Diseases of the larynx / by Dr. J. Gottstein ... trans. and added to by P. M'Bride.

Contributors

Gottstein, Jacob, 1832-1895.
McBride, P. 1854-1946.
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Publication/Creation

Edinburgh ; London, [1883]

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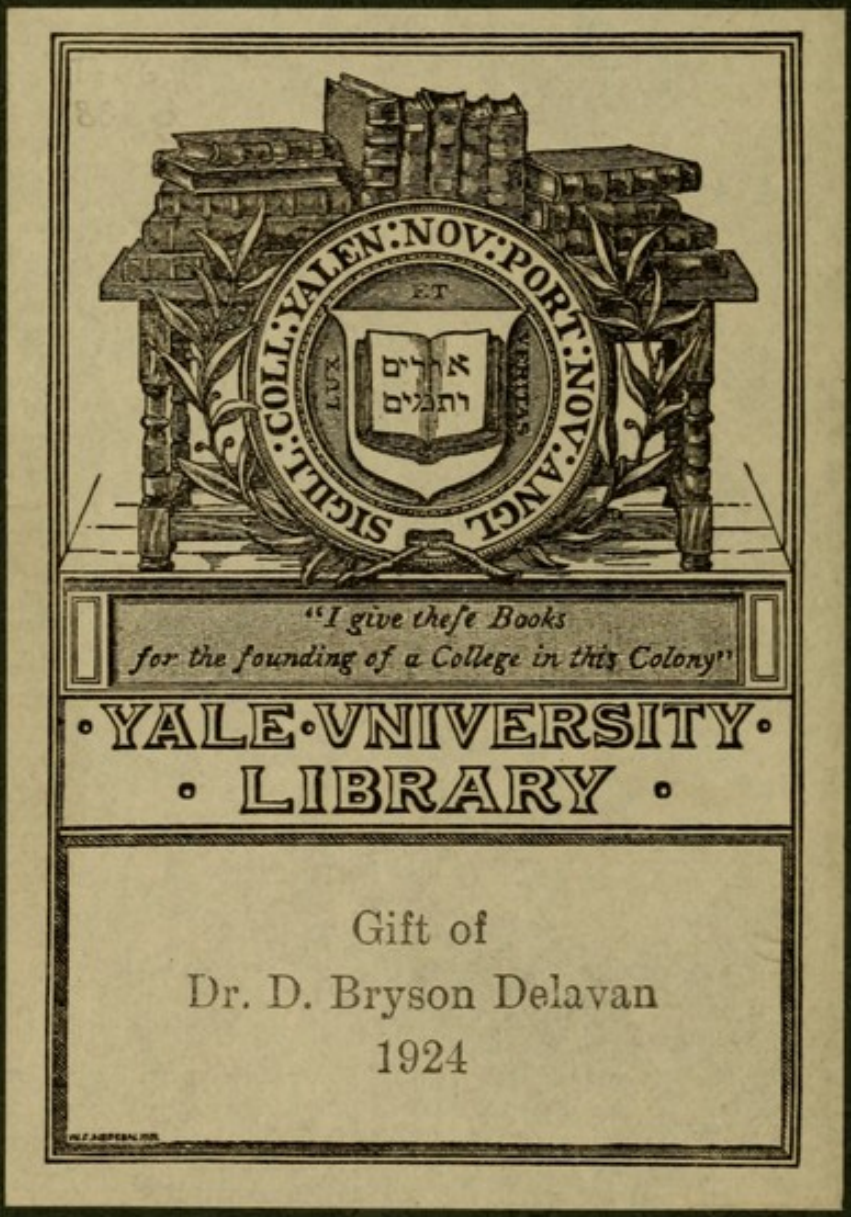
Diseases of the Larynx

GOTTSTEIN

EDITED BY P. M'BRIDE, M.D.



DISEASES

OF

THE LARYNX

BY

DR J. GOTTSTEIN

LECTURER AT THE UNIVERSITY OF BRESLAU

TRANSLATED AND ADDED TO

BY

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W. & A. K. JOHNSTON

EDINBURGH AND LONDON

AUTHOR'S PREFACE.

Although fully aware of the value of recent text-books, *e.g.* those of Ziemssen, Störk, and Mackenzie (translated and annotated by Semon), it yet appeared to me that another work on laryngeal disease, adapted to the needs of the general practitioner and student, would supply a want.

With this intention I have endeavoured to give a short, but so far as possible complete, systematic account of laryngeal diseases.

Considering the effect of the introduction of the laryngoscope upon the development of laryngeal pathology and therapeutics, I have, of course, discussed laryngoscopy fully in the first or general part, and in the second or special division due stress has been laid on its importance with reference to diagnosis and treatment. On the other hand, I have done my best to pay proper attention to evidence as to origin, pathology, and semeiology, gained from other methods of examination, and not to lose sight of the connection between local and general symptoms.

The records of a series of personal observations, chosen with a view to impressing special points in diagnosis, and the addition of a number of illustrations, will, it is hoped, add to the clearness of the descriptions.

I have referred as much as possible to the works of my fellow laryngologists, as is only proper in a text-book, but have not altogether put on one side my own experience and views, derived from almost twenty years of special practice.

In some diseases (*e.g.* laryngitis submucosa, nervous cough, chorea laryngis, and disturbances of co-ordination), I have deviated more or less from the classification of other authors, but I do not think that this has been done at the expense of the generalisation so necessary in a text-book. The chapter on disturbed co-ordination has not, so far as I know, been before worked out in the same manner.

Although the work is chiefly intended for the general practitioner and student, I venture to hope that even the experienced specialist may find in it some points of interest.

Breslau, *October 1883.*

Dr J. GOTTSTEIN.

TRANSLATOR'S PREFACE.

I FEEL that the translation of this work needs no apology, and that if it be not appreciated the fault must lie not with the author, but the translator.

I have endeavoured to translate as much as possible verbatim, and at the same time to use readable English, but a high style of composition cannot be attained in a translation without a sacrifice of accuracy. There are, of course, faults in the original work, but they are slight (the most noticeable being a tendency towards repetition), but such as they are, they are reproduced in the translation. It would also, perhaps, have been more accurate to class lupus and leprosy as secondary, instead of primary affections. As the German edition appeared in 1883, I have endeavoured to bring my translation up to date, partly by annotations and partly by the addition of an appendix. The latter also contains a chapter on laryngeal vertigo, which is rewritten from a paper published in the "Edinburgh Medical Journal," and contains my own views on the matter, for which, of course, Dr Gottstein is not responsible, and the same, indeed, applies to all my additions.

In reducing the doses from the decimal system to grains and ounces, only approximate accuracy has been attempted, and if in this respect any mistakes of importance have occurred, I shall feel grateful to those who point them out.

I cannot conclude without expressing my obligation to Dr R. Mackenzie Johnston for his careful revision of the proof sheets.

P. M'BRIDE.

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PART I.

CHAPTER I.

ANATOMY OF THE LARYNX.

Now that the introduction of the laryngoscope has made it possible to inspect the larynx not only for purposes of exact diagnosis, but also with the object of therapeutic and surgical treatment, a thorough comprehension of laryngeal disease cannot be acquired without a careful consideration of the anatomical structure of this complicated organ; and, for this reason, in a work like the present a short description is necessary.

The larynx, suspended above from the hyoid bone, continuous below with the windpipe, bounded behind by the pharynx, and having on either side the large nerves and vessels of the neck, is situated, when at rest, between the upper border of the third and the lower border of the sixth cervical vertebra, and rises or falls more or less during respiration, phonation, and deglutition. It forms, especially in the male, an elevation which can be both seen and felt between the muscles connecting the trunk with the hyoid bone; its most prominent portion (pomum Adami) is formed by the junction of the two lateral plates of the thyroid cartilage, which unite at an angle in the middle line. Above this spot there is a deep notch (the superior thyroid), which can easily be made out by palpation, while below a smooth concavity corresponds to the crico-thyroid membrane, to which again succeeds the slight convexity of the cricoid cartilage. The lower part of the lateral walls are covered by the lobes of the thyroid gland, which also frequently sends an offshoot upwards in front of the middle line of the larynx.

The skeleton of the larynx is composed of nine cartilages, three of which are single (cricoid, thyroid, and epiglottis), while three occur in pairs (arytenoids, cartilages of Wrisberg and Santorini); the last named are, however, by no means constant in their occurrence and development.

The principal support of the larynx is formed by the cricoid cartilage, which resembles a signet ring slightly flattened—low anteriorly, high posteriorly, and somewhat compressed from side to side. Its front portion, which corresponds to the narrow part of the ring, and only forms a quarter of the whole circumference, is continued by a sudden rise of its upper margin into the plate which lies behind. On the upper

angles of the plate may be seen the articular surfaces for the arytenoid cartilages, which slope backwards and inwards; on its outer surface, about half-way up, is situated on a wart-like prominence a small concave, circular, and slightly upturned articular surface, on which the small cornu of the thyroid cartilage moves. From the upper margin of the ring there extends to the lower border of the thyroid cartilage a ligament (the crico-thyroid), which is chiefly composed of elastic fibres, while the remaining space between the two cartilages is filled by a portion of the elastic membrane of the larynx. The lower border of the cricoid cartilage is united with the first ring of the trachea, which it slightly overlaps in front.

If we consider the cricoid cartilage as the basis of the laryngeal skeleton, we may say of the thyroid that it gives to the larynx its peculiar funnel-shaped form. The two symmetrical plates of which the thyroid cartilage consists are united in front at an angle of 90°. The ridge formed by the line of union slopes slightly from above downwards and backwards, and according to its shape the outline of the neck may be characterised by a well-marked prominence, as in adult males, or rounded, as in women and children. The upper margin of each plate is convex at its anterior angle, and hence through their union is formed a central notch (superior thyroid) which serves for the attachment of the thyro-hyoid ligament. The posterior margin is prolonged downwards and slightly forwards from the inferior angle of each side into a process (the cornu minus); and in the same way the cornu majus, which is somewhat longer and thinner, extends upwards and slightly inwards from the upper angle of the plate. The inferior cornu presents on the inner surface of its extremity an articular facet for articulation with the cricoid. The superior horn is united with the cornu majus of the hyoid bone by means of the lateral thyro-hyoid ligament. The lower margin of the thyroid cartilage is, as we have seen, united with the cricoid.

The epiglottis is a flat, flexible, fibro-cartilage, and its shape presents many variations: Sometimes it resembles a slightly elongated ace of hearts with the point directed downwards; sometimes a leaf with the stalk below; then, again, it may seem not unlike an elongated saddle or a tongue hollowed out in the centre; its under surface is attached to the thyroid notch by means of the thyro-epiglottic ligament, and forms an elevation in the lumen of the larynx (the tubercle of the epiglottis), which on laryngoscopic examination is characterised by its rounded shape. The superior free margin of the epiglottis extends upwards over the base of the tongue. During life the position of the epiglottis varies; in the adult it is, as a rule, nearly vertical, in children it is often horizontal, or even lower behind than in front; its position also changes slightly during deep inspiration and phonation. The upper

surface of the epiglottis is concave from before backwards, and convex from side to side, while, of course, the inferior surface presents opposite characteristics.

The arytenoids are the most mobile cartilages of the larynx, through which movements most important alike for respiration and phonation are produced; they are situated in the posterior part of the larynx, and are united with the cricoid through a saddle-shaped joint. Each is shaped like a pyramid turned slightly inward, with a flattened apex, and with the base sloping off obliquely. The base has two processes; the one (processus muscularis) arises as the margin which separates the posterior from the anterior surface of the pyramid becomes broader towards the base, and overlaps the margin of the cricoid cartilage, to it are attached the lateral and posterior crico-arytenoid muscles; the other (the processus vocalis) is formed by the junction of the median, anterior, and inferior surfaces of the pyramid. The outer border of this prominence can be recognised more or less distinctly by means of the laryngoscope through the yellow colour which it imparts to the mucous membrane, and marks the boundary between the cartilaginous and ligamentous portion of the vocal cord.

The cartilages of Santorini, small, conical, and slightly bent backwards, lie on the apex of the arytenoids; the cartilages of Wrisberg are situated in the aryepiglottic folds; finally, the sesamoid cartilages, which, however, are by no means constant, appear as small elongated bodies attached to the edge of each arytenoid by means of elastic fibrous tissue.

The individual cartilages of the larynx are attached by means of ligaments to each other and to adjacent parts, *i.e.* to the hyoid bone and trachea. The larynx is remarkable for the fact that there is between mucous membrane and cartilage a continuous layer of elastic fibrous tissue which varies in thickness, and is at some parts firmly, at others loosely, attached to the mucous membrane, while here and there it shapes itself into distinct ligaments. Of importance to the laryngoscopist is the glosso-epiglottic ligament, which arises from the root of the tongue as a septum, and is attached to the anterior surface of the epiglottis in the middle line, and also the superior and inferior thyro-arytenoid ligaments. The superior thyro-arytenoid ligament, which lies in a fold of mucous membrane, and together with this forms the ventricular band or false cord, is attached in front to the receding angle of the thyroid cartilage, just above the insertion of the epiglottis, while posteriorly the fibres, which are few and not continuous with one another, are lost in the region of the anterior border of the arytenoid.

The inferior thyro-arytenoid ligament represents that part of the larynx which is most important for its function—the vocal cord. The right and left vocal cords arise quite close to each other from the

thyroid cartilage, at about the middle of its receding angle (anterior commissure). The fibres only unite to form a cord anteriorly, then divide into separate groups, of which one passes along the free edge and becomes attached to the point of the processus vocalis; a second lies on the upper surface of the cord, and is inserted immediately behind the posterior extremity of the ventricle; while a third is situated on the under surface of the cord, and is attached below the processus vocalis to the median surface of the arytenoid cartilage, or the anterior surface of the cricoid plate. In addition to elastic fibrous tissue, the substance of the vocal cords is to a great extent composed of the fibres of the internal thyro-arytenoid muscle. On making a section, one sees that its shape is triangular or prismatic. Two sides of the triangle are free, of which one is directed upwards towards the ventricular band, the other is directed downwards and inwards towards the lower part of the opposing wall of the trachea, while the third surface represents the outer attachment.

Besides the true there also occur false ligaments, which are only formed by reduplications of the mucous membrane. As the latter passes from the base of the tongue to the upper surface of the epiglottis there are produced, besides the median fold, which has been already referred to, and in which the median glosso-epiglottic ligament is concealed, also two lateral folds (lateral glosso-epiglottic folds), so that two shallow depressions are formed on each side. The mucous membrane descends from the lateral wall of the pharynx over the inner surface of the thyroid cartilage, and then again ascends, and in this way the aryepiglottic folds or ligaments are formed. The depression which is thus produced on either side is spoken of as the sinus pyriformis.

The muscles of the larynx may be divided, according to their physiological function, into two groups; the first embraces those which move the larynx as a whole, whether it be to raise, lower, or fix it; the second, those which change the position of the cartilages relative to one another, and in this way regulate the shape of the organ and the tension of its elastic portions, more especially the vocal cords. The muscles of the second group may be divided as follows: (1) Those whose function it is to maintain a way of communication between the external atmosphere, the respiratory muscles proper, and the lungs; (2) those which produce closure of the glottis requisite for phonation, and also render possible absolute closure when it is desired to place the air within the lungs under great pressure, and to continue this pressure; (3) those which regulate the tension of the vocal cords.

Among those muscles whose function it is to fix the larynx and to raise and lower it, we number the sterno-thyroid, which draws down the larynx; the thyro-hyoid, which raises it as a whole; and, finally, the inferior constrictor of the pharynx, which either, like the preceding,

fixes the whole larynx, or, more especially, one of the two larger cartilages (thyroid or cricoid). The first of these three muscles, the sterno-thyroid, contains a number of long fibres, which are attached to the posterior part of the thyroid cartilage behind its articulation with the cricoid, thus making it possible for it to raise the anterior part of this cartilage, and so to produce relaxation of the vocal cords.

The posterior crico-arytenoid muscles or abductors act as enlargers of the glottis, and on their proper fulfilment of this function human life is often dependent. They arise on either side from the inferior half of the posterior surface of the plate of the cricoid, and, their fibres converging, run obliquely upwards and outwards, to be inserted into the posterior and lateral margin of the processus muscularis of the arytenoid; through their contraction, the cartilage is fixed inwards and backwards, rotated round its long axis, and thus the vocal process is turned outwards and the glottis opened. A small external portion of this muscle, which runs more or less perpendicularly, may draw the arytenoid outwards and downwards.

As antagonists of the last-named muscle, that is, as closers of the glottis (adductors), several muscles act, but more especially the lateral crico-arytenoid, which, arising from the upper margin of the side of the cricoid, passes backwards and upwards, and is inserted into the lateral surface of the muscular process; as it draws the arytenoid outwards and downwards, and thus rotates the point of the vocal process inwards, it closes the glottis, and more especially its ligamentous portion.

The action of this muscle is aided and increased by (1) the transverse muscle (musculus transversus), which is stretched horizontally between the two lateral margins of the arytenoids, and by its contraction so approximates the two cartilages that their inner surfaces, and more especially the posterior inferior parts of these which principally compose the cartilaginous portion of the vocal cords, are in apposition. (2) The thyro-arytenoid (the vocal muscle proper), which passes backwards from the lower half of the inner surface of the thyroid, near its receding angle, in two portions, which are described by some anatomists as separate muscles (externus and internus), to be inserted into the lateral margin of the arytenoid. While the fibres which run from before backwards approximate the points of insertion of the vocal cord, the tension of the latter necessary for the production of various notes is regulated by the amount of their contraction; at the same time, the vocal cords are approximated to one another, and thus, in other words, the muscle gives to the vocal cord as a whole both the position necessary for phonation and the proper amount of tension. A few fibres of the outer portion of this muscle spread outwards towards the ventricular bands, and by this means these may be approximated.

The crico-thyroid muscle acts to a certain extent as an antagonist to

the last-named; it arises from the anterior surface of the arch of the cricoid, passes obliquely upwards, and is inserted into the lower and inner edge and inferior cornu of the thyroid. It increases the tension of the vocal cords, as during fixation of the cricoid it tends to move the thyroid forwards and downwards.

The arteries of the larynx are the superior and middle (also called crico-thyroid) laryngeal, which both arise from the superior thyroid, and the inferior (or posterior) laryngeal, which arises from the inferior thyroid. The veins correspond for the most part with the arteries and empty themselves into the internal jugular. Lymphatic vessels are not found in the cartilages, ligaments, and muscles, but are numerous in the mucous membrane, except on the posterior surface of the epiglottis and vocal cords, in which situations they are few and small.

The nerves are the superior and inferior laryngeal (or recurrent), both branches of the vagus. The superior laryngeal nerve is principally sensory, and only sends a motor twig to the crico-thyroid muscle. It arises from the lower part of the pneumogastric ganglion, and opposite the cornu of the hyoid bone divides into two branches, of which one, containing motor fibres (ramus externus s. minor), descends over the thyro-pharyngeus muscle to the lower edge of the plate of the thyroid cartilage, and ends in the crico-thyroid muscle. The other or sensory branch (ramus externus s. major) pierces the thyro-hyoid membrane and, as it passes inwards and slightly backwards just beneath the mucous membrane, which forms the floor of the sinus pyriformis, sends branches to the laryngeal portion of the pharynx (rami pharyngei), to the sinus pyriformis itself, to the outer layer of the aryepiglottic fold, and, finally, to the whole inner surface of the larynx (rami laryngei). The inferior or recurrent laryngeal nerve arises on the right side in front of the subclavian artery, near the apex of the pleural cavity from the vagus, ascends behind the carotid running between the trachea and œsophagus, pierces the crico-pharyngeal muscle at the lower cornu of the plate of the cricoid, and supplies all the muscles of the larynx, with the exception of the crico-thyroid. The left inferior laryngeal nerve leaves the vagus on a level with the inferior margin of the aortic arch, ascends, winding round the transverse portion of the arch between it and the bronchus lying in the anterior part of the sulcus, which the œsophagus forms with the trachea, as high as the lower edge of the cricoid, where it passes into the larynx in the same manner as the nerve of the opposite side.

