less obstruction to nasal respiration, with a frequent desire to snuff, hawk, or clear the throat.

SYMPTOMS.

The symptoms, besides those just enumerated, are a sensation of fulness in the posterior nares, and expectoration of small masses of tenacious mucus; which is sometimes streaked with blood. There is also more or less alteration of the voice in pronouncing nasal tones.

SIGNS.

On rhinoscopic inspection the deep-red hypertrophied glandular tissue can be seen at the vault of the pharynx. Sometimes it has the appearance of an hypertrophied tonsil, and at other times it hangs in pendent masses (Fig. 133). The

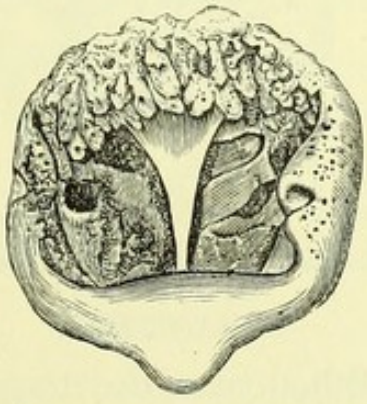


FIG. 133.—Rhinoscopic view of vegetations at vault of pharynx (Cohen).

palate is often thickened, and chronic follicular pharyngitis usually co-exists. The finger passed behind the palate feels the growth.

DIAGNOSIS.

Thorough inspection and palpation leave no chance for error in diagnosis.

TREATMENT.

Locally.—Astringents and caustics may be employed with some benefit; but removal of the offending mass with forceps, or better still with the galvano-cautery, is much the most effective treatment.

SUBMUCOUS INFILTRATIONS AT THE SIDES OF THE VOMER.

This is a very common affection, characterized by more or less difficulty in nasal respiration and increased secretion. It is often associated with adenoma of the vault of the pharynx and chronic inflammation of the pharyngeal mucous membrane. The altered mucus collects in the posterior nares and "drops into the throat" or causes frequent hawking. The symptoms are those of post-nasal catarrh. Inspection by the aid of the rhinoscope reveals a yellowish-white puffiness on one side or on both sides of the vomer, near its posterior margin (Fig. 134).

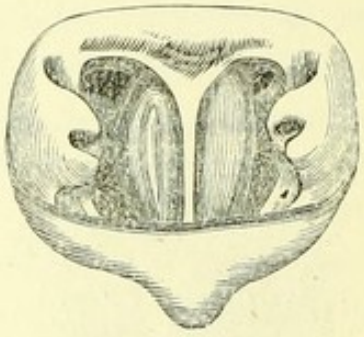


FIG. 134.—Submucous infiltration at sides of vomer (Cohen).

DIAGNOSIS.

There can be no difficulty in the diagnosis when pharyngeal affections have been excluded and the characteristic appearances just mentioned are discovered.

TREATMENT.

We should destroy the œdematous tissue by means of the

galvano-cautery, or we may tear it off with forceps. The former is most effective. Astringents have little effect.

DISTORTION OF THE NASAL SEPTUM.

The septum may be bent so far to one side as completely to obstruct the corresponding nasal passage and proportionately interfere with respiration through the nose. This condition, when extreme, crowds the end of the nose to one side. The affection seems to be caused by increased growth of the edges of the cartilaginous septum.

DIAGNOSIS.

Inspection reveals a convexity of the septum on one side, with a corresponding concavity in the opposite passage.

TREATMENT.

We should dilate the occluded passage by tents of compressed sponge, metallic tubes, or tubes of laminaria. If these measures fail, we may perforate the septum so that air can pass from one nasal passage into the other. M. Chassaignac recommends subperiosteal excision of a sufficient amount of the septum to allow it to be easily crowded into its normal position, where it should be retained until healing is complete, by means of a bit of sponge in the nasal passage.

THICKENING OF THE SEPTUM.

Aside from the abnormal growth from the borders of the septum, which sometimes causes its deflection to one side, we frequently observe thickening near its lower border, due to bony or cartilaginous outgrowth. I have often observed this condition in patients affected with chronic coryza.