The mucous membrane of the larynx is immediately continuous with that which lines the floor of the mouth and the pharynx. It shows even to the naked eye variations in different parts of the larynx which are of some importance in considering many pathological processes. On the anterior wall of the larynx the mucous membrane is attached so

firmly to the parts beneath that it can neither be displaced nor pinched into folds. It is just as smooth and as firmly attached on the anterior concave surface of the cricoid cartilage; on the other hand, between the arytenoids (that is, on the posterior wall of the larynx) it is attached by loose and expansile cellular tissue to the anterior surface of the transverse arytenoid muscle, and shows several longitudinal folds which disappear when the glottis is widened. On the ventricular bands and in the ventricles the mucous membrane is rather loosely attached to the subjacent structures, and is at both extremities marked by small flattened elevations caused by glands. The vocal cords are covered with delicate mucous membrane, which is so loosely attached that it is easily movable and can be raised in folds, except at the free margins, where it is firmly attached to the elastic fibrous tissue, which is most abundant at this point. The epithelium is in part pavement and in part ciliated. The pavement epithelium is a continuation of that lining the pharynx, and covers the mucous membrane on the upper and under surface of the epiglottis, the margins of the aryepiglottic folds, and extends as a narrow stripe over the opposing surfaces of the arytenoids on to the vocal cords, which, especially at their free margins, show a large amount of pavement epithelium. In the rest of the larynx the epithelium is composed of elongated ciliated cells, which send thread-like processes downwards. Papillæ are found on the mucous membrane of the upper surface of the epiglottis, and on the free margins of the vocal cords, from which they continue to the under surface, getting smaller and fewer. Underneath the epithelium there is found a thin homogenous layer of transparent connective tissue, which, however, is only completely homogenous in the mucous membrane of the vocal cords, while at other parts it shows more or less fibrous and cellular elements. The mucous membrane itself is composed of a delicate fibrillar connective tissue which contains numerous proliferating cells. The cells are granular, and contain a well-developed nucleus imbedded in a thin layer of protoplasm. According to Luschka, these cells are to be regarded as the true matrix of the epithelium, and play an important part in all the inflammatory affections of the larynx. Coyne found lymph follicles in the mucous membrane, and believes that their presence explains the occurrence of certain ulcerations in the course of typhoid. Acinous glands occur sometimes singly, sometimes in groups, and are particularly numerous on the tubercle of the epiglottis, at the angle formed by the epiglottis with the aryepiglottic folds, on the ventricular bands, and within the ventricles; they are, moreover, irregularly scattered over the posterior wall of the larynx, especially in the neighbourhood of the crico-arytenoid articulation, but absent on the upper surface of the vocal cords.

Having now described the individual parts of which the larynx is composed, so far as necessary for practical purposes, it remains to present

a picture of the architecture of the interior of the larynx, for only in this way can laryngoscopic examination be made intelligible.

The interior represents an elongated irregular cavity which, for convenience of description, may be divided into an upper, a middle, and a lower, although the boundaries which are supposed to divide these separate parts are founded principally on external contour, and are not justified either by special anatomical conditions nor by the course of pathological processes. The superior laryngeal space (vestibula laryngis) extends from the entrance of the larynx to the ventricular bands. Its anterior surface is formed by the epiglottis, and is, in accordance with the shape of this cartilage, convex with a slight concavity in the centre, while the lower part shows a prominent rounded projection—the tubercle of the epiglottis. The posterior wall is formed by the upper portion of the arytenoids above the attachment of the ventricular bands, and by the cartilages of Santorini, which are attached to their apices. This wall, called the interarytenoid commissure, is liable to considerable changes in shape through the movement of the cartilages, appearing during deep inspiration, when the cartilages are widely separated, as a flat depression, while, as the cartilages are approximated, it forms a perpendicular sulcus which, during complete closure of the glottis, is changed into a hardly recognisable cleft. The lateral walls, which are composed of the aryepiglottic folds, are attached to the epiglottis, which is wedge-shaped with the smaller end downwards, so that they approach each other below, and proportionately diminish the space between them.

The middle laryngeal space is bounded above by the ventricular bands, below by the vocal cords, and laterally by the ventricles. The space between the ventricles forms an oval which is wider behind than in front, and is inclined obliquely downwards and backwards. The space between the vocal cords is the glottis proper, and varies in shape and width according to the position of the cords. Each of the ventricles forms an oblong space between the ventricular band and vocal cord, which is about as long as the latter.

The inferior laryngeal space is bounded above by the vocal cords, below by an imaginary plane through the lower edge of the cricoid cartilage in front, and at the sides by the conoid ligament and by the anterior and lateral portions of the cricoid cartilage; while posteriorly is situated the plate of the cricoid and the base of the arytenoids. The walls of the space diverge from the under surface of the vocal cords, until a circumference corresponding to that of the first rings of the trachea is attained.

CHAPTER II.

THE PHYSIOLOGY OF THE LARYNX.

ALTHOUGH in our anatomical description of individual parts of the larynx, more especially of the muscles, we have considered as far as possible their functions, we yet deem it necessary here to bring forward the few physiological facts necessary for a proper comprehension of various pathological changes, and, moreover, to glance at the laryngoscopic images which may occur in health.

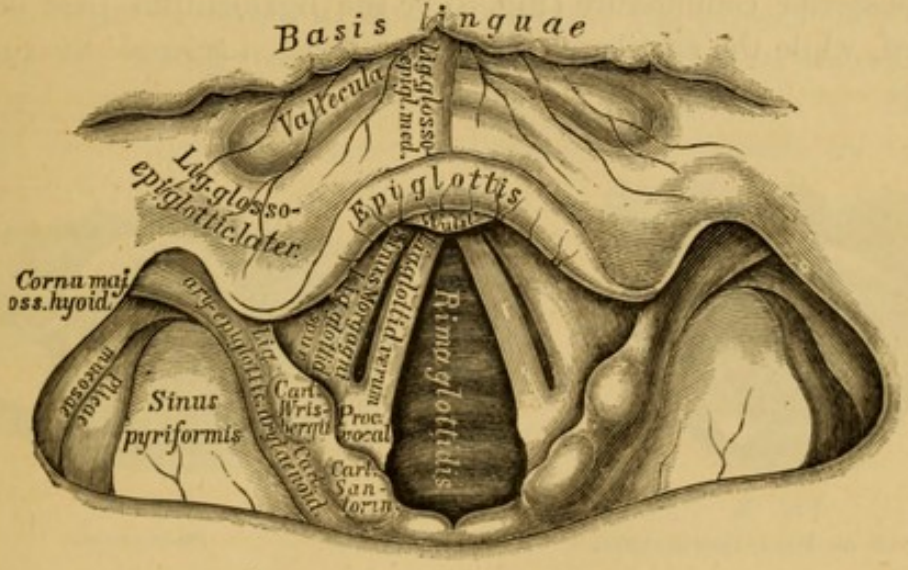

FIG. 1.
GLOTTIS AT REST.

In order to fulfil its double function as an organ of respiration and voice, the larynx must in the first place give room for the passage of air, and in the second place must be able to adapt the approximation and tension of the vocal cords for purposes of phonation.

More especially must the complicated system of muscles which, as we have seen, partly support and aid but also partly antagonise each other, act in such a way that both functions can go on unimpeded.

As the position of rest of the glottis during which no muscle is called into action, that position may be considered which it assumes during

Wulst = Tubercle of the Epiglottis.

ordinary quiet breathing and which nearly corresponds with what Ziemssen has called the cadaveric position. The opening of the glottis then represents a narrow isosceles triangle, the sides of which are bent at an obtuse angle in its posterior part (Fig. 1).

During deep-forced respiration the vocal cords separate still further on inspiration, but during the subsequent expiration again approach each other; during inspiration the vocal cords form a wide and almost pentagonal opening, and under favourable circumstances one can then see the bifurcation of the trachea (Fig. 2).

For a membranous pipe with two tongues—such as we may consider the larynx—to produce a sound, it is necessary that both tongues be sufficiently tense and be approximated until they are in contact or nearly so. We have already, in the section devoted to anatomy, shown how closure and tension of the vocal cords are regulated. The glottis when narrowed for the purpose of producing a sound may, however, be closed in one of two ways, that is to say, the ligamentous and cartilaginous portions of the vocal cords may approach each other in their whole length so that the cleft of the glottis extends from the anterior to the posterior commissure (Fig. 3) or the ligamentous part only may be closed, while the cartilaginous portion forms a triangle with the apex in front.

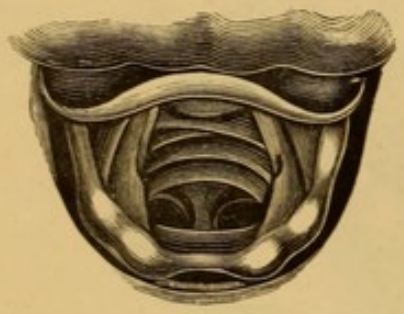

Fig. 2.
Position of Deep Inspiration.

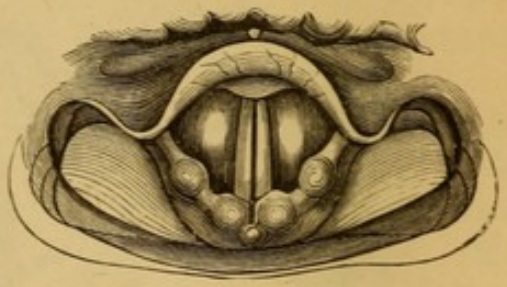

Fig. 3.
Phonation.

Both forms occur in health, but the former is the more common. Grutzner states that it is easy for him to place his vocal cords in the second position at will. If he then speaks with a strong expiratory effort, his voice sounds hollow, hoarse, and sepulchral; if he speaks with slight pressure, a whisper is produced. Sometimes the inner surfaces of the arytenoids are brought into contact and a cleft only remains between the vocal cords from the anterior commissure to the points of the vocal processes. This is particularly the case during the production of falsetto notes, when the vocal cords enclose a short and comparatively broad elliptical opening (Fig. 4).

The ventricular bands are capable of almost the same movements as the cords, only under normal circumstances their edges never come in

contact. The hypothesis that they are directly concerned in the production of voice is unproved. Only in disease, or when an absolute

FIG. 4.
DURING FALSETTO NOTE.

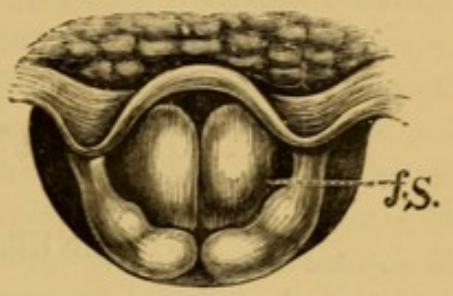

FIG. 5.
APPROXIMATION OF THE VENTRICULAR BANDS OR FALSE CORDS.

closure of the glottis is required in order to exert great pressure upon the air within the lung, are the ventricular bands approximated and the tubercle of the epiglottis pressed down upon them as in Fig. 5. We must limit ourselves to this anatomical and physiological sketch, and refer the reader for further details to works on anatomy and physiology, more especially *Der Kehlopf des Menchen* by Luschka, Tübingen 1871, and *Physiologie der Stimme und Sprache* by Grützner in Hermann's *Handbuch der Physiologie.*

CHAPTER III.

GENERAL ETIOLOGY.

The larynx, from its position near the surface of the body, is more exposed to injury from without than other internal organs. Its protective organ, the nasal cavity, intended to warm and purify the inspired air, but imperfectly fulfils this function, and every atmospheric change may directly influence the mucous membrane of the larynx. Accordingly, sudden elevations or depressions of the external temperature, excessively moist or dry air may cause disease of this organ; in the same way the admixture of solid particles or irritant gases or vapours with the respired air may prove injurious. Another kind of danger is due to the neighbourhood of the food passages, not only because foods and fluids may get into the larynx when the act of deglutition occurs during an inspiration, but taking food or drink at too high a temperature, excessive use of alcohol, or swallowing caustic fluids may also produce more or less important pathological changes in the larynx.

In a number of cases pathological processes extend from the pharynx to the larynx. Sometimes it remains unproved whether the same cause has not produced disease of the pharynx and larynx simultaneously, but at the same time there is no doubt that many affections extend to the larynx from the pharynx by continuity and contiguity. Diseases of the food passages may affect the larynx directly or indirectly; in the same way, tumours of neighbouring regions may either extend to the larynx or, through their pressure, cause narrowing of its lumen; while, by their preventing return of venous blood, hyperæmia and œdema may be caused; or, through injury of the nerves which supply the larynx, paralysis may result.

In considering the etiology of laryngeal disease, we must not omit exposure to cold. Whatever be thought of the importance of this factor, it cannot be denied that sudden chilling of the body when heated and damp cold weather produce laryngeal disease, and that epidemics or inflammatory affections of the larynx are most common during inclement seasons.

As a direct cause we must, moreover, consider excessive use of the organ, for many an orator or singer has paid for his rashness in expecting

too much from his voice by becoming the victim of transient or permanent laryngeal disease.

As symptomatic, or perhaps more accurately, as infectious diseases of the vocal organs must be classed those which occur during the course of acute or chronic zymotic diseases, *e.g.* measles, scarletina, smallpox, typhoid, glanders, and, moreover, tubercle and syphilis.

We must not omit to mention that certain individuals are specially predisposed to laryngeal disease; particularly those who have once or oftener suffered in this way. This predisposition also exists after whooping-cough, in persons of delicate constitution, in the anæmic, and in those who lead a sedentary and enervating life. Age and sex are also not without their influence. Although many diseases, such as pseudo-croup, croup, and laryngismus stridulus, are peculiar to childhood, still on the whole adults, and especially adult males, are more liable than children, probably because men are more exposed to the previously considered causes than women and children.

CHAPTER IV.

GENERAL DIAGNOSIS.

Among the methods of examination which are at our disposal for the recognition of laryngeal disease, laryngoscopy takes by far the first place, and the results which we can thus attain are of such great importance in diagnosis that we must discuss it first and separately.

Laryngoscopy.—We understand by laryngoscopy a method of examination which enables us to bring into view the interior of the larynx whether for physiological, diagnostic, or therapeutic purposes.

When we consider the simplicity and comparative ease with which this method is now executed and also the small amount of apparatus necessary, we are almost led to think that its history is already old. We can, however, only trace it back to 1858 when Czmerak, stimulated by the experiments of Tuerk, which had come to his knowledge, not only showed how the difficulties which are encountered in inspecting the interior of the larynx may be overcome, but also, recognising the whole importance of laryngoscopy in the diagnosis and treatment of laryngeal disease, energetically advocated its practical introduction among physicians.

It is interesting to see how the idea which forms the basis of laryngoscopy sprang up from time to time, but how those who worked at it always failed in carrying it out—even when they had almost reached the goal. The first attempt at constructing an instrument in order to see and remove suspected tumours from the larynx was made by a French physician, Levret, in the last century; his instrument consisted of a polished plate of metal which reflected rays of light in the direction of the tumour, and at the same time showed the image on its reflecting surface. On the other hand, the first who suggested a systematic examination of the cavities of the body with the mirror and reflected light, and described an apparatus for this purpose, was Bozzini—a physician in Frankfort on the Main (1825). His idea, however, received little favour among medical men, and the Vienna university, as also "Josef's Academie," delivered a damaging criticism on the instrument. An equally small amount of success attended the experiments of Cagniard de la Tour (1825) and Senn of Geneva (1827). Babington of London

(1829) was nearer the mark; he constructed two mirrors—a small one to receive the laryngeal image and a larger to throw sunlight upon the former. Although this "glottiscope," as it was called, very nearly approaches the laryngoscope of to-day, it met with no success and was soon forgotten. Further unsuccessful attempts were made by Bernati 1832, Baumès 1838, Sixton 1840, and Warden 1844, who was the first to use reflected lamp light (a large Argand burner and prisms).

Neither science nor medical practice having derived any real advantage from these attempts, all the more credit is due to a layman, Manuel Garcia—a singing master in London—in that he was not only the first of whom it can be said with certainty that he saw the interior of the larynx during life, but because the results which he arrived at by means of the laryngoscope must be considered most important in relation to our physiological knowledge concerning voice production and the production of chest and falsetto tones. Garcia may then, with perfect justice, be considered as the real inventor of the laryngoscope; only, on the one hand, his discovery received little attention from physicians and his anatomical and physiological observations, characterised according to Grutzner by great acuteness and marked power of observation, were not credited, and, on the other hand, the whole importance of his discovery in relation to medical science and practice naturally escaped him. Only after Tuerk of Vienna (1857) discovered the laryngoscope anew and gave it a convenient shape, and more especially after Czermak had experimented with the mirrors which he borrowed from Tuerk, recognised its importance, established its almost universal adaptability, substituted artificial illumination by means of reflectors for uncertain sunlight, and finally propagated its praises by word and pen, was the matter completed, and a new field conquered for medical science and surgical skill. We may then speak of Garcia and Tuerk as the inventors of the laryngoscope, and Czermak as the discoverer of laryngoscopy.

In order to see the interior of the larynx, we require 1st, a laryngeal mirror for introduction into the pharynx; 2nd, a sufficient illumination.

The laryngeal mirror (Fig. 6, *a. b.*), as it was first used by Tuerk and is now generally considered most convenient, consists of a small mirror and a long handle which are attached to each other at an angle of from 120° to 125°. The mirror must be made of clean white glass well amalgamed and with as narrow a setting as possible. The surface should have a diameter of from 1 to 3 centimetres; it is necessary to have at least three mirrors, the sizes of which vary within these dimensions. The thickness of the mirror should only slightly exceed 1 mm. The larger size should ordinarily be used, and recourse should only be had to the smaller when we cannot accomplish our object with the other, because the amount of light is proportionate to the surface

of the mirror, and, as the field of vision increases, it is proportionately easier to see the whole interior of the larynx at once. The handle should be 2 millimetres in diameter and about 15 or 20 centimetres in

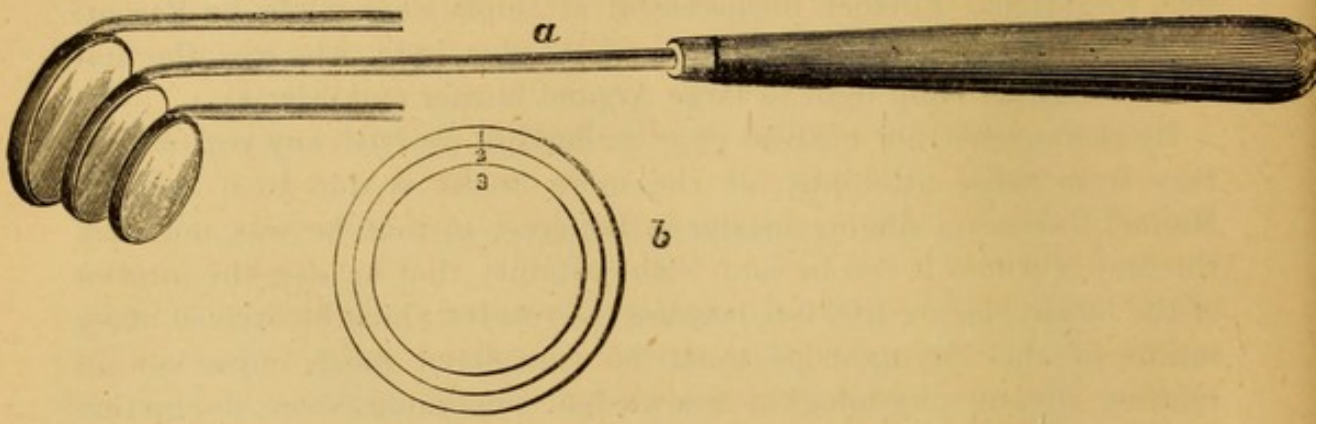

FIG. 6.

a. Laryngeal mirrors. *b*. Diagrams showing the size of the reflecting surface of mirrors 1, 2, 3.

length; it is composed of metal and sufficiently resistant not to bend during examination, while it terminates in a handle of wood or ivory about 10 centimetres long. It is better for the stem and handle to be immovably fastened together; but, in order to make laryngoscopic cases convenient and to enable one handle to serve for mirrors of different sizes, the stem may be fastened to the handle by a screw.

Metallic mirrors are now hardly ever used, for, although they give a more accurate image, still their employment is fraught with too much inconvenience; thus they become dim from the slightest moisture, are easily spoilt by contact with medicated solutions, and get scratched in cleaning. Among glass mirrors so much useless material is offered for sale that we would recommend a careful examination to the intending purchaser. The glass must be white, so that white paper is reflected white and not green or blue; the thickness of the mirror should be a little over 1 millimetre; and the metal setting should be firmly adapted to the edge of the reflecting surface. Mirrors with very flexible stems are unsuitable, and the handle should not be too thin or smooth so that it can readily be held in the operator's hand. We consider round mirrors as all sufficient and have seen no advantage from the use of oval or quadrilateral varieties. Magnifiers and appliances for measuring the laryngeal image have been adapted to mirrors, but the results are not satisfactory and can certainly be dispensed with in practice, so that we need not consider them further.

A good and accurately applied illumination is of such importance towards obtaining a clear laryngeal image that the success of a laryngoscopic examination is altogether dependent upon it. In this everything hinges not only upon the strength of the light but also upon its accurate application. The physical law which must be taken into consideration is that the rays of light which impinge upon a plane mirror are so reflected that the angle of reflection and the angle of incidence are equal. In order to illuminate the interior of the larynx, we must, therefore, hold the mirror against the posterior wall of the

pharynx at such an angle that the rays of light which fall on it are thrown into the larynx. This angle varies in different individuals within very narrow limits, and as an average we may place it a little over 45°. But, as the rays which have been thrown into the larynx return by the same route, the observer's eye must be as nearly as possible in the centre of the disc of light thrown into the patient's mouth in order to see that part of the larynx which is most brightly illuminated. A portion of the rays, however, is lost through absorption and refraction, and, moreover, only that portion is of use which falls directly on the laryngeal mirror. In order then to get the necessary intensity of light, and to utilise as much as possible the rays which fall through the narrow opening formed by the patient's mouth, we endeavour to concentrate it by means of special optical appliances, and this is done by reflecting mirrors, lenses, or a combination of both.

ILLUMINATION BY REFLECTING MIRRORS.

In order to reflect light into the pharynx, and from thence, by means of the laryngeal mirror, into the larynx, we make use of a circular reflector from 8 to 10 centimetres in diameter and having an aperture in its centre. If sunlight be used the reflecting surface should be plane, but concave if artificial light or diffuse daylight be employed. The reflector is supplied with a universal joint connected by means of a stem to a special apparatus which serves to attach it either to the head of the operator or to the lamp.

Some laryngoscopists hold the stem between the teeth according to Czermak's method, which (as also holding the reflector in the hand) is very inconvenient. The most suitable plan is to have the reflector attached to the head of the observer either by a spectacle frame or by a forehead band.

Of more importance than the method of attachment of the reflector is its correct focal distance. The object of the reflector is to project the image of the flame as the optical expression of the union of the various reflected rays to such a distance that it falls within the interior of the larynx. Now the observer's eye, when placed behind the reflector, is situated at about 14 centimetres from the patient's mouth, and we can further estimate the distances from the mouth to the wall of the pharynx, against which the laryngeal mirror rests, and from the latter to an imaginary plane through the glottis at about 8 centimetres; according to this, then, the image of the flame must be projected 30 centimetres in order to fall upon the rima glottidis, and this also nearly corresponds to the distance at which the normal eye can see an object distinctly. But, as only that portion of the light which finds room on the laryngeal mirror can be utilised for illuminating the larynx, we can to a certain extent diminish the size of the image of the flame in

order to increase its intensity. For this reason we must use the image which is equal to the size of the flame or smaller, because a small image

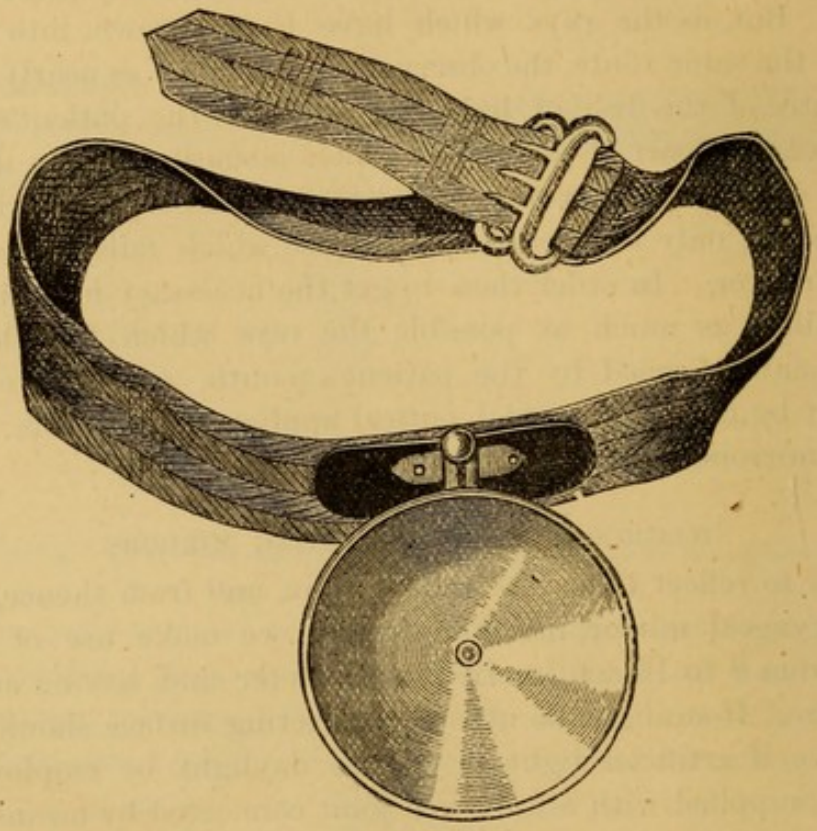

FIG. 7.
REFLECTOR AND FOREHEAD BAND.

contains more rays of light than a portion of a larger image. We get the image equal in size to the flame when the distance from the reflector alike to the larynx and to the flame is equal to twice the length of the focal distance. As the distance of the larynx from the reflector is given at about 30 centimetres, and as the position of the flame at a like distance from the observer can be arranged, we must use a reflector of 15 centimetres (focal distance) in order to throw into the interior of the larynx an image equal in size to the flame.

The diminished image of the flame lies without the focal distance and within twice the focal distance, and accordingly, in order to use it for illuminating purposes, the focal distance of the concave mirror must be more than 15 and less than 30 centimetres.

Concave mirrors with a focal distance of from 15 to 20 centimetres are therefore the most suitable.

In our calculations we have supposed that the brightest light is thrown upon the glottis, and for the parts above and below it must, of course, be less, but still always strong enough to be employed with advantage, more especially as we are enabled to correct the mistake by slightly changing the distance of the examining eye from the mouth.

Short and long sighted persons who cannot accommodate their vision to the distance of 30 centimetres must use suitable glasses.

It is evident on optical principles that for the correct employment of the diminished

image the position of the light is not unimportant, and that, as the focal distance of the concave mirror increases, the distance of the flame must also increase in order that the interior of the larynx may be illuminated by its reflected image. According to the formula $\frac{1}{F} = \frac{1}{A} + \frac{1}{A^1}$, where F is the focal distance, A the distance of the flame from the mirror, and A^1 the distance of the image of the flame, we can in every case calculate the necessary distance of the flame if we substitute for F the known focal distance of the mirror, and for A^1 the number 30. In the case of the reflector with a focal distance of from 15 to 20 cms., such as we have recommended, the proper distance of the flame is between 34 and 50 cms. Considering the importance of a reflector having the correct focal distance, it is to be recommended before purchasing one to examine it carefully. This is done approximately by estimating the distance of the reflected image of some distant object, *e.g.* the window or chimney of an opposite house, from the mirror; or a small figure, *e.g.* a cross, may be cut out in the centre of a piece of cardboard; the latter is attached to a lamp so that the hole is in front of the flame, the rays of light which pass through are then received upon the concave mirror, which is finally so adjusted that a clear image of the cross is thrown upon the cardboard. The distance between the mirror and the cardboard corresponds exactly to the radius of curvature of the former—that is twice the focal distance.

ILLUMINATION BY MEANS OF LENSES.

If a convex lens be placed in front of a lamp a bright space results behind the lens, as the rays are less divergent when they leave than when they enter it. This bright space is used by some laryngoscopists for illuminating purposes, and various laryngoscopic apparatus have been constructed upon this principle. The simplest is the water lens (Schuster Kugel) used by Stoerk—that is to say, a ball of glass filled with water, and in a case of emergency a bottle filled with water may be substituted. According to Stoerk the water lens has the advantage that, owing to its great focal distance, the observer is quite independent of the original light. Fauvel, Krishaber, and Moura-Bourouillou in their apparatus attach a biconvex lens directly to the lamp, which stands on a table narrow enough to permit the operator to introduce the throat mirror into the mouth of the patient who is seated on its opposite side. A screen attached to the lamp protects the eyes of the observer, whose face is held close to the lamp when this

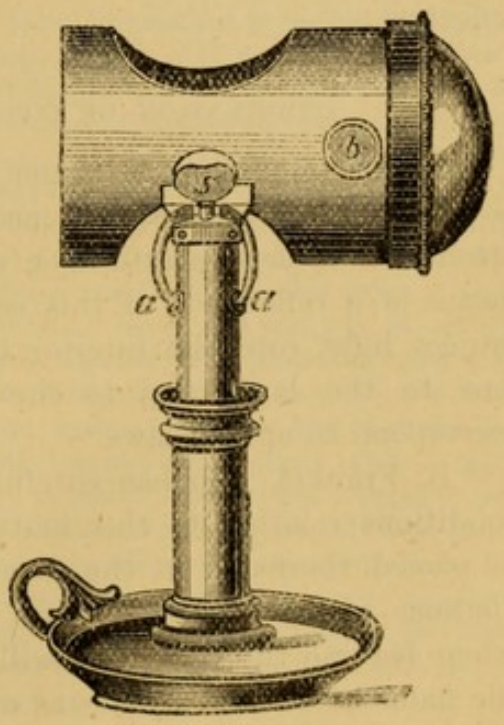

FIG. 8.

MACKENZIE'S LIGHT CONCENTRATOR

a. A candle to which the concentrator is attached by two arms. *s*. Screw to fasten the arms. *b*. One of two cork discs attached to the side of the concentrator, in order to enable it to be grasped when hot.

method is employed. Mackenzie constructed a lamp with a biconvex lens (rack movement lamp) which admits of every possible perpendicular and horizontal motion, and also a so-called light concentrator which may be adapted to any lamp or even to a candle.

It is composed of a small metallic cylinder about 9 cms. in length and 6 cms. in diameter, closed at one end and having at the other a plano-convex lens of about 6·3 cms. in diameter, the plane surface of which is directed towards the light. In the upper and lower surfaces of the cylinder are situated, opposite to one another, two round openings of about 5·7 cms. in diameter. These are not equidistant from the two extremities of the cylinder, but are placed so near its closed extremity that a perpendicular drawn through their centres is situated at about 6·3 cms. from the plane surface of the lens, and so that rays starting from this point pass in an almost parallel direction. At the lower of these two openings are situated two semicircular arms so adapted that they can be attached by means of a screw to the widest lamp as well as to an ordinary candle or even to a thin glass tube.

Illumination by means of lenses is specially preferred in France; the light is good, but the method is less simple than the use of the concave reflector.

COMBINATION OF CONCAVE MIRRORS WITH LENSES.

In order to produce a larger image, with at least as much lighting power as is arrived at by means of a concave mirror, it has been attempted to concentrate rays, which have passed through a prism, by means of a reflector. If this combination is to be of real use and to project light into the interior of the larynx, then the relation of the lens to the lamp and to the reflector must not be arbitrary but correspond to optical laws.

* B. Fränkel, who has carefully considered all the various physical conditions relating to this matter, constructed an apparatus in which he placed the flame in the focus of the lens, which latter had a focal distance of from 10 to 12 cms. As in this case the rays are parallel when leaving the lens, they will be again united to form an image of the flame at 30 cms. by means of a reflector whose focal distance is also 30 cms. The lens may also be placed nearer the flame or may be removed to a point beyond its focal distance. In each case the manner in which the rays leave the lens must be calculated, and according to this the reflector must be chosen.

It is useless to use more than one lens—as in Tobold's apparatus, which contains three, and is much employed on account of its convenient arrangement—because the light is much diminished in its

* Ziemssen *Handbuch der Speciellen Pathologie und Therapie.* Bd. IV.

passage through three lenses, and the disc of light obtained by this means covers a greater surface than is necessary and illumination is thus in part lost. Even when the lenses are so arranged that not a diffusion of light but an image of the flame is obtained, the latter is greater than the circumference of the larynx at the expense of its illuminating power.

As a source of light lamps with circular burners are suitable, whether oil, petroleum, or gas be consumed. A medium sized moderator or petroleum lamp is sufficient for most cases. Artificial forms of light, such as the oxyhydrogen, are superfluous, and only used in hospitals and in the consulting rooms of specialists.*

If we compare the above methods we can only say that each, provided the laws of physics are taken into account in its employment, has advantages but also certain drawbacks. At all events, illumination by means of a reflector attached to the head of the observer is distinguished by its simplicity and by the power it gives to place the reflected light in the desired position by a slight movement of the head, and we can only recommend the beginner to overcome the difficulties of this method and to make general use of it.

It is a matter of no importance whether the reflector be attached to the head by means of a spectacle frame or a forehead band. Mackenzie finds a spectacle frame without the upper part of the setting most convenient, while the forehead band is preferred by most German laryngoscopists. The latter is composed of a plate corresponding to the bend of the forehead made of metal or rubber and lined with leather, velvet, or silk, to which is attached a band 3 or 4 cms. broad and of sufficient length, having a buckle at one end. It is not advisable to employ elastic because it does not attach itself firmly enough to the head, and also because it is apt to be melted by the heat of the body and thus becomes sticky and gets spoilt. We prefer a buckle to a sliding catch. Care must also be taken that the reflector, while moving freely and easily in its socket, remains fixed in every position which it is made to assume. The central opening may be round or oval, its edge must be covered with black because the smallest spot from which the varnish has been removed dazzles and irritates the eye and disturbs the examiner. One must not undervalue these details, because larnygoscopy often is made more difficult to the beginner by want of attention to them. Schroetter, in order to give the reflector a firmer support on the forehead, has attached to its posterior surface, above the central opening, two india-rubber balls, which, as in the case of a spectacle frame, lie on the bridge of the nose. This modification is much to the point, but can be dispensed with if the forehead band be of good material. Appliances for magnifying the laryngeal image are useless for practical purposes. Micrometers for measuring the exact size of various portions of the larynx and distances are not necessary.

PRACTICE OF LARYNGOSCOPY.

In order to make a laryngoscopic examination satisfactorily the following points must be attended to, viz. (1) The position of the patient; (2) Illumination; and (3) The laryngeal mirror must be so introduced

* The electric light promises to afford a very satisfactory method of illuminating the larynx. The electricity may be obtained either directly from a battery or from accumulators which must, of course, be charged afresh at varying intervals. The light may be attached to the forehead of the observer or may be inserted into the mouth attached to the laryngeal mirror (Translator).

as not to irritate tongue or pharynx, and placed in such a position that it reflects the interior of the larynx.

1. The Position of the Patient.—The patient sits opposite the observer with his back against the edge of the table, or better so that the table is to his right. The lamp stands near his shoulder, so that it approaches the latter as much as possible and is situated in the plane corresponding to the front of the shoulder. If it be not desired to use the image of a flame which is equal to it, but the diminished image, the lamp must be placed behind the patient, and its distance must be greater in proportion to the focal distance of the reflector.

The flame should be on the same level as the mouth of the patient. In order to make this possible for patients of different heights one may use either a chair which can easily be made higher or lower, or a lamp which can be adjusted to any desired elevation. The patient bends the head a little back, opens his mouth as far as he can, stretches out his tongue, surrounds it with a linen cloth, and holds it, with his thumb underneath and two fingers above. He should be directed to sit straight, not to bend his back, and not to incline his head to either side. The observer must, of course, accommodate his head to the height of the patient so that he can see into the mouth. After the position has been regulated in this way, the next point must be attended to.

2. Illumination.—The reflector, which is so attached to the head that one eye can conveniently see through the central opening, is turned so that the centre of the disc of light (or image of the flame) falls on the uvula. The reflector may also be placed in position before the tongue is put out and taken hold of, and the condition of the pharynx examined while the tongue is depressed with a spatula or with the handle of a laryngeal mirror. We prefer to inspect the fauces by means of daylight before beginning a laryngoscopic examination. Having satisfied himself that the illumination is sufficient, and properly adjusted, the observer passes to the next or third step.

3. Introduction of the Laryngeal Mirror.—The mirror is now warmed over a lamp on its reflecting surface, so that the moisture of the expired air may not dim it,* and after the observer has assured himself that it is not too hot by pressing it against the back of his hand, he takes the handle like a penholder between the thumb index and middle finger of his right hand, and, while the patient is made to say "eh," introduces it into the pharynx in the following manner. At first the handle is held obliquely downwards in the direction of the operator's hand, the mirror is kept in the middle line, as far as possible away from the tongue, and pushed on with its back parallel to the palate, without, however, touching it until it reaches the uvula which

* If the mirror be held over a lamp until a film has formed and again disappeared the proper amount of warmth is usually attained (Translator).

is slightly raised upon its posterior surface. At the same moment the handle is raised and likewise turned outwards—that is to say, towards the left angle of the mouth (provided the operator is using his right hand) until the larynx is brought into view.

While the operator keeps the handle depressed until the uvula is reached, care must be taken that the anterior edge of the mirror does not touch the tongue. One cannot be too careful in separating the two positions which have been described, for the beginner is always inclined to introduce the mirror at once with the handle held vertically. To what extent the latter must eventually be raised (that is to say how large an angle the inclination of the mirror should form with the plane of the laryngeal aperture) depends upon the extent to which the patient's head is inclined backwards, also upon the angle between the laryngeal aperture and the horizon, and in part upon the position of the patient; although the variations are within very narrow limits, the observer must in each case find the laryngeal image for himself by elevating the handle more or less according to circumstances. The mirror itself must not in the meanwhile be moved from its position in front of the uvula, but its inclination may be changed by slight alterations in the position of the handle. These slight alterations are also necessary in order to bring the various portions of the larynx into view.

The handle must not be grasped too tightly, and we recommend that it be rested upon the middle finger while only slight pressure is exercised by the thumb and index. In this way lightness of touch, together with accuracy, is attained. It is also better for the patient to hold his own tongue.

The observer should accustom himself always to look through the central opening of the reflector, whether the latter be attached to the head or to the lamp. The other eye should not be closed, for with it he may, if the oral cavity be large enough, see past the edge of the reflector into the laryngeal mirror.

If it be seen after introduction of the mirror that the illumination through faulty position or displacement of the reflector is insufficient, it is better to take out the mirror and readjust the reflector than to move about the head and to keep the mirror fixed in the patient's throat.

It has been assumed that the examination is made with a reflector; but if illumination by means of lenses be used, the only difference is the position of the observer in relation to the lamps, which has been before considered.

If sunlight be used the patient sits with his back to the source of light, which is thrown into his mouth by means of a plane or even a concave mirror.* Illumination by means of sunlight gives the most distinct laryngeal images, and we strongly recommend its use when possible, because the parts are reflected in normal colours.

The employment of diffused daylight concentrated by means of a reflector of 30 cms. focal distance is less to be recommended.

SPECIAL OBSTACLES TO LARYNGEAL EXAMINATION.

Cases in which, in spite of dexterity and patience on the part of the physician, no satisfactory view of the larynx can be obtained certainly occur, but are very rare; in most persons a satisfactory result is obtained at the first sitting, and it is only in exceptional cases that special preparation and training are necessary. At the same time, many cases

* If a concave mirror be used care must be taken to avoid burning the pharynx (Translator).

present difficulties and obstacles a knowledge of which (together with the means of overcoming them) is essential.

There are some patients who during examination do not respire regularly, or in other words hold their breath ; particularly when they are made to say "eh" (a) the glottis remains in the position of phonation or the ventricular bands even approach one another as in Fig. 5, so that, not only is it impossible to get a view of the larynx, but the patient is made restless by the diminished supply of air, and the mirror has to be withdrawn without any result being arrived at. In such cases it is desirable not only to instruct the patients how to breathe, but also to make them take one or two deep inspirations before introducing the mirror.

If the frænum be very short the tongue cannot be stretched sufficiently over the lower incisors, and an attempt must be made to obtain sufficient space by depressing it either with the finger or a spatula. If the tongue be very thick and fleshy a similar procedure may be necessary. Sometimes, through reflex action, the tongue rears itself up and forms a convex prominence at the moment when the mirror is to be introduced. This difficulty is overcome either by making the patient not only hold the tongue but also forcibly stretch it out, or by pressing it down by the hand or spatula.

Difficulties of another kind occur in many people whose pharyngeal mucous membrane is abnormally sensitive. This is sometimes caused by acute or chronic catarrh, and occasionally by nervousness ; it also often occurs idiopathically. To wait until the hyperæsthesia is diminished by treatment of the catarrh—as has been proposed—is not only waste of time, but quite unnecessary. We also consider inhalations of bromide of potassium and tannin, and brushing with glycerine of tannic acid, which have been recommended, as uncertain and not requisite. If the hyperæsthesia be not due to a want of dexterity on the part of the examiner, and if attempts to introduce the mirror repeated at short intervals (about five minutes) be unsuccessful, the sensibility can be blunted by making the patient take small pieces of ice into his mouth during fifteen or twenty minutes.*

Hypertrophied tonsils rarely form a serious obstacle, and an oval mirror may then be used. In cases of elongated uvula, which sometimes falls before the mirror and thus by its reflection hinders the view, the largest size of laryngeal mirror should be chosen, and an attempt made to press the uvula upwards and backwards with a certain amount of force.