DIAGNOSIS.

Inspection shows a more or less prominent protuberance of one or both sides of the septum. When only one side is affected, no corresponding concavity is seen in the opposite passage. This outgrowth usually extends along the inferior margin of the septum for half or three quarters of an inch, and upward from a quarter to three eighths of an inch. The

thickening of the septum at the most prominent part may reach three eighths of an inch or more. Palpation with the finger or a probe shows that this prominence is not due to submucous œdema.

TREATMENT.

I know of no local applications which either diminish the size of the outgrowth or check its increase.

The associated coryza should receive appropriate treatment. If the outgrowth becomes so large as materially to obstruct respiration, the mucous membrane may be everted and the excrescence chiseled away. *Internally.*—Internal treatment is usually indicated by the fact that the affection is most frequently the result of rachitis, scrofula, or constitutional syphilis.

NASAL ABSCESS.

This is usually found near the anterior nares, located either on the septum or in the alæ. It may be an ordinary furuncle, it may be the result of idiopathic or traumatic inflammation of the submucous tissues, or it may be caused by the breaking-down of syphilitic gummata.

DIAGNOSIS.

The diagnosis is attended with little or no difficulty.

TREATMENT.

We should use warm anodyne or astringent applications, and the pus should be evacuated.

SYPHILITIC AFFECTIONS OF THE NARES.

Secondary or tertiary syphilis may be manifested in this situation. It causes swelling and ulceration of the parts, and there is a profuse fetid discharge from the nose. Sometimes abscesses are formed. In many cases there is serious destruction of tissue with deformity of the organ.

Secondary symptoms are usually attributed to mucous patches, and are not often attended with ulceration. This condition causes an abundant greenish-yellow discharge, espe-

cially during the day-time, with pain and obstruction of the nares.

Ulcerations, either in the secondary or tertiary stages, render the discharges and breath very offensive.

DIAGNOSIS.

The affection is liable to be mistaken for scrofulous affections, from which it can only be distinguished by the history, the concomitant signs, and the results of treatment.

TREATMENT.

Internally.—Our treatment should be antisyphilitic, viz., iodide of potassium freely, and bichloride of mercury with such tonics as seem necessary in individual cases. *Locally.*—The parts should be kept clean by means of some form of nasal douche. Ulcers may be touched with acid nitrate of mercury or the galvano-cautery.

STENOSIS OF THE NASAL PASSAGES.

This results from various causes, but most frequently from hypertrophy or an œdematous condition of the mucous membrane covering the turbinated bones; or from deflection of the septum narium.

DIAGNOSIS.

The diagnosis may be readily made by inspection. Upon posterior rhinoscopy the tissues covering the inferior or middle turbinated bones, or both, will often be found so thickened as to nearly or completely obstruct the posterior nares.

TREATMENT.

The treatment varies with the cause of the affection. If it results from deflection of the septum, this must be straightened or perforated. If it results from thickening of the mucous membrane, the nasal cavities may be dilated by silver tubes, sponge-tents, or by tubes of laminaria, as recommended by Cohen; but simple dilatation usually gives only temporary relief. The most effectual method of treatment is to destroy the redundant tissue, and to prevent its renewal by more or less continuous use of mineral astringents, such as recommended in speaking of chronic coryza.

When the turbinated bones are moderately enlarged, cauterization with strong acetic acid* and the use of astringents, as above, will be found most satisfactory; but if the posterior nares are much obstructed by the swollen tissue, this must be removed by some more radical operation. The œdematous tissue may be torn off with forceps, but this is a bloody and very painful operation. It may be removed by Jarvis' wire snare, but patients inform me that this also is exceedingly painful. It may be removed by the galvano-caustic loop. This latter operation I have performed several times with very satisfactory results. This, like the preceding operations, causes considerable pain, but it is only temporary, and it may be promptly relieved by a weak alkaline spray. It should not be forgotten that erysipelas may occasionally follow any of these operations, though it is not a frequent accident.

FOREIGN BODIES IN THE NASAL PASSAGES.

Children often introduce into the nostrils pebbles, buttons, coins, kernels of corn, beans, and the like; where they may remain for months, or even years, causing an offensive discharge and obstruction to nasal respiration. The foreign substance may become incrusted with the calcareous salts in the secretions, and thus form the nucleus of a calculus.

SYMPTOMS.

We find as the most prominent symptoms: obstruction to nasal respiration, an offensive discharge, loss of the sense of smell, and alteration of the voice. Pain is present if the foreign body is large or irregular, and this is usually accompanied by inflammation, which is followed by more or less deformity according to the severity of the inflammation.

SIGNS.

The passages having been thoroughly cleansed, direct and indirect rhinoscopic inspection with a strong light, together with palpation by means of the finger or a probe, will usually detect the foreign substance.

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* See treatment of chronic coryza, page 400.

TREATMENT.

The offending substance may sometimes be removed by means of the posterior nasal douche, by curved bougies, or by catheters passed into the nostril from behind. Forceps, a hook or wire loop, or Gross' instruments for removing foreign bodies from the nasal passages and ears (Fig. 135) may be employed for the same purpose.



FIG. 135.—Gross' instruments for removing foreign bodies from the nasal cavities and ears.

NASAL TUMORS.

A great variety of morbid growths have been found in the nasal passages, the majority of which spring from the mucous membrane.

The different varieties occur in the following order of frequency: first, myxomata or mucous polypi; second, fibromata which are comparatively infrequent; third, adenomata; fourth, papillomata; fifth, neuromata; sixth, enchondromata and osteomata. These latter are all very rare.

SYMPTOMS.

The patient experiences a sensation of fulness in the nasal passages, which is usually increased in damp weather. Nasal respiration is obstructed, and the voice has a nasal twang. Coryza and epistaxis frequently accompany the above symptoms. Deformity results if the growth is large. The sense of smell is often impaired or lost, and with it so much of the sense of taste as depends on the olfactory nerves. Hearing is impaired when the orifice of either Eustachian tube is obstructed. There may be difficulty in swallowing if the tumor presses upon the palate.

SIGNS.

Inspection usually reveals the existence of a morbid growth.

Mucous polypi vary greatly in size and in number. They are occasionally single, but usually multiple. They are generally attached by a small pedicle. They are found most frequently

attached to the upper turbinated bone, though they may spring from the middle or lower turbinated bones, or from the septum. These tumors have a yellowish-white color, and a semi-transparent appearance; they are soft to the touch, owing to their semi-fluid or gelatinous contents. Exceptionally they become incrusted with calcareous deposits from the secretions.

Fibrous tumors have a more irregular surface, and are redder than those just mentioned. They are firm to the touch and bleed easily. These growths are usually single and sessile, though they are occasionally multiple and pedunculated. They grow gradually, expanding in every direction, sending prolongations into adjoining cavities, and causing absorption of surrounding structures by pressure. By extension into the sinuses they may cause the characteristic deformity known as "Frog face."

The adenoid growths may attain a great size. They present no characteristic appearance, but are so rare that they are not likely to be mistaken for other growths.

Papillary growths usually occur near the nostril and are easily recognized.

Neuromata are very rare in the nasal passages.

Cartilaginous growths spring from the septum. They are covered by mucous membrane which may have a normal or congested appearance.

Osteomata are at first covered by mucous membrane, but later this gives way, and the bony tissue is exposed. The surface of these growths may be uniform or nodulated. They may attain a large size and produce great deformity.

DIAGNOSIS.

The diagnosis must be made by inspection and palpation anteriorly or posteriorly, or in both directions.

TREATMENT.

We should remove the growth through the natural passages, or when necessary through external incisions. Astringent or caustic injections will occasionally cure mucous polypi, but the treatment is tedious and usually unsatisfactory; generally it is best to remove them with forceps. Osteomata, if

operated on early, can usually be enucleated. If they are friable, they may be crushed; if so hard as to prevent crushing, they may be reduced by the dental burr or drill, as recommended by Dr. Cohen. Cutting or crushing forceps, the écraseur, the galvano-cautery, and the gouge and chisel are all useful at times in removing these growths.