More important and serious are the difficulties which may be caused by the condition of the epiglottis. The latter is often so much inclined

* Probably in such cases the most useful application is brushing with a solution of hydrochlorate of cocaine which may be used in the proportion of from 2 to 20 per cent. Further allusion will be made to this remedy later (Translator).

backwards, that inspection of the larynx is impossible. If increased traction on the tongue and the loud intonation of "eh" (ä) in falsetto is not sufficient to raise the epiglottis, the patient must be made to say "e"; but, as this is apt to cause the tongue to rise, it must be pressed down either with the left hand or a spatula. The mere intention on the part of the patient to say "e" is often sufficient to raise the epiglottis. In other cases the same result is obtained by several rapid, short, and loud expirations. Attempts have also been made to overcome this difficulty by instruments and operative interference. It has been recommended to employ various kinds of probes and forceps in order to raise the epiglottis; it has further been advised to pass a thread through the part, or through the median glosso-epiglottic ligament, by means of special instruments, and thus exercise traction. We agree with those who consider all such appliances as unnecessary; at all events, if the above-mentioned means are unsuccessful, the epiglottis can be raised by means of a simple bent probe (the so-called laryngeal sound).

Speaking generally, it cannot be too strongly impressed that many apparent difficulties disappear in the presence of dexterity on the part of the laryngoscopist, and this can only be obtained by frequent practice in laryngeal examination. As patients are not always available for the beginner, he may for practice use a phantom or autolaryngoscopy; for the former may be used a skull fixed on a stand and in the interior of which is hung a larynx taken from a body, or better still, a phantom made of pasteboard or plaster; those by Oertel and Isenschmid (in Munich) are particularly to be recommended. Practice on a phantom is instructive in distinguishing the various parts of the laryngeal image, and in practising the introduction of instruments, but does not teach what mistakes are committed in introducing and holding the mirror, and for this reason we prefer autolaryngoscopy. The simplest method is that of Johnson: an ordinary reflector is attached to the head in the usual way and the observer seats himself in front of a toilet mirror, near, and a little behind which, a lamp is placed. By then adjusting the reflector and the toilet mirror, it is easy to throw a disc of light on the image of the fauces as it appears in the latter. If a laryngeal mirror be now introduced in the ordinary way the observer himself, as also those who are directly behind him, see the image of the larynx as it appears in the reflection. The same object can be accomplished in a different way if a reflector be attached by an arm to the lamp, and a small plane mirror be fixed near its central opening, on its anterior surface. The experimenter sits opposite the reflector near the lamp, and adjusts the small mirror, so that his own mouth can be seen with one eye, and he is thus enabled to regulate the illumination and the introduction of the laryngeal mirror.

THE LARYNGEAL IMAGE.

(Compare Fig. 1.)

It must be remembered in laryngeal examination that only one image is seen and that this, according to the laws of optics, seems to be situated as far behind the mirror as the reflected object is away from it. As, besides, the mirror is placed at an angle approaching 45°, the image corresponding to the plane of the glottis seems almost perpendicular, and hence *every object which is really situated in front (epiglottis, anterior commissure) occupies the upper portion of the mirror, while what is really behind (arytenoids, posterior commissure) occupies the inferior.* A further inversion of images does not occur, and accordingly the parts of the left side are reflected to the left (but to the right of the observer), while those of the right side are reflected to the right (left of the observer). The parts, which on inspection of the normal larynx at first catch the eye, are the vocal cords, which are remarkable owing to their brilliant white colour and their movements. The beginner is inclined to concentrate his whole attention on the cords, and, as we have been able to assure ourselves, to limit his inspection to them. It cannot, therefore, be too distinctly impressed, that *a laryngeal examination can only be considered as complete, when all those parts have been seen which can be examined by means of a mirror, more especially the anterior commissure as also the posterior wall of the larynx, which, while they are the most difficult parts to inspect, are yet of importance from a pathological point of view.*

The vocal cords should be inspected during quiet respiration (Fig. 1), when they appear as narrow stripes on the lateral wall of the larynx, so that between them may be seen the anterior portion of the cricoid, usually one or more rings of the trachea, and occasionally the point of bifurcation of the latter. If the patient be asked to sound a note the vocal cords approach the middle line until they are nearly in contact, either, as has been stated in the section devoted to physiology (compare Fig. 3), in their whole length or only in their ligamentous portions. The boundary between the ligamentous and cartilaginous portions is marked by a small yellow speck—the fibro-cartilaginous point of the vocal process. It is always a good plan to use the cords as a starting-point for examination and also for purposes of localisation. Above the anterior commissure is seen the tubercle of the epiglottis as a rounded eminence. The epiglottis itself, which overlaps the aperture of the larynx and varies much in shape, appears as a movable valve which is sometimes erect and thus permits a better view of its laryngeal surface, and at other times hangs down, so that the surface, which is turned towards the base of the tongue, becomes visible. Immediately above the cords, at each side, is seen a narrow depression running from before backwards—the ventricle of Morgagni, which is often only visible as a dark line between the true and false cords. The ventricular bands

(false vocal cords) are thick folds of mucous membrane which form the upper boundaries of the ventricles and run from the epiglottis in front to the arytenoids behind. They move with the vocal cords, but only come in contact during swallowing, straining, and in morbid conditions, when they take the place of the cords as organs of phonation (Fig. 5). They extend upwards, without a sharp line of demarcation, into the upper portion of the lateral laryngeal wall and into the free margin of the aperture of the glottis. This free margin, formed by the aryepiglottic folds, is more or less sharply defined and extends obliquely downwards and backwards from the epiglottis to the arytenoid cartilages. At the spot where the upper margin of the lateral meets the posterior wall, are situated two small rounded elevations (the cartilages of Santorini) and, in front of them, in the posterior part of the aryepiglottic ligament, in many persons, the cartilages of Wrisberg. The cartilages of Santorini and the arytenoids move with the vocal cords. During closure of the glottis they come in contact and sometimes even in health—although more frequently during disease—cross each other. Between the cartilage of Santorini and the arytenoid of each side is situated the interarytenoid fold (incisura), which is best seen when the glottis is widely open and, during its closure, appears only as a narrow cleft. It forms the upper margin of the posterior laryngeal wall, which appears fore-shortened, in the lower part of the mirror, as a narrow fold of mucous membrane. Although not directly belonging to the larynx, the base of the tongue and the pyriform sinus can be seen in the mirror and should be examined; the base of the tongue with its glands is already seen while the mirror is being introduced (*i.e.* in its horizontal position); from it is seen, passing to the epiglottis in the middle line, the central glosso-epiglottic ligament; on both sides of the ligament are the valleculæ, which are bounded externally by the lateral glosso-epiglottic folds. The pyriform sinuses lie on the outer side of the aryepiglottic ligaments, and inside of the thyroid cartilage; they form a free space which passes into the œsophagus behind the arytenoids.

In order accurately to comprehend pathological changes, it is necessary to have a knowledge of the normal colour of the individual parts. In general it may be said that the colour of the mucous membrane—the vocal cords excepted—resembles that of the hard palate, but one or two points are worthy of attention. The upper surface of the epiglottis is of a pale pink, but sometimes reddish yellow, more especially at its free margin, owing to the cartilage shining through, while the lower surface is of a bright red, which is most intense on the tubercle. The colour of the cartilage is also sometimes communicated by the cartilages of Santorini and Wrisberg, but in other cases the colour of the mucous membrane which covers them is rather more pronounced. The vocal cords are characterised by their pearly whiteness, but may also, in rare

cases, be tinged with red without giving rise to alterations in voice. According to Semon a slightly pink tinge is almost as commonly observed as the normal white colour, in men who use their voices in the exercise of their profession (particularly baritone and bass singers).

OTHER METHODS OF EXAMINATION.

In the presence of the certainty which attends the use of the laryngoscope in the diagnosis of laryngeal disease, the other methods of examination, on which reliance had to be placed in pre-laryngoscopic times, have lost much of their value. If we devote a few words to the consideration of these, it is only because they may be made use of in some few points of diagnosis, and because we are dependent upon them in those very rare cases in which laryngoscopic examination cannot be carried out, as, for instance, in early childhood.

Very little light is gained by inspection of the larynx from without; only in rare cases of severe inflammation, especially perichondritis, is the external surface of the larynx enlarged. This method of examination also enables us to estimate the presence and size of enlarged glands.

By palpation changes in the position of the larynx and upper portion of the trachea can be estimated, such as occur from the pressure of large hard glandular and other external tumours. The larynx is then

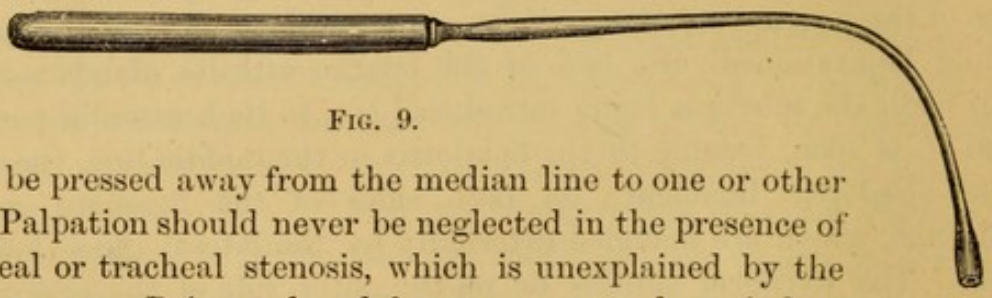

Fig. 9.

felt to be pressed away from the median line to one or other side. Palpation should never be neglected in the presence of laryngeal or tracheal stenosis, which is unexplained by the laryngoscope. Pain produced by pressure, as also a feeling of crepitation, which results when the larynx is moved backwards and forwards in the presence of bare and necrosed cartilage, we are, in the present state of our knowledge, unlikely to use as diagnostic signs. In the same way, palpation of the larynx internally, by means of the index or index and middle fingers passed rapidly down to the margin of the glottis, should be confined to these cases in which (*e.g.* young children) laryngoscopic examination cannot be carried out, and in which disease of the epiglottis, aryepiglottic folds, or the laryngeal aperture (foreign bodies) is suspected.

Auscultation and percussion of the larynx do not yield any results worth mentioning.

Of more importance than the methods hitherto considered is the use of the laryngeal probe.

Probes are introduced into the larynx in order to establish, in doubtful cases, the origin and consistence of tumours, to test the sensibility of the mucous membrane, and finally, in cases of ulceration, to find the depth of the ulcer and the condition of the cartilage. Probes (Fig. 9) are catheter-shaped or rectangular instruments, attached to a wooden handle and best made of silver, in order to admit of being suitably bent in each case. Of course, the introduction of a probe must always take place under guidance of a mirror, which should be held with the left hand while the sound is introduced with the right. Probing the larynx, it is true, requires a certain amount of dexterity, but should be practised by every physician, even if he has no intention of performing endo-laryngeal operations, because it is the best method of preparing the larynx for any surgical treatment which may be afterwards necessary.

CHAPTER V.

GENERAL SYMPTOMATOLOGY.

Diseases which attack the larynx may injure and disturb its function both as an organ of voice and of respiration. The disturbance of voice (dysphonia) may show itself in different ways. The voice becomes thick, is wanting in clearness, or hoarse, that is to say it is accompanied by disturbing sounds; the more these sounds mask its tone the more hoarse is the voice. Dysphonia is produced by the regular vibrations of the vocal cords becoming disturbed by catarrhal swelling, by accumulations of mucus, or by the presence of tumours. These disturbing sounds may be so in the ascendant that the voice can hardly be said to possess any timbre. At the same time it becomes weaker because the vibrating parts are not in the necessary state of tension, and thus loss of voice, or aphonia, is produced. In complete aphonia the cords are not made to vibrate by the air which passes over them; just as in the case of whispering, this condition is voluntarily produced.

Aphonia is always present when there is insufficient closure of the glottis, be it mechanical owing to the presence of tumours, or thickening of the posterior laryngeal wall, or due to paralysis of the muscles of the cords. In other cases the voice may be not hoarse but only flat and wanting in timbre, that is to say deficient in over-tones; this flat voice is especially noticed in unilateral paralysis of the cord, and a probable diagnosis of this condition may sometimes be made when this deficiency of timbre is present. A too high or falsetto voice, as it occurs in many persons, must also be considered pathological. It depends upon the fact that such persons cannot bring about sufficient tension of the vocal cords to produce chest tones, and is only observed in men.

Finally we must allude to diplophonia or double voice (also called diphthongia), which is characterised by the production, in the larynx, of two notes at the same time. This symptom is sometimes observed in unilateral paralysis of the cords and in the presence of small neoplasms, which, during phonation, become so placed between the margins of the glottis that it is divided into an anterior and a posterior segment, the two vibrating separately. It must be here observed that only some sounds are produced double.

Disturbance of Respiration, Laryngeal Dyspnœa, Stenosis of the Larynx, also called Croupy Breathing.—Disturbance of respiration may occur in varying degrees of intensity through narrowing of the laryngeal lumen and may, in severe forms, assume a dangerous character and even cause death. Stenosis may be due to acute or chronic inflammatory or œdematous swelling of the epiglottis, aryepiglottic folds, or other portions of the larynx; to cicatrices; tumours, which may obstruct the glottis either on account of their size or their position; foreign bodies; paralysis of the abductors or spasm of the adductors; and, finally, to pathological conditions of the surrounding tissues and organs, which may compress the larynx from without, *e.g.* phlegmonous inflammation of the surrounding cellular tissue, retro-pharyngeal abscess, or glandular tumours.

A moderate amount of stenosis shows itself in slowing of the respiration with slightly increased tension of the abdominal muscles at the end of expiration; only when acts requiring an energetic use of the respiratory function are undertaken, *e.g.* speaking, walking, ascending stairs, and crying in children, is the dyspnœa temporarily increased.

A greater degree of stenosis produces—in consequence of diminished interchange of gases in the lungs and resulting irritability of the respiratory centre—a greater amount of exertion in breathing, and dyspnœa, which shows itself in the anxious expression of the patient.

The alæ of the nose are widened on each inspiration, the shoulders are raised, all the muscles which expand the thorax labour heavily, the sterno-mastoids, the scaleni, and omohyoids are distinctly tense, the supraclavicular region and intercostal spaces become indrawn, while the pectoralis major, serratus anticus major, and the rhomboids start out under the skin, and the epigastric and hypochondriac regions sink inwards.* The passage of air through the stenosed larynx is accompanied by a loud shrill hissing or crowing. Laboured inspiration follows the lengthened expiration without an interval; owing to the deep, and consequently lengthened, respirations their frequency is diminished. If, however, the respiratory muscles become weakened and the irritability of the respiratory centre diminished (stage of asphyxia), the depth of the respirations is diminished but their frequency increased.

Laryngeal dyspnœa is usually inspiratory as the swollen parts (epiglottis, aryepiglottic folds, vocal cords) or neoplasms are pressed inwards like a valve at each inspiration; very rarely it is purely expiratory, when movable tumours in the lower part of the larynx are forced upwards towards the glottis by the outgoing current of air and close it; more commonly it is of a mixed character, especially during inflammations of the mucous membrane and in croup.

* The larynx itself moves energetically with respiration, while in tracheal dyspnœa it is stationary.

Even a moderate amount of stenosis causes marked rarefaction of the air within the lungs, in consequence of which the lower portion of the thorax sinks during inspiration.

The dyspnœa is not always proportionate to the amount of stenosis present. Thus a rapidly formed obstruction causes more severe disturbance of respiration than a similar obstruction when arising gradually in the course of chronic disease. Obstacles to respiration situated at the entrance of the larynx are often less threatening than when they occur in the rigid and less yielding walls of the inferior division, *i.e.* in the subglottic region; a slight amount of stenosis in the larynx of a child will cause more considerable dyspnœa than a similar lesion in a grown-up person.

The Course, Result, and Prognosis of stenosis depend principally upon the primary disease, but yet it is a symptom which may greatly influence the progress and termination of the latter. The symptoms of stenosis, both acute and chronic, are liable to sudden an marked variations, so that a patient with a moderate amount may feel well until, owing to sudden muscular exertion or intercurrent pulmonary affection, attacks of dyspnœa set in. When a marked degree of stenosis is present, the dyspnœa increases from time to time to suffocative attacks, more especially when the already narrow opening of the glottis is obstructed by accumulated secretions, membrane, etc., or when attacks of spasm occur. When marked obstruction has lasted for a considerable length of time and after repeated suffocative attacks, the symptoms of carbonic acid poisoning set in (drowsiness, weakness of the heart, etc.) as the forerunners of a fatal termination. Prognosis is always doubtful, because, even in mild cases, owing to increase of the primary disease or to obstruction of the narrowed lumen by accumulations of mucus, etc., asphyxia may set in before medical aid arrives.

Diagnosis.—Stenosis of the upper air passages, owing to the symptoms just described, affords such a characteristic picture that its diagnosis can hardly present much difficulty, but, on the other hand, the question as to the exact seat of the obstruction—whether the stenosis be in the larynx, a trachea, or bronchi—is not always easy to answer. The greatest certainty is to be obtained by a laryngoscopic examination, which, however, is unfortunately not always possible, and other points must then be taken into consideration. In most cases of laryngeal obstruction, the voice is altered, but it must be remembered, on the one hand, that the voice is normal when the cords are not affected and also in paralysis of the abductors, and that, on the other hand, in tracheal stenosis the voice may be altered in consequence of pressure on the recurrent exerted by the same tumour which compresses the air passages. In laryngeal stenosis the larynx descends at every inspiration,

while in tracheal stenosis this symptom is either quite absent or only slightly marked, in spite of the presence of severe dyspnœa.

TREATMENT.—Treatment of this condition is only called for when the primary disease cannot be treated, or when it is impossible to cure it in time. It is often sufficient to relieve the intercurrent attacks of suffocation; thus, for example, an emetic may be given in order to remove accumulated secretion. Not uncommonly, however, nothing else remains than to admit air by means of tracheotomy. In a few chronic cases an attempt at dilatation may be made, but we shall refer further to treatment in a subsequent chapter.

Subjective sensations, which accompany some laryngeal affections, sometimes take the form of tickling, burning, feeling of rawness or pressure, but may also amount to severe suffering which impedes speaking and swallowing, often making both impossible. The sensation of rawness and burning occurs in simple catarrh, especially the acute form, while severe pain is confined to destructive processes. This pain often extends to the ear of the affected side, probably through radiation from the vagus; not uncommonly, however, pain is absent, even in extensive ulcerations. Some patients complain of anomalous sensations in the larynx when the latter is found to be quite healthy, and the phenomenon is then due to diseases of remote organs (radiated impressions from the stomach or lungs).

Laryngeal cough—that is to say, a cough produced by laryngeal disease, is occasionally not to be distinguished from the same symptom as it occurs in affections of the lungs and bronchi; sometimes it is, however, distinguished as laryngeal by its peculiar sound. It varies from a short cough to most severe paroxysms; at one time it is slight, while at another the attacks are long continued.

Sometimes the sound is rough, abrupt, hoarse, aphonic, or it may be whooping and barking as in croup. The cough may have its origin in various pathological conditions, the only point of importance being the part of the larynx attacked. It has been established both by experiment and clinical observation that all parts of the larynx, when irritated, do not produce cough. This symptom is not excited by irritation of the posterior surface of the epiglottis, ventricular bands, the upper surfaces of the cords, or the aryepiglottic folds. As the point which is most apt to produce it, may be mentioned the interarytenoid commissure and the posterior wall of the larynx. Accordingly, only pathological conditions of the larynx which attack these parts directly or indirectly will cause cough, while the timbre of the latter is principally dependent on the state of the vocal cords. From this reflex laryngeal cough is to be distinguished a cough which may be voluntarily produced in attempts to relieve abnormal sensations. These sensations consist in the feeling of a foreign body in the larynx which

the patient attempts to remove by coughing, and are caused in part by an accumulation of mucus, and in part by changes in the mucous membrane, which simulate the presence of a foreign body; sometimes, however, they are due to nervous disturbance alone. Of course, the timbre of the cough caused by irritation of the lungs, bronchi, etc., must depend upon the condition of the cords (whether normal or pathological) and we must not on that account designate it laryngeal.

Expectoration presents no characteristics to mark it as coming from the larynx. Laryngeal sputum is generally slightly mixed with air, colourless, and transparent; sometimes it is characterised by a globular form and a peculiar gelatinous consistence resembling frog spawn. An admixture of pigment molecules not uncommonly gives the secretion a blackish grey tinge; sometimes it is mixed with blood in light or dark red streaks, or small coagula. It is a matter of clinical observation that considerable hæmorrhage never occurs from the larynx. Shreds of false membrane are often coughed up in large pieces in croupous inflammations, and these may appear as complete casts of the laryngeal cavity, and thus show their origin from this source. The presence of pus in the sputum always leaves the observer in doubt as to whether it has come from the larynx, or from deeper portions of the respiratory tract.