NEUROSES OF THE NASAL PASSAGES.

ANOSMIA.

Anosmia or loss of smell is sometimes caused by blows on the head; but it is often due to inflammatory affections of the nasal mucous membranes, or to nasal tumors, or other causes of obstructed nasal respiration.

DIAGNOSIS.

The diagnosis is made by the patient.

TREATMENT.

The cause for this symptom must be sought, and if found in any physical alteration of the nasal cavities, this should receive proper treatment, such as just recommended in speaking of the various conditions which cause obstruction of these passages. Galvanization of the mucous membrane with a weak current should be tried in other cases. Generally treatment will be ineffectual.

HYPERÆSTHESIA.

Hyperæsthesia is characterized by frequent sneezing or constant snuffling. Sneezing may be excited by trifling causes, and may be prolonged for several hours.

TREATMENT.

If the hyperæsthesia is due to neuralgia or hysteria, internal treatment suitable for these affections is indicated. *Locally.*—Sedative unguents, or sprays containing stramonium, camphor, carbolic acid, and the like, are indicated.

PARALYSIS OF THE NOSTRILS.

This may be entirely local, or it may be part of a more general paralysis.

DIAGNOSIS.

The affection will be recognized by the flaccid condition of the nostrils, which collapse with inspiration, and thus obstruct nasal breathing.

TREATMENT.

The nostrils may, if necessary, be kept open by mechanical means. This is sometimes necessary, in order to relieve the inflammation of the throat, which is likely to result from the patient's having to breathe constantly through the mouth. The ordinary treatment for paralysis should also be employed.

APPENDIX.

In the following list of formulæ, those which relate to diseases of the throat and nasal passages are mostly taken from the Pharmacopœia of the Hospital for Diseases of the Throat, London. The various mixtures, excepting formula 4, which would never be prescribed in quantities of less than four ounces, have been reduced to the standard of one ounce. Some of these I have found very beneficial in my own practice, and others have been inserted on the recommendation of various distinguished physicians.

1. ℞ Tinct. aconiti radicis.....ℳ viij.
Aquæ.....fl. ℥ i.

M. S. Teaspoonful at a dose. Repeat every half-hour or hour, at first, and subsequently less frequently in acute inflammatory affections of the air passages.

2. ℞ Morphiæ sulphatis.....gr. i.
Antimonii et potass. tart.....gr. i.
Ammonii chloridi.....ʒ i.
Ext. grindeliæ robustæ fluidi.....fl. ʒ iv.
Syrupi pruni virginianæ et
Misturæ glycyrrhizæ comp.....āā fl. ʒ ij.

M. S. Teaspoonful for cough. *Especially useful in acute bronchitis.*

3. ℞ Morphiæ sulphatis.....gr. i.
Chloral.....ʒ i.
Syrupi zingiberis.....ʒ iv.
Misturæ glycyrrhizæ comp.....*ad* fl. ℥ i.

M. S. Teaspoonful every half-hour or hour until relieved. *For spasmodic asthma.*

Emulsion of Cod-Liver Oil.

4. ℞ Olei morrhuæ..... ℥ xvi.
Sach. alb. (granulated)..... ℥ vi.
Acaciæ..... ℥ iv.
Olei gaultheriæ..... ♏ xv.
Aquæ.....q. s. *ad* fl. ℥ iv.

Triturate the sugar and acacia thoroughly with one half the amount of water, until a uniform mucilage is formed; then add the oil slowly, with constant trituration, and subsequently add the remainder of the water. (It requires about an hour to make the emulsion properly.)

This makes a very perfect emulsion, to which may be added lactophosphate of calcium or phosphoric acid, which will give it an agreeable acidulous taste. Chloride of calcium may be added when desired, but the lactophosphate of calcium will doubtless answer the same remedial purpose.

5. ℞ Morphiæ sulphatis.....gr. i.
Ammonii carbonatis.....gr. xxx.–xl.
Syr. pruni virg.,
Misturæ glycyrrhizæ comp.....āā fl. ℥ iv.

M. S. Teaspoonful, in water, for cough.

6. ℞ Antimonii et potassii tartratis.....gr. xx.
Cantharidis et
Olei tiglii.....āā gr. xl.
Camphoræ et
Ext. stramonii (aq.).....āā gr. lxxx.
Adipis..... ℥ iiss.
Cerati simplicis.....*ad* ℥ i.

M. S. Counter-irritant ointment.

7. ℞ Tincturæ iodinii..... ℥ ss.–℥ i.
Potassii iodidi.....gr. x.–xx.
Aquæ.....*ad* fl. ℥ i.

M. S. Use as an injection, which should be withdrawn in about five minutes. For chronic pleurisy.

8. ℞ Ext. euonymi fluidi.....fl. ℥ i.

S. One teaspoonful to be taken four or five times a day with water.

A valuable diuretic and cathartic in cardiac disease.

In place of the above, an infusion made with one ounce of the plant to a pint of water may be used in doses of a wine-glassful.

GARGLES.

Gargles are only useful in diseases of the fauces. They cannot affect the nasal passages, pharynx, or larynx. These preparations may be sedative, astringent, stimulant, or antiseptic.

Sedatives.

9. ℞ Potassii bromidi.....gr. x. *ad* fl. ℥ i.
10. " Potassii nitratis.....gr. xx.
Potassii chloratis.....gr. x.
Aquæ ferv.....*ad* fl. ℥ i.

M. S. Use as hot as it can be borne.

11. ℞ Acidi carbolici.....gr. i. *ad* fl. ℥ i.

Astringents.

12. ℞ Acidi tannici.....gr. xij.–ʒ ii. *ad* fl. ℥ i.
13. " Aluminis.....gr. viij. *ad* fl. ℥ i.
14. " Ferri et ammonii sulphatis.....gr. viij. *ad* fl. ℥ i.
15. ℞ Sodii biboratis.....gr. xxv.
Glycerinæ.....♏ xxv.
Tinct. myrrhæ.....♏ xxv.
Aquæ.....*ad* fl. ℥ i.

M.

Stimulants.

16. ℞ Acidi acetici dil.....♏ xv.
Glycerinæ.....♏ xviij.
Aquæ.....*ad* fl. ℥ i.

M.

17. ℞ Acidi carbolici.....gr. ij.–x. *ad* fl. ℥ i.
18. " Potassii chloratis.....gr. x.–xxv. *ad* fl. ℥ i.

Antiseptics.

19. ℞ Acidi carbolici vel
Potassii chloratis, (see stimulants).
20. ℞ Potassii permanganatis.....gr. i.–ij. *ad* fl. ℥ i.

TROCHISCI, OR LOZENGES.

Each lozenge contains seventy to eighty per cent of red currant fruit paste, one to two per cent of powdered tragacanth, four per cent of sugar, and a varying quantity of the medicament, according to the following formulæ.

Sedatives.

21. ℞ Morphiæ sulphatis.....gr. $\frac{1}{30}$ *ad* troch.
22. " Ext. opii.....gr. $\frac{1}{10}$ " "
23. " Sodii biboratis.....gr. iij. " "
24. " Ammonii chloridi.....gr. ij. " "

Astringents.

25. ℞ Krameriæ.....gr. iij. *ad* troch.
26. " Kino.....gr. ij. " "
27. " Acidi tannici.....gr. iss. " "

Stimulants.

28. ℞ Acidi benzoici.....gr. ss. *ad* troch.
29. " Cubebæ.....gr. ss. " "
30. " Guaiaci.....gr. ij.–iij. " "
31. " Pyrethri.....gr. i. " "

Potassium chlorate is more pleasant and more efficacious in compressed pills than in troches.

Antiseptics.

32. ℞ Acidi carbolici.....gr. i. *ad* troch.
Potass. chloratis, (see stimulants).

VAPOR INHALATIONS.