CLINICAL HISTORY.

After having mentioned the methods of examination and the symptoms which must be attended to in laryngeal disease, it seems necessary to add a few words as to the method of taking the clinical history. If it be desired to avoid errors in diagnosis and prognosis, the observer must not be satisfied with ascertaining the local condition, but must consider the whole clinical aspect of the case. After the general points have been considered, special attention must be paid to the following particulars, viz. age, occupation, duration, and cause of the disease, and the present and past subjective symptoms.

The duration of laryngeal disease may often be of use in forming an opinion, but the patient and those about him are frequently unable to give a clear account of the beginning of the malady, because they are apt to date its commencement from the appearance of the most marked and threatening symptoms. For instance, a physician is told that a child has been suddenly seized by symptoms pointing to croup; careful questioning, however, elicits that the patient has suffered for several days from hoarseness, and that his general health has been deranged. By this means the observer may gain information which enables him to distinguish between croup and pseudo-croup. Hoarseness which has lasted for months, and when the laryngoscopic appearances are only those of catarrh, must be considered most carefully before a prognosis

is given, and the suspicion that it is perhaps due to a constitutional malady cannot be avoided.

Of not less importance is a knowledge of the cause. The statement of the patient that his trouble is due to "catching cold" can seldom be accepted as satisfactory, although we may at times be inclined to attach importance to this factor. The occupation of the patient, his habits (living in dusty atmosphere, abuse of alcohol), atmospheric influences, presence or absence of epidemics, unfavourable weather, hereditary tendency, and previous acute or chronic diseases must all be considered. Finally, in the present condition of the patient we must take into account not only the subjective symptoms and their value in throwing light upon the results of our objective examination—specially by means of the laryngoscope—but also the general condition of the body, constitutional diseases, affections of neighbouring organs (glands and large vessels), and, above all, the state of the lungs. No diagnosis and prognosis of laryngeal disease can be considered as certain until the whole respiratory tract has been examined.

CHAPTER VI.

GENERAL THERAPEUTICS.

Remedies which are used in laryngeal disease are either applied directly to the part (local applications), or they are introduced into the circulation (subcutaneously or by the stomach), in order thus to influence the diseased organ (internal remedies).

Local applications are applied either externally to the skin covering the larynx (external method), or they are introduced into the interior of the larynx (endo-laryngeal method).

Remedies which act through the skin are not now in such common use as before the invention of the laryngoscope. They consist in local blood-letting, cold and warm applications, setons, inunctions and pigments, rubefacients, blisters, and finally the percutaneous use of electricity.

Local depletion is now seldom used, and that principally when croup attacks strong plethoric children; from two to six leeches, according to the age of the child, are then applied to the manubrium sterni. Cold—in the form of ice-bags, Leiter's cooling apparatus, and compresses—is said to lessen tissue change by checking the blood supply, and thus to diminish exudation. As the application of cold, if too long continued, tends to produce relaxation of the vessels and increased congestion of the inflamed parts, it is better, either to use from the beginning compresses dipped in water which is not quite cold (10°–15° C. or 50°–60° Fahr.), or to employ ice-bags only in the early stages of inflammation (6–12 hours) and then substitute other applications. Heat is applied by means of cloths or sponges dipped in hot water, which probably act principally as counter-irritants, or by means of compresses*—used as recommended by Priessnitz—which become gradually heated. The latter supply a valuable means of promoting absorption, and are therefore used chiefly in the later stages of acute inflammations—when cold applications are no longer considered advisable or when they are not well borne—and also in subacute or even chronic cases.

* These compresses, after being dipped in cool or cold water, are applied to the throat, and afterwards covered by mackintosh or oil silk (Translator).

Derivatives are not now so much lauded as formerly, although sinapisms may be of use by causing rapid counter-irritation; whether vesicants, by causing serous exudation, can check infiltration within the larynx is more than doubtful; their use is certainly to be condemned in acute cases. Inunction of mercurial ointment and painting with tincture of iodine are used to promote absorption.

Among external applications must be included the percutaneous use of electricity. Both forms are used—the poles being placed laterally on the plates of the thyroid—in order to stimulate paralysed nerves and muscles, in anæsthesia and sometimes with a view to diminishing hyperæmia or exudation. A strong or medium current, which is frequently opened and closed, while its direction is from time to time changed, or a powerful Faradic current may be allowed to pass through the larynx from side to side. The electrodes may also be placed upon points corresponding to the courses of the recurrent nerves, or in unilateral paralysis they may both be applied to the corresponding nerve; finally, one pole may be applied to the pomum Adami and cricoid, while the other is in contact with the cervical portion of the spine. There is no doubt—and it has been proved by experiment—that by the cutaneous application of the galvanic or Faradic current the laryngeal muscles can be excited.

ENDO-LARYNGEAL METHODS OF TREATMENT.

Although local treatment of laryngeal disease had been employed before the introduction of the laryngoscope, principally owing to the labours of Trousseau and Belloc, yet it was only afterwards that it came to be further developed, improved, and used with rational accuracy. The object of endo-laryngeal therapeutics is to treat pathological conditions of the larynx by local means, and this may be accomplished (1) by making the patient inhale certain remedies in the form of vapour, gas, or fine spray; (2) by the application of fluid or solid substances by means of specially constructed instruments; (3) by direct surgical means, such as burning, cutting, etc.

THE INHALATION OF MEDICATED VAPOURS.

This method is less employed in laryngeal than in pulmonary disease. The most simple and perhaps the most efficient of this class of remedies is the steam of hot water. The inhalation of warm vapours softens tough and dried secretions, loosens false membranes, and aids their detachment, for, as Oertel has shown, the transition from croupous exudation to a suppurative process is hastened by steaming. It is in most cases sufficient to place a spirit lamp under a vessel filled with water, and to let the steam thus generated be inhaled through a suitable funnel, which should, if possible, be

supplied with a short tube. Instead of water, infusions of mallow or camomile may be used.

Medicinal agents may also be added, but only those which are themselves volatile or from which volatile substances are given off at a high temperature. In the treatment of laryngeal disease only the following substances need be considered, viz. carbolic acid, thymol, creasote, and balsam of Peru. These may be prescribed as follows:—

Acid carbol. 3–4.
Thymol 1·5, spt. vini rect. 15, magnes. carb. ·75. } to 100 grammes
Creasote 6. } of water.
Balsam Peruvian 4, spirit. vini rect. 2.

Sig. A teaspoonful in half a liter of water for each inhalation.

The temperature of the steam should not be above 60° C. (140° F.) nor under 55° C. (130° F.). These inhalations should be used several times a day for five minutes, and in croup for a quarter of an hour at a time at intervals of half an hour.
Roughly these prescriptions may be represented as follows :—

Acid carbol. gr. 15–20.
Thymol gr. 8, spirit. vin. rect. min. 80, magnes. carb. gr. 4. } ad. ℥i.
Creasote min. 30.
Balsam Peruv. min. 20, spirit. vin. rect. min. 10.

Sig. A teaspoonful in about 17 ounces of water, etc.

THE INHALATION OF GASEOUS SUBSTANCES.

Volatile agents, such as oil of pine, turpentine, solutions of bromine, and bromide of potassium (aa. 2 in a 100 of water),* or 5 to 10 per cent. solutions of carbolic acid are used by bringing cotton wool saturated with these remedies in front of the mouth by means of special respirators, *e.g.* Curschmann's, Bäschlin's, or Hausmann's. This method of using inhalations has the advantage that the patient can use it for several hours without inconvenience, and that he can at the same time move about.

SPRAY INHALATIONS.

Sprays have been much used in the treatment of laryngeal disease. Numerous varieties of these instruments have been invented, but that constructed on the principle of Bergson, which is also used in antiseptic surgery, has the most extended employment. We believe that we may assume a knowledge of these, and content ourselves with the remark that we consider Siegle's steam spray, in which steam,

* Approximately gr. X. ad. ℥i.

instead of compressed air, is used as a propelling force, is most serviceable; only when the spray is to be used cold (astringents and hæmostatics) are instruments with a double air-ball to be preferred. These inhalations should be repeated from one to four times daily and still oftener in diphtheria, and should last from two to twenty-five minutes. The most useful remedies are applied in the following proportions :—

* Acid tannic 1–2, Glycerin. 10; of this 10–20 drops.
Alum ·3–2 (gr. 1½–gr. X).
Argent. nitrat. ·02–1 (gr. $\frac{1}{10}$–gr. 5).
Liq. Ferr. perchlor. ·3–3 (min. 1½–min. 15).
Zinc. chlorid. ·3 (gr. 1½).
Acid. carbol. ·5–1 (gr. 2½–gr. 5).
Aq. creasot. 1–10 (min. 5–min. 50).
Ol. terebinth. ·5–2 (min. 2½–10).
Acid. lactic. 3 (min. 15).
Hydrarg. perchlor. ·02–·3 (gr. $\frac{1}{10}$–1½).
Potass. chlorat. 1–2 (gr. 5–10).
Sod. chlorid. 1–2 (gr. 5–10).
Sod. carb. ·2–1·5 (gr. 1–8).

} to 100 grammes of water (℥i).

Lime water (Aqua calcis) is used either pure or in the proportion of 1–8.

Narcotics are commonly used only as additions to other remedies and in the following proportions :—

Aq. lauroceras. ·3–3 (min. 1½–15).
Extract. opii ·01–·05 (gr. $\frac{1}{20}$–$\frac{1}{4}$).
Morph. muriat. ·1–·5 to ten parts of glycerine; of this 20 to 30 drops.
Tinct. opii ·05–1 (min. ¼–5).
Extract. belladon. ·01–·05 (gr. $\frac{1}{20}$–$\frac{1}{4}$).

} to 100 grammes of water (℥i).

Of these solutions five, ten, and even forty grammes are used at each sitting. There is no doubt that the spray reaches the respiratory tract, and especially the larynx, but it is equally certain that only a small fraction of the inhaled fluid actually enters, so that it is impossible even to attempt the application of definite doses. This is all the more the case because the proportion between vapour and medicated fluid not only varies in different apparatus but also depends upon the force of the steam, the distance of the spray, and the depth of the inspirations. It

* Here again, we have given the approximate reduction of the doses recommended to grains, minims, drachms and ounces. On comparing them with the prescriptions found in the Pharmacopœia of the London Throat Hospital and with Dr Bosworth's work on the Throat and Nose, it will be seen that the solutions recommended by Dr Gottstein are in some instances much weaker than those recommended in the works referred to. It may also be noted that Bosworth prefers the spray in the treatment of laryngeal disease to other methods (Translator).

is also impossible to control the action of the inhaled fluid upon the diseased parts. All authors are agreed that concentrated solutions should not be used for inhalation and that, when it is intended to apply a powerful agent, or to act upon a definite part, no result can be expected from the use of sprays. We are convinced that the principal benefit derived from their use depends upon the action of hot steam, and that the remedial agents can only be considered of slight utility.* From this it follows that the use of sprays in laryngeal disease is very limited, and that they are only indicated in those cases in which the patient cannot see his physician often enough, and in which, consequently, the treatment has to be conducted in part by himself.

As a contrast to the hitherto described methods of local treatment, which only admit of the indirect and uncertain application of remedies, must be considered the introduction of fluid and solid bodies by means of special instruments, fulfilling, as it does, the demands of exact local therapeutics.

We need hardly say that we do not consider gargles as remedies which can be accurately applied. Unfortunately they are still employed by many physicians in order to cure hoarseness. It is true that they may be of some use in diseases of the epiglottis, but the patient must then understand how, by keeping his head back and his tongue depressed, the fluid may be allowed to flow back into the pharynx as far as the entrance of the laryngeal cavity.

All instruments, whether used for the purpose of applying remedies or operating, must be introduced under the control of the laryngeal mirror. The mirror is held in the left hand while the instrument is directed by the right. The latter must have a suitable curve, either like a catheter or more approaching a right angle. In the former variety, which is principally used in Germany and France, the stem forms a large curve, while in the latter, which is used in England and America, the angle is only slightly rounded. The introduction of the last mentioned is somewhat more difficult, but they have the advantage that in introducing them the epiglottis need not be touched, as is sometimes done when employing those with a larger curve. With either any desired part of the larynx can, however, be reached; when instruments of the catheter shape are used, it is advisable to choose them with a flexible handle in order to be able to adapt them to individual peculiarities. The introduction of instruments into the larynx requires expertness which, however, must be acquired by every medical man, because without it rational treatment of laryngeal disease is impossible. A small amount of practice

* It may here be observed that it is not necessary to use the steam spray, so that undue dilution of the inhaled fluid can be avoided. Moreover, as has been before observed, some of the solutions recommended may be used in a more concentrated form than prescribed by Dr Gottstein. A cheap and convenient spray is that invented by Prosser James, which can be obtained from all instrument makers (Translator).

with a probe, such as has been described, is sufficient as a preparation—if not for all endo-laryngeal operations, still for the most necessary local treatment.

It is, of course, essential that all laryngeal instruments should be strong and of good quality and, if possible, made of one piece. It is also necessary to test them before use, more especially in the case of sponges and brushes.

The application of fluids may be made by brushes, sponges, or syringes.

The laryngeal brush consists of a stem, supplied with a handle, to which is attached a brush of fine camels' or squirrels' hair. The stem is made of aluminium or German silver, but must not be too flexible, lest it bend when used; the brush is either pointed at its extremity or cut straight across. It is desirable for the brush to be surrounded at its attachment by a layer of hard rubber.

The laryngeal sponge is similarly constructed, with the exception that a sponge the size of a bean is substituted for the brush. Brush and sponge may be used in the same way for the introduction of fluid remedies, and both have advantages and disadvantages. The sponge, on account of its rough surface, cannot be introduced into the cavity of the larynx, but can only be placed at its entrance and then squeezed; a localised action upon a particular part can consequently not be attained. The brush, on the other hand, absorbs less fluid, but can be introduced into the interior of the larynx and especially, if pointed at its extremity, can be made to touch definite parts. Whether brush or sponge be used, it is necessary that each patient should have his own instrument. For

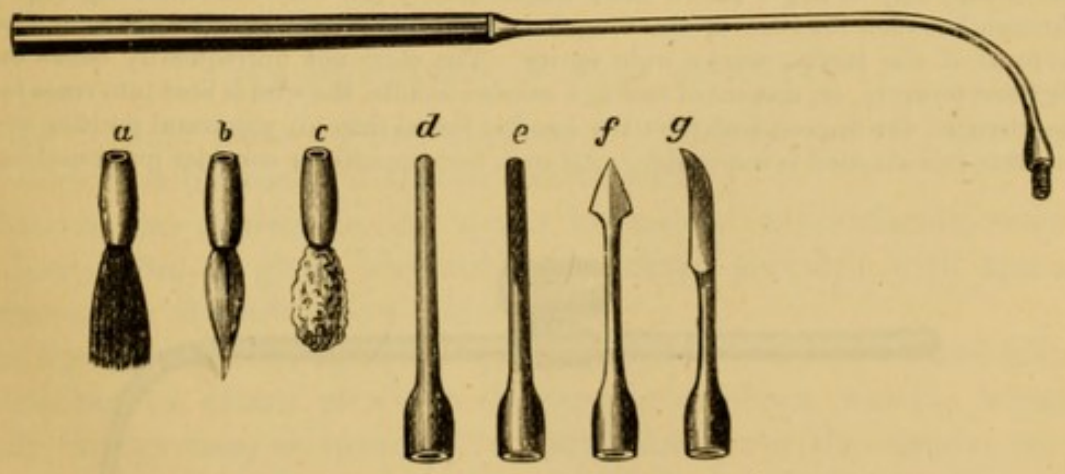

FIG. 10.

a, *b*, *c*. LARYNGEAL SPONGES AND BRUSHES.

this purpose special sponge-holders have been invented, which consist of forceps whose branches are firmly closed by means of a catch, in order to prevent the sponge from falling into the larynx. Not only for each

patient but at each application a new sponge is used. It is simpler and quite sufficient to use instruments so constructed that a brush or sponge can be screwed on to the handle. The physician is then in possession of a handle, suitable for all sponges or brushes ordered by him.

After use sponges and brushes are carefully cleaned, and this is best accomplished by dipping them in boiling water which makes the best disinfectant. We prefer brushes to sponges because they can be more easily cleaned.

Instead of sponge or brush a pledget of cotton wool may be used in the following manner. A bunch of wool, about as large as a hazel nut, is twisted round the end of a probe such as is about to be described. It is still more convenient to use a special forceps-like instrument to hold the wool in order to prevent its falling off; the instrument must, of course, have an arrangement by which its branches are firmly held together; after each time it is used the cotton wool must be thrown away and a new piece inserted. This method of making applications exceeds the others in cleanliness and safety so far as infection goes.

It is not advisable to trust the use of the sponge or brush to the patient or his relatives. In cases where this is absolutely necessary, the patient must be taught to hold the tongue as in laryngoscopic examination, to pass the sponge between the tongue and palate as far as the posterior wall of the pharynx, and then, by elevating the handle, to press it against the entrance of the larynx. The introduction of the instrument and the elevation of the handle should take place in one act, during which the hand describes an arc from below upwards.

It is incredible of what bad quality sponges and brushes (such even as are supplied by instrument makers and unfortunately ordered by physicians) often are. For example, the sponge may be larger than a hazel nut so that it can only with difficulty be pressed through between the base of the tongue and the pharynx. Brushes are sometimes as large as if the larynx were a wide cavity. The stem not unfrequently bends on the slightest pressure, or, instead of having a wooden handle, the wire is bent into rings for the insertion of the fingers, and thus the hand is forced into an unnatural position so that accurate introduction is impossible. All such instruments we consider quite useless.

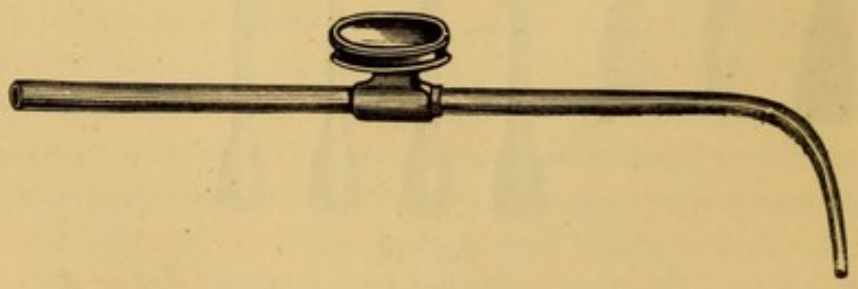

FIG. 11.

STOERK'S OR HARTEVELT'S LARYNGEAL SYRINGE.

Laryngeal syringes have no special advantages over sponges and brushes, except when it is desired to introduce large quantities of fluid

(*e.g.* lime water in croup). The simplest form is that suggested by Stoerk and Hartevelt.

It consists of a hollow tube of hard rubber suitably curved and supplied with a handle. At the junction of the tube with the handle there is a small vessel communicating with the lumen of the former. This vessel is hermetically closed above by an india-rubber membrane stretched across it. By pressing on this india-rubber drum, air is driven out of the tube, and by then inserting the point of the instrument into the medicated fluid, this is sucked up. If slight pressure be made on the membrane the fluid flows out in drops, but if the pressure be increased, it is poured out in a continuous stream. The medicinal solutions used by means of sponge or brush in various chronic and subacute diseases of the larynx are as follows :—

Argent. nitrat. ·3–3 aq. dest. 10 (gr. 15–150 ad ℥i).
Acid. tannic. 1–5 glycerin. 10 filter (gr. 50–250 ad glyc. ℥i).
Zinc. sulphat. 2–3 aq. dest. 100 (gr. 10–15 ad ℥i).
Potass. chlorat. 5 aq. dest. 100 (gr. 25 ad ℥i).
Acid. carbol. ·1 glycerin. 10 (gr. 5 ad glycer. ℥i).
Creasot. pur. 1. (min. 5) spirit. vin. rect. 40 (min. 200) glycer. 60 (min. 300).
Morphiæ muriat. ·3–·5 glycer. 10 (gr. 15–25 ad glyc. ℥i).
Tinct. opii pure or diluted.
Potas. bromid. 1–2 glycerin. 10 (gr. 50–100 glyc. ℥i).
Ammon. bromid. 1–2 glycerin. 10 (gr. 50–100 glyc. ℥i).
Aq. calc. pure or with equal parts of water.

When the laryngeal syringe is used weaker solutions should be employed.

THE APPLICATION OF SOLID REMEDIES.

This is done either by the insufflation of powders or the introduction of caustic by means of special instruments.

Powders are applied to the larynx by means of insufflators, which are bent tubes of glass, hard rubber, or silver, provided with special appliances for the introduction of powders.