These may be used with various forms of inhalers. Mackenzie's eclectic inhaler is the most complete, but some of the cheaper instruments will answer the same purpose. The best of the cheap inhalers was devised by the late Dr. F. H. Davis, of this city. An inhaler which is in common use consists of a glass flask holding about a quart. This has a perforated cork, through which two glass tubes are passed, one to the bottom

of the flask to admit the air, and the other, through which the patient inhales the vapor, into its upper part. Almost any of the numerous inhalers may be used for the purpose, or in the absence of an inhaler an earthen teapot may be employed. These inhalations are prepared by adding a teaspoonful of the medicated solution to a pint of water, at a temperature of about 150° F. They should be used morning and evening for about five minutes each time, six respirations being taken per minute.

The oleaginous or balsamic remedies should be rubbed up with light carbonate of magnesium, in order to maintain their suspension in the water, as shown in the following formula.

33. ℞ Olei cajuputi.....♏ viij.
Mag. carb. lev.....gr. v.
Aquæ.....*ad* fl. ℥ i.

M. S. A teaspoonful in a pint of water at 150° F., for each inhalation.

These vapors may be sedative, antispasmodic, antiseptic, or gently or strongly stimulant.

Sedative Vapors.

34. ℞ Ætheris et spts. vini rect.....āā.
35. " Chloroformi et spts. vini rect.....āā.
36. " Lupulinæ.....gr. xxx.
37. " Aqueous ext. belladonnæ
vel ext. stramonii.....gr. v. *ad* ℥ i.
38. " Aqueous ext. opii.....gr. v. *ad* ℥ i.
39. " Tinct. benzoin. comp.....fl. ℥ i.
40. " Tinct. opii camph.....fl. ℥ i.

Antispasmodics.

41. ℞ Ætheris vel chloroformi (as above).
42. " Amyl nitrite.....♏ viij. *ad* fl. ℥ i.

Mild Stimulants.

43. ℞ Olei pini sylvestris.....♏ xl. *ad* fl. ℥ i.
44. " Olei cubebæ.....℥ ss. *ad* fl. ℥ i.
45. " Olei cassiæ.....♏ vi.
Olei limonis.....♏ x. *ad* fl. ℥ i.

M.

46. ℞ Olei anisi..... ♏ vi. *ad* fl. ℥ i.
47. " Tinct. benzoin. comp..... fl. ʒ i.
48. " Olei myrti..... ♏ vi.
Camphoræ..... gr. v. *ad* fl. ℥ i.

M.

More stimulating than the above.

49. ℞ Acidi carbolici..... gr. xx. *ad* fl. ℥ i.
50. " Creasoti..... ♏ xl. *ad* fl. ℥ i.
51. " Olei cari..... ♏ vi. *ad* fl. ℥ i.
52. " Olei juniperi..... ♏ xx. *ad* fl. ℥ i.

Strong Stimulants.

53. ℞ Olei calami arom..... ♏ v. *ad* fl. ℥ i.
54. " Olei caryophylli..... ♏ x. *ad* fl. ℥ i.
55. " Tinct. iodinii comp..... ♏ x.

S. Repeat two or three times at each inhalation.

56. ℞ Aquæ ammoniæ et aquæ..... āā fl. ʒ iv.

Antiseptics.

57. ℞ Acidi carbolici, creasoti
vel olei juniperi (as in 49, 50, and 52).
58. " Potassii permanganatis..... gr. v. *ad* fl. ℥ i.

SPRAY INHALATIONS.

These are to be used by the patient in full strength, with the hand-ball atomizer, or in about twice this strength by the steam atomizer. One or two drachms should be used at each inhalation. These applications are useful principally in treating diseases of the fauces and of the nasal cavities. It is almost impossible for the patient to draw them into the larynx. These inhalations may be classified as sedatives, astringents or stimulants, hæmostatics, and antiseptics.

Sedatives.

59. ℞ Acidi hydrocyanici dil..... ʒ ss. *ad* fl. ℥ i.

To be used only as a cold spray.

60. ℞ Potassii bromidi..... gr. x. *ad* fl. ℥ i.

Astringents and Stimulants.

61. ℞ Acidi tannici ..... gr. iij. *ad* fl. ℥ i.
62. " Zinci sulphatis ..... gr. ij.–x. *ad* fl. ℥ i.
63. " Zinci chloridi ..... gr. ij.–x. *ad* fl. ℥ i.
64. " Aluminis ..... gr. x. *ad* fl. ℥ i.
65. " Ferri perchloridi ..... gr. iij. *ad* fl. ℥ i.

Hæmostatics.

66. ℞ Ferri perchloridi ..... gr. v. *ad* fl. ℥ i.
67. " Acidi tannici ..... gr. x. *ad* fl. ℥ i.

Antiseptics.

68. ℞ Sodii benzoatis ..... ℥ i. *ad* fl. ℥ i.
69. " Aquæ calcis ..... fl. ℥ i.
70. " Brominii ..... gr. ss. *ad* fl. ℥ i.
71. " Potassii bromidi ..... gr. xxv. *ad* fl. ℥ i.
72. " Acidi lactici medicinalis ..... ♏ xx. *ad* fl. ℥ i.
73. " Potassii permanganatis ..... gr. v. *ad* fl. ℥ i.
74. " Potassii chloratis ..... gr. xx. *ad* fl. ℥ i.

DRY INHALATIONS.

These are composed of substances which volatilize at ordinary temperatures, or simply by the heat of the hand. They may be used with any of the instruments which are ordinarily used for vapor inhalations, or they may be easily inhaled from a small wide-mouthed bottle, in the bottom of which the medicine has been placed.

One of the simplest and most efficacious inhalers for this purpose consists of a glass tube about four or five inches in length, open at both ends, and holding a small sponge at its middle. The remedy is dropped on the sponge, and air is inspired through the tube.

When these substances are used with the small glass-tube inhaler, the amount given for each inhalation should be divided into three or four parts which are to be used successively.

If the effect is only needed in the throat and nose, the solution may be concentrated so that the same amount of medicine will be obtained without repeatedly charging the inhaler. In

this case, the patient should not inspire deeply, and only two or three inhalations should be taken per minute. These inhalations may be sedative or stimulant.

Sedatives and Antispasmodics.

75. ℞ Acidi hydrocyanici diluti.....fl. ʒ i. *ad* fl. ℥ i.
S. A teaspoonful at each inhalation.

76. ℞ Ætheris. S. A half teaspoonful at each inhalation.

77. " Amyl nitrite.....♏ i.
Alcohol.....♏ xxx.
M. S. Use at each inhalation. *This is useful, especially in spasmodic affections.*

78. ℞ Olei santili albi.....♏ i.
Alcohol.....*ad* fl. ʒ i.
M. S. To be used at each inhalation in divided doses.

79. ℞ Chloroformi.....fl. ʒ ss.
S. To be used at each inhalation; to be breathed slowly.

Stimulants.

80. ℞ Tinct. iodinii.....♏ x.–xx.

In this same category may be included the carbonate of ammonium and camphor used as smelling salts; and nascent chloride of ammonium used by any of the inhalers constructed especially for that purpose.

FUMING INHALATIONS.

Fuming inhalations are prepared by saturating bibulous paper with a solution of the remedy of a given strength, drying the paper, and then cutting it into twenty equal parts, each of which will contain one twentieth of the amount of medicine used. These strips may be rolled into cigarettes, or they may be burned under a funnel which will conduct the smoke to the mouth. They are employed in asthma and spasm of the larynx. The principal medicines employed in this manner are:

81. Potassii arsenias.....gr. xv.,

82. Sodii arsenias.....gr. xx.–xl. or

83. Potassii nitras.....gr. xxx.–lx.,
Aquæ .....*ad* fl. ℥ i.

These latter may be modified, as recommended in the Throat Hospital Pharmacopœia, by the addition of various volatile principles.

These volatile substances are added by moistening the nitre paper in a tincture, or, in the case of volatile oils, in a solution of one part of the oil to nine parts of alcohol, and then exposing the paper to the air a few minutes to allow the alcohol to evaporate. These papers must be freshly prepared and kept in tinfoil. The following are the preparations most useful:

Sedatives.