At the posterior extremity of the insufflator is attached a small india-rubber bag by means of which the powder is blown into the larynx. These instruments, as invented by Rauchfuss, have the disadvantage that every time the bag is compressed, the beak moves, and thus the substance may be driven in a wrong direction and exact localisation is impossible. Insufflators provided with an india-rubber tube, and in which the powder is blown through the apparatus by the operator's mouth, are for this reason to be preferred ; the tube is therefore provided with a mouthpiece of caoutchouc or glass. In order to prevent the air

expired by the patient, if he cough during the insufflation, passing into the mouth of the physician, a valve has been introduced which only opens towards the laryngeal end of the instrument. The author uses an insufflator with a tube and air-bag, the latter being held between the knees and thus compressed. In this instrument the tube is 75 cms. in length.

The remedies which are used in this way are almost similar to those which are applied by means of sponges or brushes. The single dose

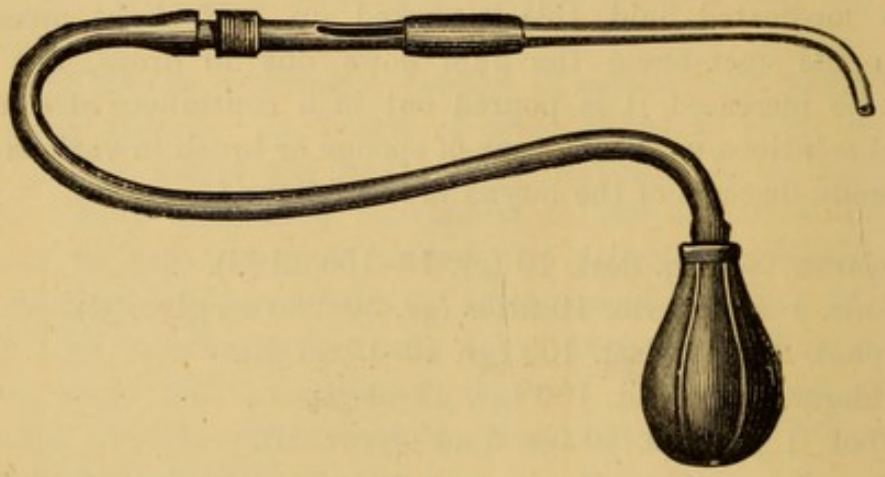

FIG. 12.
INSUFFLATOR WITH TUBE AND AIR-BAG.

employed at each application is from ·1–·25 (grammes) (roughly $1\frac{1}{2}$–$3\frac{1}{2}$ grs.). In active remedies and in such as are composed of very small quantities of fine powder (*e.g.* morphia), bulk is increased by the addition of a small quantity of starch, talc, or sugar of milk. Substances may be prescribed in the following proportions :—

Argent. nitrat. ·05–1. Talc in very fine powder 10.
Acid tannic 1–3 talc 10.
Alum pure or with equal parts of milk sugar.
Acid. borac. pure.
Sodæ benzoat. 1–2 talc 10.
Iodoform pure or rubbed up with ether.
Acetate of morphia ·004* or ·0075–·015 for a dose.

It is a good plan in ordering morphia to prescribe each dose with the addition of starch ·20 or boracic acid ·25.

The indications for the use of insufflations are similar to those for the employment of fluid remedies. The applications are easily made, but do not admit of the limitation of the remedy to any particular point so certainly as when the brush is employed ; the latter, on the other hand, is more apt to produce spasm. In affections of the trachea the use of powders is to be preferred.

* This refers to grammes, one gramme being equal to 15.43 grains (Translator).

Caustics, of which nitrate of silver is the most important, must be applied by means of special instruments. Of these the most efficient and simplest is a probe, the laryngeal end of which is ribbed or roughened. The caustic is made to adhere by dipping the instrument,

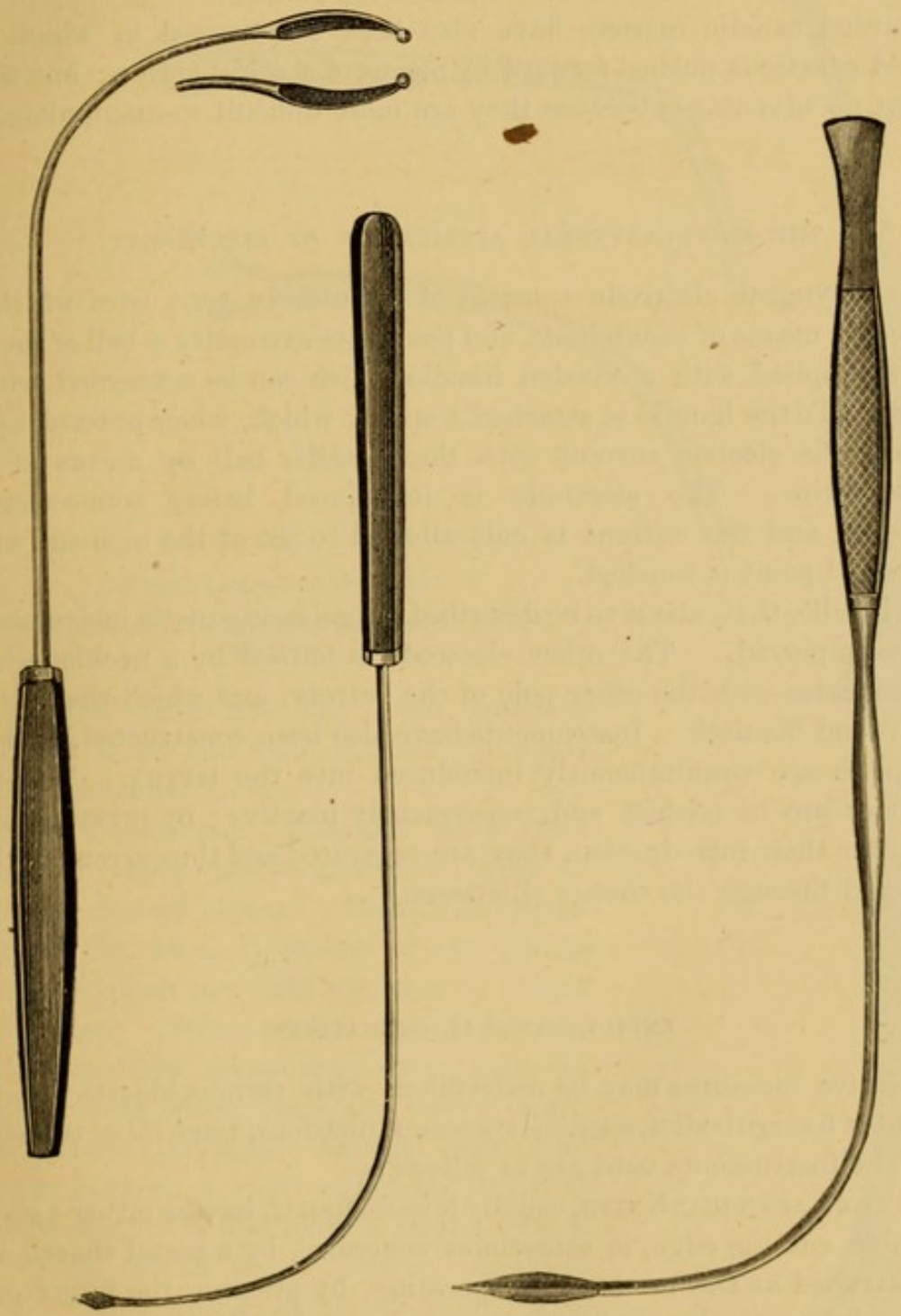

FIG. 13.

LARYNGEAL KNIVES.

when slightly warmed, into nitrate of silver which has been melted in a porcelain vessel over a spirit flame. It is still easier to heat the end of the probe and then bring it into contact with a piece of caustic.

According to the part of the larynx which it is desired to cauterise, the caustic should cover either the point or one side of the lower end of the instrument, so that healthy parts may not suffer. A little consideration, as to which side of the probe is to be brought into contact with the diseased parts, will suggest how this is to be done.

Guarded caustic carriers have also been constructed in which the covered caustic is pushed forward by means of a spiral spring; but these present no advantages because they are more difficult to manipulate.

THE ENDO-LARYNGEAL APPLICATION OF ELECTRICITY.

The laryngeal electrode consists of a suitably bent wire which is isolated by means of caoutchouc, and has at its extremity a ball of metal; this is supplied with a wooden handle which can be connected with a battery. To the handle is attached a spring which, when pressed upon, connects the electric current with the metallic ball by means of the isolated wire. The electrode is introduced before connection is completed, and the current is only allowed to act at the moment when the desired point is touched.

As a handle, that, about to be described for galvano-caustic instruments, may be employed. The other electrode is formed by a necklet which communicates with the other pole of the battery, and which the patient wears round his neck. Instruments have also been constructed in which both poles are simultaneously introduced into the larynx. The two electrodes are in contact and consequently inactive; by pressing on a lever after their introduction, they are separated and the current is thus conducted through the tissues (Ziemssen).

ENDO-LARYNGEAL OPERATIONS.

Operative measures may be undertaken with various objects, *e.g.* the removal of foreign bodies, opening abscesses, incisions, removal of tumours, etc. The instruments used are as follows:—

1st. The Laryngeal Knife, usually lancet-shaped, having either a single or double cutting edge, is sometimes concealed by a metal sheath and only extruded at the moment of operating, by pressing the finger on a spring, while again it may be used unprotected. It is advisable to have several knives of different sizes and varying in the position of the two-edged extremities, so that we are enabled to incise from before backwards or transversely; probe-pointed knives are also sometimes required. The author considers protected knives as unnecessary for those who have had a certain amount of practice in the introduction of laryngeal instruments;

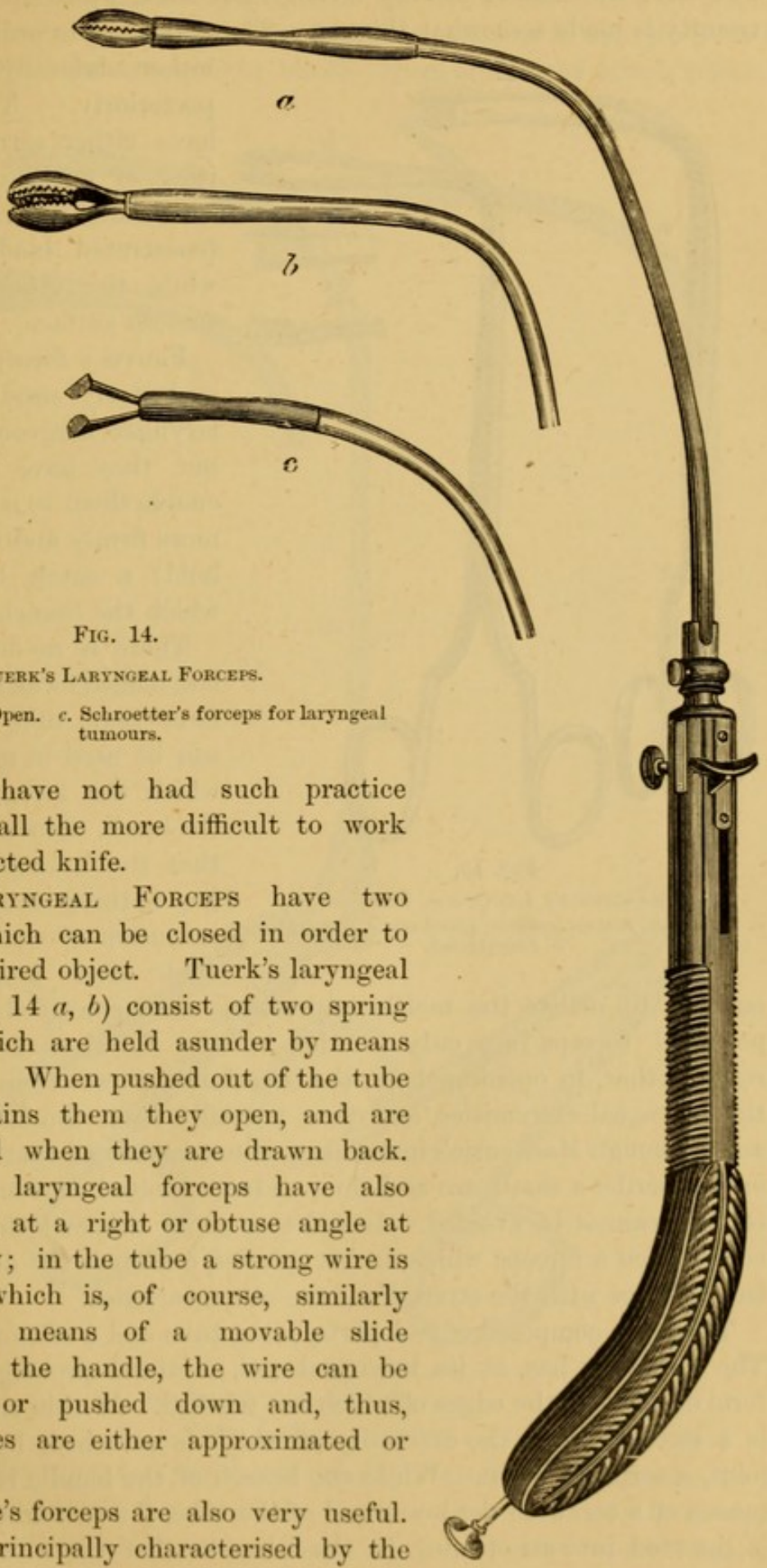

FIG. 14.

TUERK'S LARYNGEAL FORCEPS.

a. Closed. *b*. Open. *c*. Schroetter's forceps for laryngeal tumours.

those who have not had such practice will find it all the more difficult to work with a protected knife.

2nd. LARYNGEAL FORCEPS have two branches which can be closed in order to seize the desired object. Tuerk's laryngeal forceps (Fig. 14 *a*, *b*) consist of two spring branches which are held asunder by means of a wedge. When pushed out of the tube which contains them they open, and are again closed when they are drawn back. Schroetter's laryngeal forceps have also a tube bent at a right or obtuse angle at its extremity; in the tube a strong wire is contained which is, of course, similarly bent. By means of a movable slide attached to the handle, the wire can be drawn up or pushed down and, thus, the branches are either approximated or separated.

Mackenzie's forceps are also very useful. They are principally characterised by the

fact that the handle is very strong and thick, while the grasping extremity is made somewhat thinner. They open, as in ordinary forceps, either laterally or antero-posteriorly. These forceps have either serrated extremities or cutting edges, and sometimes the margin of one fenestrated blade is cutting while the other presents a smooth surface.

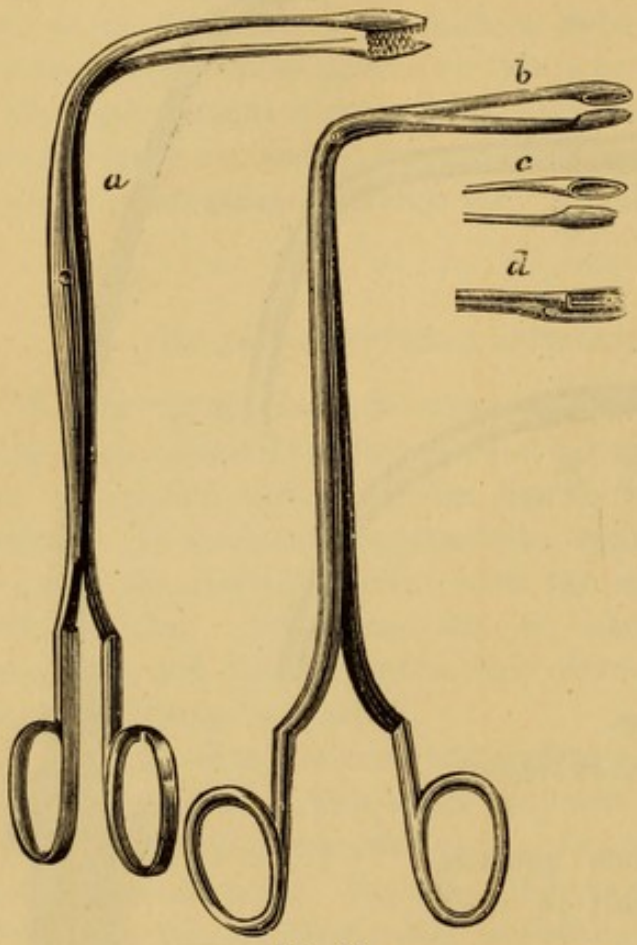

Fig. 15.

Mackenzie's Laryngeal Forceps.

a. Lateral. *b*. Antero-posterior (cutting). *c*. Spoon-shaped. *d*. Fenestrated.

Fauvel's forceps, which are exclusively used by French laryngeal surgeons, are similar, but they have (in order to enable them to seize a tumour more firmly and to keep their hold) a catch by means of which the branches are fixed.

There is no doubt that the last-named forms admit of more force than tube forceps, and can be used in many cases in which the latter leave us in the lurch. Stoerk rightly says that the branches of forceps are nothing more than the extension of our fingers, and that after a time one is enabled to utilise the tactile impressions thus conveyed. The more powerful forceps are only inferior to the tubular variety in this respect, that, in opening them, the branches separate from the bend to the laryngeal extremities, and thus partially cover the field of vision; and, although Mackenzie's instrument is so constructed that the branches only describe a small arc and thus undergo limited movement, yet loss of light cannot be avoided. In order to avoid this evil the author has constructed a forceps which, in his opinion, combines the delicacy of the tube forceps with the strength of the other varieties.

These are composed of two parts, viz. a tube and a scissor-like handle. The bent tube has, at its laryngeal end, a lateral prolongation in the form of a spoon, the edges of which are toothed. Within the tube there is a strong wire to the extremity of which is attached, by means of a joint, a serrated spoon. While one branch of the handle is attached by means of a screw to the lower end of the tube, the extremity of the wire is inserted into an opening in the other, so that the wire follows each

movement of the branch. The arms of the handle articulate by means of a screw which is situated not far from the junction of the handle and the tube. If the branches of the handle be separated the wire is pushed

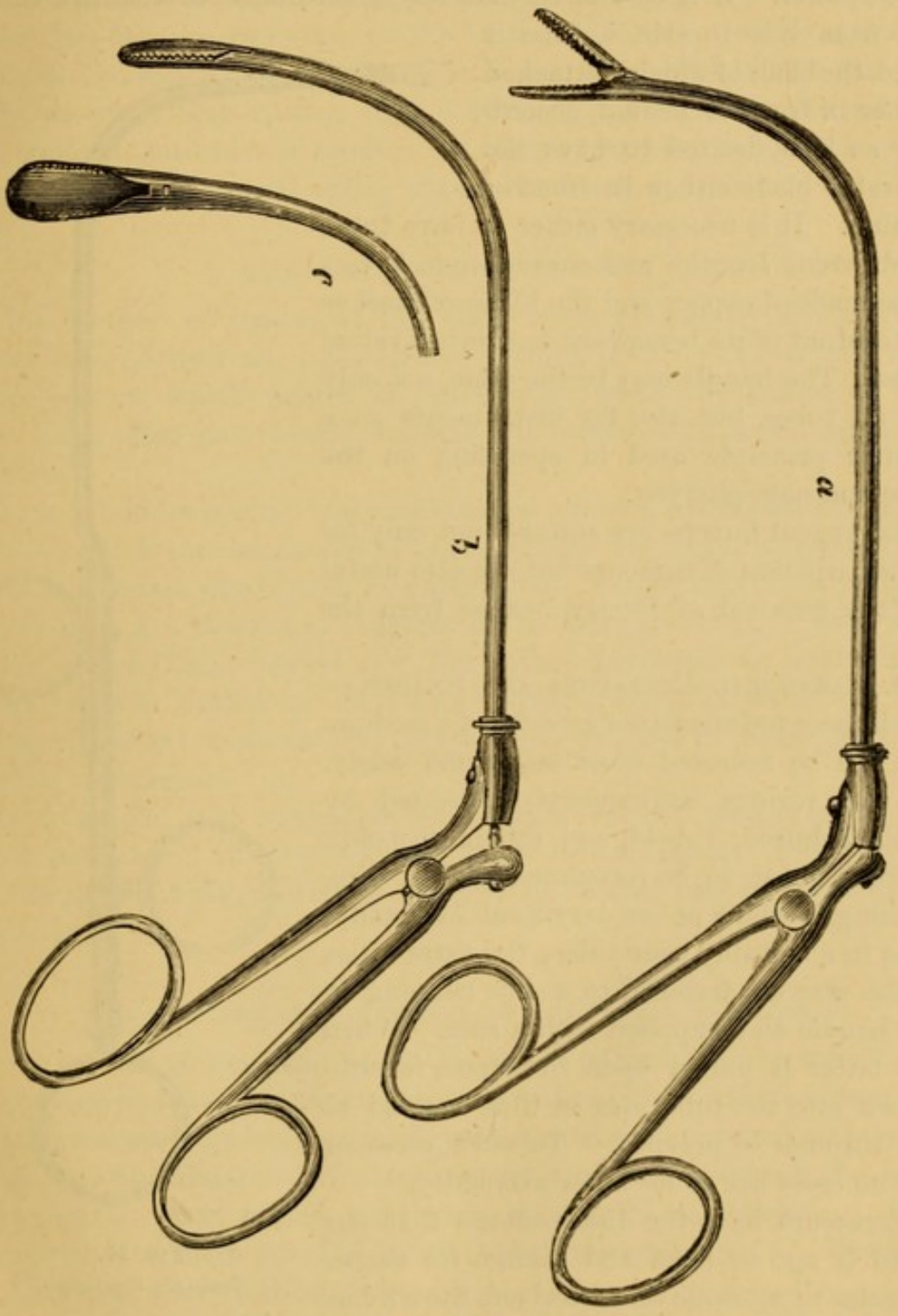

FIG. 16.
GOTTSTEIN'S LARYNGEAL FORCEPS.
a. Open. *b*. Closed. *c*. Lateral.

forward in the tube, and the spoon, which is attached to the wire by a joint, is separated from the one on the opposite side,—in short, the forceps are opened; when, on the other hand, the branches are approximated,

the wire is pulled upon and the forceps closed. As the lever arm, upon which we pull, is eight times as long as that to which the movable wire is attached, it is evident that a small amount of exertion will exercise great power. If it be desired that the spoon-shaped extremities should act from side to side, a tube is used, the blade of which is attached either in front or behind, according as it is desired to have the movable blade either in front or behind. It is necessary either to have tubes of different lengths and curves, or to have a tube made of copper and the blade of steel so as to admit of its being bent to suit individual cases. The handle may be the same, not only for all tubes, but also for instruments on a similar principle used in operating on the nose and naso-pharynx.

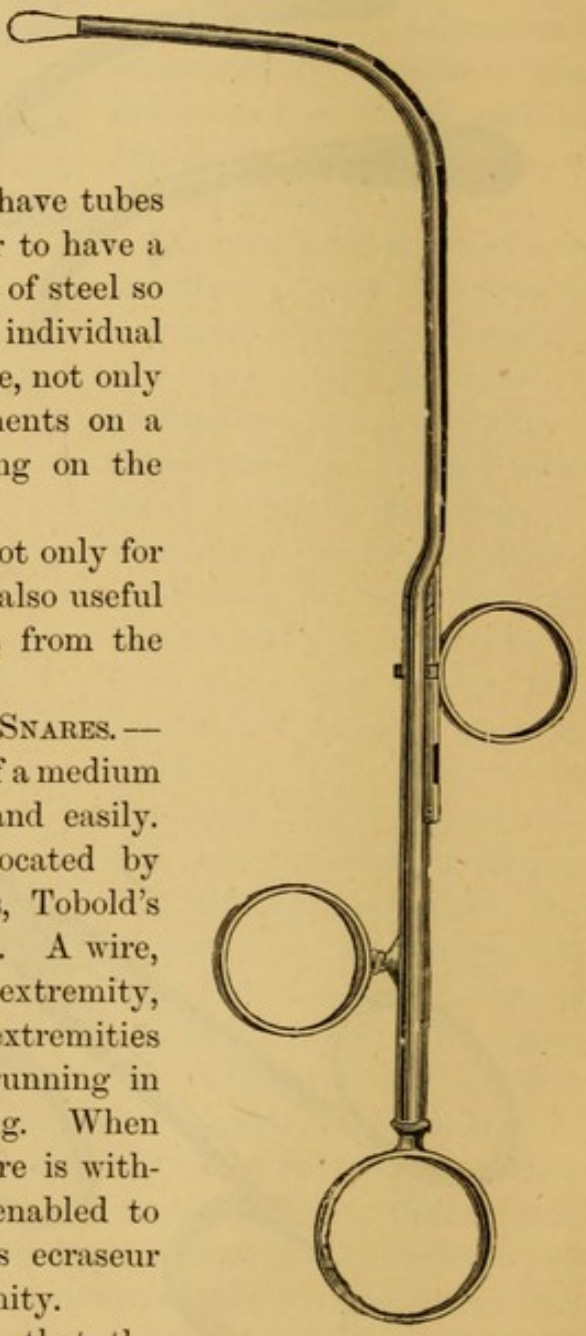

Fig. 17.
Tobold's Ecraseur.

Laryngeal forceps are suitable not only for the extirpation of tumours but are also useful for the removal of foreign bodies from the larynx.

3. Laryngeal Ecraseurs and Snares.—With these pedunculated growths of a medium size can be removed most safely and easily. Of the various instruments advocated by Gibb, Johnson, Tobold, and others, Tobold's snare is most to be recommended. A wire, forming a snare at its laryngeal extremity, runs in a suitably bent tube; the extremities of the wire are fastened to a slide running in the handle and supplied with a ring. When the latter is pulled upon the snare is withdrawn into the tube, and is thus enabled to cut through a polypus. Tobold's ecraseur has no cross bar at its lower extremity.

Ecraseurs have the disadvantage that the snare is apt to bend and change its shape. In order to set aside this drawback Stoerk has added to the lower extremity of the tube an immovable hollow ring of metal, which covers the snare during its introduction. Rings of different sizes are used in order to enable wire loops corresponding to larger or smaller growths to be introduced. Fine iron wire (thin piano wire) is most suitable for snares.

4. The Guillotine.—Voltolini was the first to suggest an instru-

ment, constructed on the principle of Fahnenstock's tonsillotome, for the removal of laryngeal polypi, and this has been modified and simplified by Stoerk. A ring-shaped knife, attached to a strong iron wire, runs within a guiding tube, which is provided at its laryngeal extremity with a bent loop for the reception of the knife. While the tube is attached firmly to the handle, the ring-knife is so connected with it through the wire that by pulling upon a slide a cutting movement can be carried out, while on cessation of traction the instrument returns to its original position owing to a spiral spring within the handle.

GALVANO-CAUSTIC INSTRUMENTS.

This method of treatment has been much praised by some, while others have formed an unfavourable opinion of it. The author considers galvano-caustic snares as unnecessary, while the points, on the other hand, often give valuable assistance in destroying non-pedunculated growths.

He uses besides pointed and knife-shaped burners, instruments (Fig. 18 *a* and *b*) which can be heated not only at their laryngeal extremity but above and to one side of this; an appropriate burner must then be used according as it is desired to cauterise either side, the front, or back wall of the larynx (Fig. 18 *c* and *d*). The author has found an instrument, which becomes heated on its concave aspect, specially useful for the destruction of granulations and polypi, when situated in the angle of the anterior commissure.

As a handle, that suggested by Voltolini may be used (Fig. 19), in which pressure on an ivory nob completes the connection. Not only all the burners, but also the endo-laryngeal electrodes, may be attached to this handle.

THE MECHANICAL TREATMENT OF LARYNGEAL STENOSIS.

This method of treatment has for its object, either to avoid tracheotomy by introducing tubes into the larynx, thus making oral respiration possible, or, after tracheotomy has been performed, to restore the normal air passage by systematic dilatation of the stricture, and so to render the tube unnecessary. Our subject may then be divided as follows: 1. The introduction of tubes into the larynx before tracheotomy. 2. Methodical dilatation after tracheotomy.

The introduction of tubes (catheterism of the larynx, tubage de la glotte, *Bouchet*) has of late been practised by Weinlechner (1877) and more especially developed by Schroetter. Silver catheters, or, better still, hard rubber instruments, of triangular shape, corresponding to the margins of the glottis, are used, of various sizes, as recommended by Schroetter. The operation is conducted under the guidance of the mirror

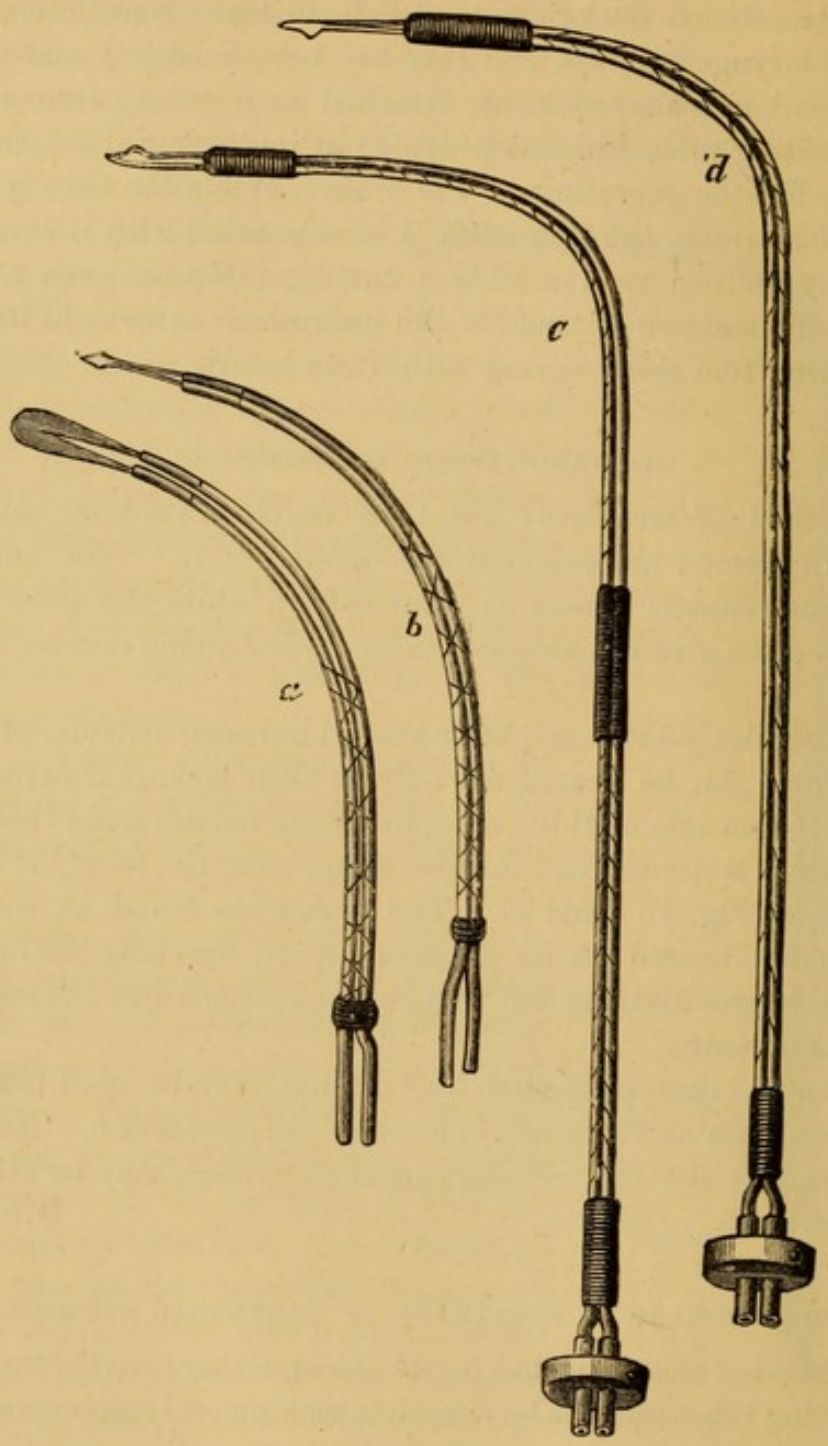

FIG. 18.

GALVANIC CAUTERIES.

a. and *b*. After Voltolini. *c*. and *d*. Lateral burners after Gottstein; antero-posterior burners are constructed on the same principles.

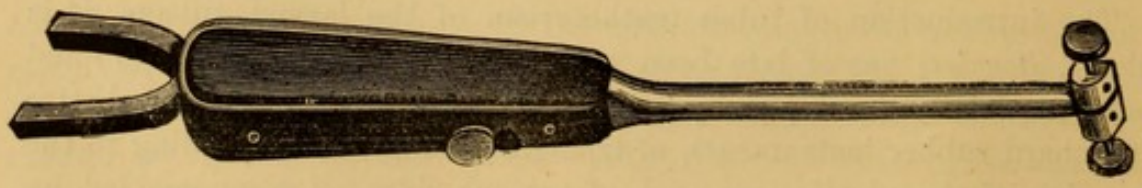

FIG. 19.

VOLTOLINI'S HANDLE FOR ELECTRODES.

and, if this be impossible, by the aid of the finger. This procedure has been proposed either to save life (as a substitute for tracheotomy in acute laryngeal stenosis) or for the gradual dilatation of chronic strictures. Although a few cases have been recorded in which catheterism made tracheotomy unnecessary in acute stenosis, or in which time was gained for its performance, still "tubage" can never replace this operation, not only because the result is transitory, but also because there are many drawbacks and dangers in the introduction of catheters more especially when left *in situ* (ulceration, disease of cartilages). Rauchfuss, however, has found that tracheotomy—especially in very young children, and when stretching the neck increases dyspnœa—is facilitated by the introduction of a catheter; the anterior wall of the trachea is thus fixed and may be pressed forward out of the wound by the beak of the instrument. Catheterism may also be practised in order to gain time, while preparations for the performance of tracheotomy are being made, or when, after the latter has been begun, marked asphyxia or apparent death occurs. Finally Hack has employed catheterism in cases of laryngeal spasm.

More satisfactory, however, are the results of this operation when employed for the purpose of gradual dilatation in chronic stricture. As the most satisfactory instruments, for this purpose, may be mentioned Schroetter's hard rubber tubes. After the patient has been prepared for their introduction during from three to eight days, by probing the larynx with an elastic catheter, or by touching and raising the epiglottis, the tube is introduced while the patient sits or lies down, and is then left *in situ* for several minutes. This is repeated daily and with gradually increasing instruments which, after the patient has become thoroughly accustomed to the manipulation, may be allowed to remain in the larynx for some time.

Methodical dilatation after tracheotomy has also been developed, if not invented, by Schroetter. Attempts to dilate the stricture by means of specially adapted dilators passed through the wound, have been abandoned because the results did not come up to the expectations formed. Likewise instruments composed of three or four pieces, which can be introduced from the mouth into the larynx closed, and which can be opened to any desired extent by means of a screw, as suggested by various authors, have not been found quite satisfactory. The tin bougies invented by Schroetter, on the other hand, have come into general use. These are triangular cylindrical plugs made of solid tin, rounded at the edges and about 4 cms. in length; they are attached by means of a thread, which passes through the upper end, to a suitable hollow tube (mandrin) through which the thread also passes. In the upper wall of the external tracheotomy tube is situated an opening corresponding to the thickness of the bougie, while on the upper wall of

the inner tube is a bent prong 3 cms. long, which fits into an aperture passing through the lower end of the bougie from before backwards. The application of the instrument is as follows: By means of the bent mandrin the bougie is passed from the mouth, through the narrowed larynx, into the upper opening of the external tube; when the inner tube is pushed into the outer, the prong attached to the former passes through the canal at the lower end of the bougie and fixes it in the desired position. The mandrin is now withdrawn and the thread, which was hitherto attached to the handle, is loosened so that it can be thrown round the neck or over the ear. In order to withdraw the bougie the inner tracheotomy tube is pulled out after the mandrin has been passed over the thread.

The bougies are left in, at first from half an hour to an hour, and afterwards for a longer time, even for a whole day. Figure 20 shows the attachment of the tin bougie to the tracheotomy tube.

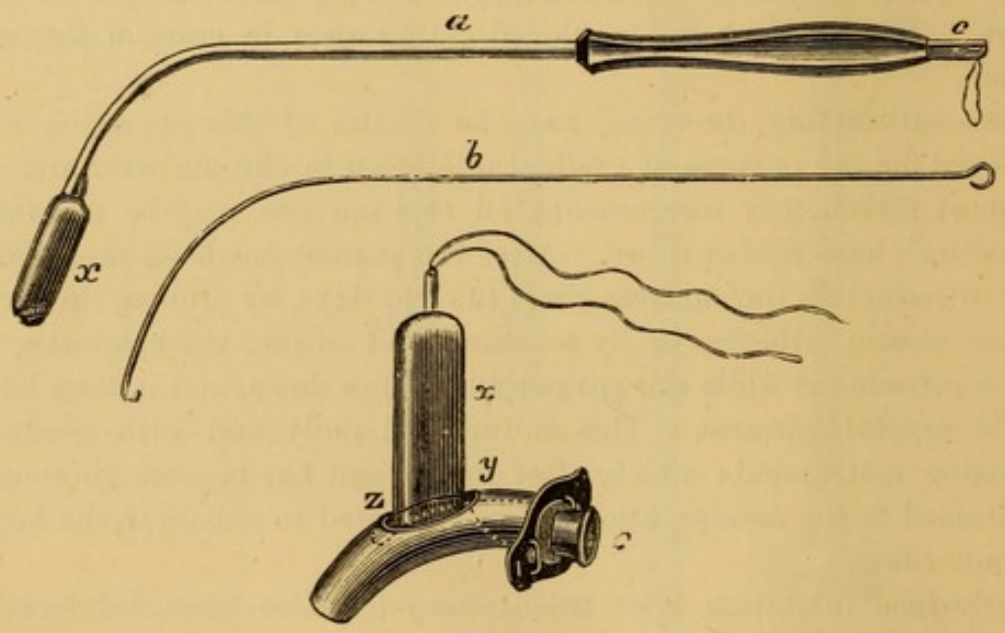

FIG. 20.

SCHROETTER'S METHOD OF DILATING LARYNGEAL STRICTURES BY MEANS OF TIN BOUGIES AFTER TRACHEOTOMY.

This method can only be used after the disappearance of all inflammation; it is specially indicated in stenosis, when resulting from inflammation of the perichondrium and submucous tissue; and also from the presence of cicatrices, membranous obstructions, and granulation tissue after this has been destroyed by suitable surgical treatment.

LOCAL ANÆSTHESIA OF THE LARYNX.

In order to be able to accomplish endo-laryngeal surgical operations with proper accuracy, it is necessary that the surgeon should not be hindered by the reflex action which results from touching the mucous membrane of the larynx. Those cases in which irritability of the mucous membrane

is so slight that it is possible to proceed to endo-laryngeal operative interference without further preparation, are very rare. Various methods have been tried for diminishing the sensibility of the larynx; large doses of bromide of potassium have been given and inhalations of this drug, of tannin, etc., have been used, but the author has never seen the slightest result from these remedies. Tuerk was the first who, by the local application of Bernhatzik's solution (actetate of morphia 0·2, rectified spirit 4·0, chloroform 15·0, applied several times at intervals of from ten to fifteen minutes), produced anæsthesia of the larynx. The result is in many cases incontestable, but the method is painful and not without danger, because, besides local anæsthesia, serious general toxic effects always result (severe giddiness, muscular weakness, tremors, etc.). Schroetter has modified this method as follows: On the evening before the operation the larynx is energetically brushed twelve times with pure chloroform in order to produce a hyperæmia of the mucous membrane and to prepare it for the absorption of the actual narcotic. After an interval of about one hour, a concentrated solution of morphia (1 in 10) is applied the same number of times; after each application the patient is told to expectorate and to thoroughly rinse his mouth and pharynx with a previously prepared gargle, containing tannic acid. The patient then goes to bed, but it is essential to have him watched during the night, and, if possible, by a physician. Next morning at eight o'clock the larynx is usually so devoid of sensibility that the operation may be undertaken at once. This method also, as even its inventor admits, is very unpleasant for the patient, while there is also the danger of poisoning; its adoption, therefore, should be limited to those cases in which it is not advisable to delay operative interference (*e.g.* removal of an impacted foreign body, etc.).

Recently Schnitzler removed a laryngeal papilloma in a child of eight under the influence of ether; this proceeding does not deserve imitation, not only because we are thus deprived of the assistance of the patient, which is so necessary for endo-laryngeal operations, but because the dangers of even slight hæmorrhage during narcosis are not to be lightly estimated.

The application of Richardson's ether spray to the exterior of the larynx, in order to produce freezing, is seldom sufficient to produce anæsthesia of the interior, even when the spray is directed upon the points corresponding to the entrance of the superior laryngeal nerve on each side, as suggested by Rossbach. Another method suggested by this author, namely, the injection of morphia at the point of entrance of the superior laryngeal nerve, is likewise untrustworthy.