84. Nitrated papers with tinct. benzoini comp.
85. Nitrated papers with tinct. hyoscyami vel stramonii.
86. Nitrated papers with oil of sandal.
87. Nitrated papers with oil of sumbul.

Stimulants.

88. Nitrated papers with spirits of camphor.
89. Nitrated papers with oil of cinnamon.
90. Nitrated papers with oil of cassia.

PIGMENTS.

This name is given to the various mixtures which are designed for topical application by means of a brush. These may be prepared with water or with glycerine, but it should be remembered that the latter is irritating to some throats. These pigments may be anæsthetic, astringent, stimulant, or antiseptic in their effects.

Local Anæsthetics.

91. ℞ Morphiæ sulphatis.....gr. iv.
Acidi carbolici.....gr. xxx.
Glycerinæ .....fl. ℥ i.

M.

Thirty grains of tannin may be added to the above when a slightly astringent effect is desired.

92. ℞ Chloral ..... ʒ i.
Aquæ ..... *ad* fl. ℥ i.

93. ℞ Morphiæ sulphatis ..... gr. xx.
Chloroformi ..... *ad* fl. ℥ i.

Astringents.

94 ℞ Zinci chloridi ..... gr. x. *ad* fl. ℥ i.

95. " Zinci sulphatis ..... gr. x.–xxx. *ad* fl. ℥ i.

96. " Ferri et ammonii sulphatis ..... gr. xxx. *ad* fl. ℥ i.

97. " Liquor ferri perichloridi ..... ♏ xl. *ad* fl. ℥ i.

98. " Acidi tannici ..... ʒ ij.
Glycerinæ ..... *ad* fl. ℥ i.

Stimulants and Caustics.

99. ℞ Zinci chloridi ..... gr. xxx. *ad* fl. ℥ i.

100. " Cupri sulphatis ..... gr. xx. *ad* fl ℥ i.

101. " Liq. ferri perchloridi ..... fl. ʒ ij. *ad* fl. ℥ i.

102. " Argenti nitratis ..... ʒ ss.– ʒ i. *ad* fl. ℥ i.

103. " Liquor hydrargyri nitratis ..... ♏ xl.– ʒ ij. fl. *ad* ℥ i.

104. " Tinct. iodinii ..... ℥ i.

105. " Iodinii ..... gr. xxx.
Glycerinæ ..... *ad* fl. ℥ i.

Antiseptics.

106. ℞ Acidi carbolici ..... gr. xxx. *ad* fl ℥ i.

INSUFFLATIONS.

Powders have been extensively used in the treatment of nasal and laryngeal affections, but, with Lennox Browne, I think them useful in only a few cases. I am accustomed to dilute all of the powders which I employ with from one to four parts of sugar of milk, acacia, or starch. The following formulæ each represent the amount of the medicine itself which is to be used at each insufflation.

107. ℞ Acidi tannici ..... gr. ss.–gr. ij.

108. " Bismuthi carbonatis ..... gr. i.–gr. ij.

109. " Bismuthi subnit. ..... gr. i.–gr. ij.

110. " Hydrastine ..... gr. ¼–gr. ½.

111. ℞ Iodoformi.....gr. i.

112. " Iodoformi.....gr. i.
Bismuthi carb.....gr. ij.

M.

113. ℞ Morphiæ sulphatis.....gr. $\frac{1}{8}$–gr. $\frac{1}{4}$.
Bismuthi carb.....gr. ij.

M. Or the above with the addition of tannin or iodoform.

Nasal Douches.

The following preparations may be used either by the anterior or posterior nasal douche, for detergent or antiseptic purposes. They should be followed by more potent remedies. The amount given below should be added to ten ounces of water at blood-heat, and part or all of it used at each application.

114. ℞ Sodii chloridi.....gr. 3 i.

115. " Sodii bicarbonatis.....ʒ ij.

116. " Potassii permanganatis.....gr. ij.

117. " Acidi carbolici.....gr. xx.

118. " Zinci sulphocarbolatis.....gr. xx.

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