As a contrast to these dangerous and uncertain methods is to be considered the simple plan of making the mucous membrane more tolerant by the use of a probe, and in the great majority of cases requiring

operative treatment, this is both sufficient and satisfactory. Every day during a sitting of five or ten minutes a laryngeal sound is introduced, and various parts of the mucous membrane touched; often after from three to five days, but sometimes after a longer interval, the sensibility is so blunted that an operation may be undertaken. For increasing the anæsthesia a few whiffs of chloroform may be administered just before the operation, or pieces of ice may be swallowed during a few minutes.*

Cleansing and Disinfecting Mirrors and Instruments.—Instruments, intended for insertion into the throat and larynx of various patients, must,

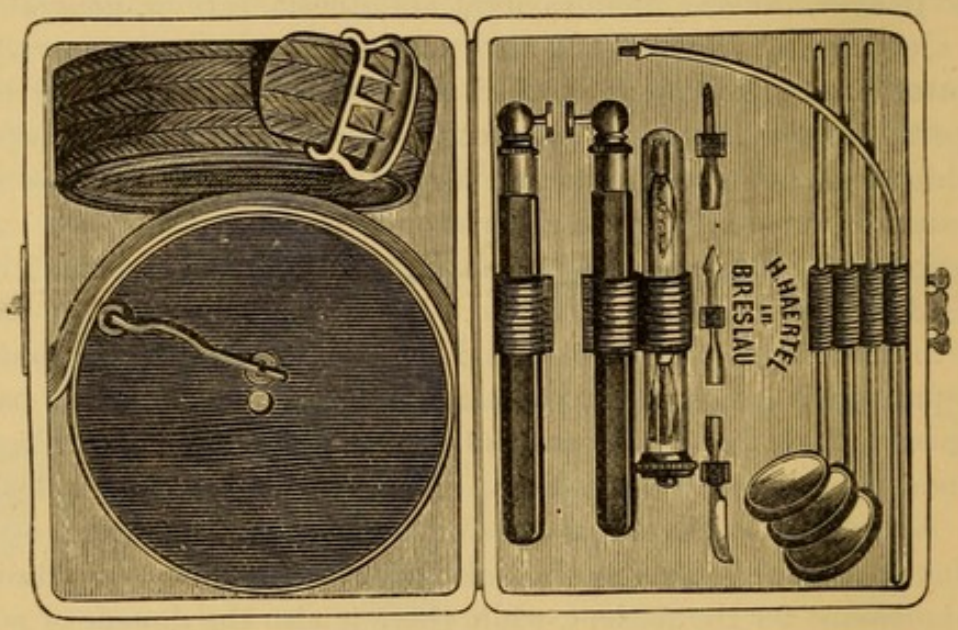

Fig. 21.
Laryngeal Case.

of course, even more than others, be cleansed and disinfected with the greatest care before and after use. The author does not consider it sufficient to have special mirrors for syphilitic (and certainly also for tubercular) patients, but recommends rather that the laryngeal mirror, as also other instruments, be immersed, before and after use, for a short time in boiling water which can be kept hot during the consultation hour by means of a spirit lamp. He has not found that since adopting this method his instruments are more rapidly spoilt. Finally, it cannot be too strongly impressed that every patient should have his own laryngeal brush or sponge. Those who require prolonged laryngoscopic treatment will also do well to provide themselves with a mirror.

* Of late the introduction of the alkaloid cocaine—obtained from *Erythroxylon Coca*, the well-known South American plant—has afforded a simple and safe method of producing local anæsthesia. The application of a solution of from 10 to 20 per cent. to the larynx by means of a brush—repeated once or twice—is stated to produce complete tolerance of operative interference. Although the anæsthetic properties of the alkaloid were only last year brought into notice by Koller, a Vienna ophthalmologist, yet the effects of coca upon the larynx were, to a certain extent, previously known to Fauvel of Paris. This authority considers that coca, in addition to its sedative action, has a powerful influence as a voice tonic and uses various preparations for this purpose, of which the Vin Mariani is one (Translator).

Manifestly it has not been possible to describe, in the foregoing pages, every instrument that has proved itself useful in laryngeal therapeutics and surgery. Those most to be recommended have been discussed, and many of them even are not essential to the general practitioner although the author has thought it well to describe them.

A laryngoscopic case (Fig. 21), as prepared under the direction of the author, contains every instrument indispensable to the physician, and that in a convenient and portable form. These are (1) a reflector with forehead band; (2) handles; (3) laryngeal mirrors of various sizes; (4) a stem, to the laryngeal end of which the following can be screwed: (*a*) several sponges and brushes; (*b*) a silver socket which, when united with the stem, forms a probe; (*c*) a second socket for attachment to the stem and to which nitrate of silver can be fused; (*d*) two small knives adapted to the stem.

INTERNAL REMEDIES.

The use of internal remedies has become more limited since local treatment, by means of the laryngeal mirror, has become properly developed; at the same time their use is fully justified, not only in a large number of cases in which local treatment cannot be carried out or is not indicated, but also as an aid to the latter, and they may then be of considerable value.

Among internal remedies the alkalies, more especially chloride of ammonium, chloride and carbonate of sodium, have for long held a deserved reputation in the treatment of diseases of the respiratory tract, and more particularly of the larynx. Of their mode of action no satisfactory explanation had, however, been given, except that it was said that these remedies "loosen the catarrh" and promote expectoration, by liquefying the secretion. Only lately Rossbach attempted experimentally to establish their mode of action, and he arrives at the following conclusions: (1) increased alkalinity of the blood diminishes or checks the secretion of mucus in the trachea; (2) the curative action of alkalies does not depend upon their power of liquefying and promoting expectoration, but upon the fact that increased alkalinity of the blood diminishes hyperæmia of the mucous membrane and decreases the secretion of mucus. We probably shall not go far wrong if we extend this action upon the mucous membrane to the whole respiratory tract including the larynx, and consider that the use of alkalies may promote improvement and cure in inflammatory affections of the laryngeal mucous membrane. According to the same author apomorphine, emetin, and pilocarpine are to be looked upon as the prototypes of expectorants, since their administration causes increased secretion of mucus, and they are consequently indicated in chronic catarrhal affections when accompanied by dryness of the mucous membrane.

Of more doubtful value are preparations of antimony, sulphur, ipecacuan, and squills. The two latter, which may perhaps favour

expectoration by their nauseating action, lead us to a consideration of emetics. Fortunately the time has passed when it was believed that an attack of croupous laryngitis could be aborted by the use of an emetic, and when the mistake was made of prescribing the same for the anxious mother as a household remedy, in order that it might be given before the arrival of the physician and that, thus, the short time between the first note of the dreaded barking cough and his advent might not be lost.

It is now generally admitted that an emetic can cut short neither a croupous nor a simple laryngitis, and its use is restricted to those cases in which it is necessary to get rid of the products of disease (membrane, secretion, etc.) which cannot be removed from the larynx by other methods. Among the most important internal remedies in the treatment of laryngeal disease are narcotics, and of these morphia is the most important. Here also we are indebted to Rossbach for a series of experiments, the results of which accord fairly well with clinical observation. According to this author morphia diminishes the reflex tendency to cough and also the secretion of mucus; atropine dries the mucous membrane when moist, and that in a more marked degree than morphia, and is therefore indicated in cases in which continuous cough is caused by abundant secretion of mucus. This much is certain, that in morphia we have an invaluable symptomatic remedy in various laryngeal diseases by means of which both the annoying cough, which tends to delay healing, and reflex irritability are diminished. In spasmodic affections the bromides are most serviceable. Of course, general affections upon which many laryngeal diseases depend (*e.g.* scrofula, syphilis, tuberculosis, anæmia) require suitable internal remedies. Of baths and mineral waters we need only say a few words. A number of springs have acquired a reputation in the treatment of chronic laryngeal disease. In the first rank may be placed the alkaline and salt springs, such as Ems, Gleichenberg, Saltzbrunn, Reichenhall, and also the sulphur waters of Weilbach and Nenndorf, the sulphurous waters of the Pyrenees, Les Eaux Bonnes, as also the warm sulphur springs of Savoy. We cannot deny the value of these in certain forms of laryngeal disease; much must be attributed to rest and the removal of the patient from business cares. At all events, we should like to insist upon the fact that local treatment should come before mineral waters.* As an after-cure, residence on the north or Baltic coasts or in sheltered places of high altitude, and, finally, the systematic use of cold-water cures may be recommended.

DIET AND HYGIENE.

Food may act injuriously upon laryngeal disease in two ways. It may either affect the part directly during deglutition or may

* Sometimes, however, a case which has obstinately resisted local treatment, will, after a week or two of change of air, prove itself amenable to the application of topical remedies (Translator).

act upon the larynx after it has been absorbed by the stomach. Those foods which act directly do so on account of their temperature, form, and consistence, or chemical composition. Patients must avoid taking food or drink at either too high or too low a temperature. It is a mistake to order patients to take certain beverages—water, tea, etc.—as hot as they can be borne; it is wrong to imbibe them at such a temperature that they may increase existing hyperæmia of the pharynx, epiglottis, or the laryngeal entrance. In painful inflammatory affections one should strive to give the larynx as much rest as possible, and on this account food of firm consistence should be avoided in order to prevent pressure upon the organ during deglutition. On the other hand, in ulcerations of the laryngeal aperture, and when the epiglottis is defective, food and drink may get into the larynx and cause violent cough. In such cases demulcent drinks and soft food are to be recommended. As a matter of experience highly spiced, and more especially peppered and acid foods and drinks cause cough and are consequently injurious in all severe laryngeal affections. We consider alcohol as an article of diet which acts injuriously, not only locally, but, as we think, also after it has been absorbed into the circulation. In moderate quantities it may be allowed in chronic cases and in the treatment of phthisis it is often indispensable in large quantities, but, on the other hand, it increases the secretion of the pharynx and larynx.

In considering the etiology, atmospheric influences have been alluded to; care must, of course, be taken that the patient should, if possible, breathe a clear air free from dust and smoke. Moist warm atmosphere is the most suitable.

Smoking is to be absolutely forbidden in acute cases, but in many chronic affections moderate smoking (two or three cigars a day), in the open air or in well-ventilated apartments, may be permitted to those who have become habituated to the use of tobacco. Of special importance is rest of the voice. When, through any pathological process, the vocal cords have lost their normal capability of vibration, a powerful expiratory effort is necessary in order to produce a loud note, and this pressure acts principally or only upon the cords; the latter are pressed together, perverted action of their muscles occurs, which, if often repeated, leads to permanent injury, and, in persons who are obliged to exert the voice professionally, may be of a very unpleasant nature. We must, accordingly, even in mild laryngeal affections, advise the patient to spare his voice, and he should be especially warned not to put any great strain upon it. In inflammatory affections and in cases of ulceration, speaking should be avoided as much as possible, and the patient should be recommended to use, not so much the larynx, as the tongue, lips, and lower jaw.

PART II.

PRIMARY LARYNGEAL DISEASES.

CHAPTER I.

DISEASES OF THE MUCOUS MEMBRANE.

ANÆMIA OF THE LARYNGEAL MUCOUS MEMBRANE.

Anæmia of the larynx usually co-exists with faulty composition of the blood; it occurs in convalescence after severe diseases, in general anæmia, in chlorosis, and in tuberculosis. Both in chlorosis and tuberculosis it is often very marked at a time when the general appearance of the patient does not show an anæmic type. Tobold recognises an isolated, purely local anæmia in nervous persons, principally females, which is associated with laryngeal pain, itching, cough, and undue sensitiveness to changes of temperature; Ziemssen believes that the nervous disturbance is primary, and that the sensory anomalies are combined, not only with motor disturbances (especially paresis of tension), but also probably with vaso-motor changes by which are produced narrowing of the blood vessels and ischæmia. We look upon this anæmia of the laryngeal mucous membrane as only apparently local, and have observed it principally in girls at puberty. In these, if they did not present the marked clinical features of chlorosis, anomalies of menstruation, as also nervous phenomena not confined to the larynx, pointed to the composition of the blood as defective. Further we do not believe, with Mackenzie, that the insufficient local nutrition predisposes to the deposition of tubercle, but consider that the anæmia of the laryngeal mucous membrane is the early manifestation of a general disturbance of nutrition, and we can only agree with this author, when he advises that the existence of marked anæmia of the larynx should always lead the physician to undertake a careful examination of the lungs. The anæmia is most marked at the entrance of the larynx and epiglottis, as the author has observed, contrary to the statement of Ziemssen. Sometimes solitary injected vessels are seen on the anæmic mucous membrane, and this condition may be associated with local congestions, which Semon aptly compares to the transient blush which appears upon the pale cheeks of the patient after any physical exertion or mental excitement. Persons with anæmia of the larynx, whether it be caused by chlorosis or tuberculosis, show more or less marked anomalies of sensibility, and less frequently motor disturb-

ances, so that one is inclined to look upon these as the result of anæmia. Tonic treatment is only satisfactory when the general condition can be improved, as in chlorosis or in simple anæmia; on the other hand, the anæmia of the mucous membrane in tuberculosis, as we shall see later, may either give place to serious laryngeal disease or remain stationary, even in the later stages of phthisis.

HYPERÆMIA OF THE LARYNGEAL MUCOUS MEMBRANE.

This may be either active or passive. Active hyperæmia occurs chiefly after excessive use of the voice, through loud or continued speaking or singing. We have already mentioned that, according to Semon, this hyperæmic condition of the vocal cords may become stationary without injury to the normal and exact function of the organ in professional singers (more especially baritone and bass). Hyperæmia may also result from the entrance of fluid or food into the larynx, and from the presence of foreign bodies which, if not speedily removed, may rapidly produce inflammation. It may also be produced by the inhalation of irritating or hot vapours. The active hyperæmia, which occurs in many infectious diseases, cannot be here considered, because it always soon gives place to other pathological changes.

Passive hyperæmia is observed in all diseases which cause general congestion, such as emphysema, valvular disease, congenital defect of the heart; also in diseases which cause local disturbance, specially tumours pressing upon the larynx, and finally owing to forced expiration, *e.g.* holding the breath, straining, spasmodic cough, and whooping cough.

Active hyperæmia, especially if the cause exists for long, becomes converted into catarrh of the larynx, while long continued passive hyperæmia leads to serous infiltration and œdema.

A laryngeal examination readily shows the anatomical changes. In the active form the mucous membrane appears injected either in its whole extent, although varying in intensity at different parts, or individual portions only may be affected—generally the cartilages of Santorini or the whole entrance of the larynx (when food passes the wrong way), the vocal process, and the margins of the cords (in excessive use of the voice). In the passive form the colour is more livid, and the mucous membrane moist.

The symptoms consist of tendency to cough, feeling of dryness, sometimes lancinating pain, and, if the vocal cords be hyperæmic, slight hoarseness. Treatment of active hyperæmia is hardly necessary; the organ must be kept at rest, and, if the cause of irritation be removed, soon returns to its normal condition. In passive hyperæmia improvement and cure depend upon relieving the causes of the congestion.

HÆMORRHAGES.

Severe hæmorrhage is rare, except after deep injuries of the larynx; even after endo-laryngeal operations the bleeding is hardly worth mentioning. Ecchymosis may be observed in phosphorus poisoning, scurvy, morbus maculosus Werlhofii, hæmophilia, and variola hæmorrhagica. Bleeding from the intact mucous membrane, which occasionally occurs in inflammatory conditions, and which has given rise to the recognition of a hæmorrhagic laryngitis, will be subsequently considered. In a case of Tuerk's a syphilitic ulcer in the sinus pyriformis extended to the lingual artery, and caused death from loss of blood; as a rule, ulcerations are not followed by hæmorrhage, or, at most, the expectoration shows admixture of blood by being spotted or streaked. In rare cases blood is effused into the subcutaneous tissue.

The symptoms of bleeding from the surface of the mucous membrane are very slight, and consist principally in the appearance of streaks in the expectoration and hoarseness,—when part of the blood is coagulated in the interior of the larynx and prevents closure of the glottis. Large extravasations into the submucous tissue may produce symptoms of laryngeal stenosis and death by suffocation.

The treatment of slight hæmorrhage rarely calls for the use of styptics; if it does not cease of its own accord, alum or tannin may be insufflated.* When symptoms of stenosis occur in cases of bleeding into the submucous tissue, tracheotomy should not be delayed.

ACUTE LARYNGEAL CATARRH.

(*Laryngitis catarrhalis acuta.*)

Etiology.—Among the causes of acute catarrh, "catching cold" is the most important. We know of no mucous membrane, except that lining the nose, which is so prone to inflammation as a result of climatic influences, as that of the larynx. Sudden changes of temperature, moist cold air, if respired for any length of time, wet and cold affecting the whole body or the feet, and cold draughts may produce laryngeal catarrh with or without coryza, more especially in persons who are predisposed. This predisposition may be caused by various circumstances; it may be acquired through faulty bringing up, or through "coddling" during childhood. Every practitioner knows that in those families, in which the anxious mother considers the weather and the direction of the wind before sending her child into the open air, attacks of croup are much commoner than when an opposite principle is adopted. This predisposition is, moreover, acquired from previous attacks of catarrh and

* A spray containing from 2 to 3 grains of perchloride or sulphate of iron to an ounce of water may effect the same purpose (Translator).

from whooping-cough. Hereditary predisposition can only be mentioned in so far that certain hereditary constitutional anomalies carry with them a tendency to laryngeal catarrh. Badly nourished strumous persons are more readily attacked by laryngitis than the strong and healthy. We have repeatedly seen patients, with an hereditary tendency to tuberculosis, suffer from tedious recurring attacks of laryngeal catarrh at a time when neither the general condition nor physical examination of the lungs pointed to phthisis. On the other hand, the catarrhs which occur in teachers, clergymen, and vocalists, depend less upon predisposition than upon excessive or faulty functional effort. Simple hyperæmia, if neglected, may result in catarrh, and likewise those factors which we have discussed as causes of hyperæmia, *e.g.* mechanical irritation (continued loud singing and speaking, foreign bodies, food passing the wrong way); thermic influences, such as hot drinks and breathing dry hot air; chemical stimuli, such as spices, alcohol, and irritating gases or vapours, may, if they act severely and long, produce the same condition. Catarrh frequently extends from the nose and pharynx, and more rarely from the bronchi, to the larynx. Although laryngeal catarrh is more common at certain times of the year, it does not occur in an epidemic form. It is worthy of remark that the mucous membranes of the nose and pharynx are sometimes affected under such conditions that we must consider the cause to exist in the presence of a specific infection, but that this does not apply to the laryngeal mucous membrane; in influenza laryngeal catarrh only occurs as a part of the catarrh which involves the whole respiratory tract. Whether the virus becomes less easily attached to the laryngeal mucosa, or is more apt there to cause a croupous or diphtheritic inflammation, cannot be decided. While, during epidemics of diphtheria, sore throats occur epidemically, laryngeal catarrh is not found to be strikingly frequent, nor does it occur in conjunction with pharyngeal diphtheria. As a symptom of general infectious diseases, laryngeal catarrh occurs in measles and variola, more rarely in typhoid and scarlet fever, and also in tuberculosis and syphilis. Men are more liable to be attacked than women, and grown-up persons than children. Season and climate doubtless influence its occurrence; relatively low temperature, sudden changes, and marked dampness (the beginning and end of winter and also the occurrence of damp, cold days in summer), and cutting cold winds, especially north and east, favour diseases of the respiratory tract generally, and catarrh of the larynx in particular.

Pathological Anatomy.—The anatomical changes shown in catarrh of the laryngeal mucous membrane can be better examined by means of the laryngoscope than on the dissecting table, not only because primary laryngeal catarrh is seldom fatal, but also because the appearances are reduced to a minimum in the dead body, and have often in great part disappeared. The changes consist principally of hyperæmia, swelling,

and increase, or change, of the secretions. These appearances vary, not only in intensity, but extent. Sometimes the catarrh is limited to the entrance of the larynx or attacks only the epiglottis, sometimes the middle space of the larynx is more affected, while again the vocal cords or the interarytenoid commissure alone may be involved, and, finally, the whole mucous membrane may be attacked. The colour varies from light to deep red; the vocal cords may be almost normal, scarcely showing even change of colour; sometimes they are more or less hyperæmic, and occasionally, owing to swelling of their under surfaces, they come to resemble deep red bands. The swelling also shows different degrees, and is not always in direct relation to the hyperæmia; sometimes it only prevents free movement of the cords with loss of function, while again it may give rise to symptoms of stenosis. The epithelial covering is thrown off at parts, and the mucous membrane seems rough and irregular, or, owing to the epithelium becoming raised, there appear white streaks which can easily be pulled off. Owing to this latter condition excoriations may arise which may, through speaking and coughing, extend to considerable ulcers—although this is rare. These occur chiefly on the free margins of the vocal cords, more particularly at the point of the vocal process, or on the cartilaginous portion. The secretion is slight at first, and in mild cases, particularly when the catarrh is limited to the cords, may remain so throughout; generally it becomes tough, transparent, and finally opaque and greyish yellow, owing to the large number of cells present. In some rare cases the secretion shows a tendency to dry upon the mucous membrane; it contains little water, and forms scales which can only be removed by violent coughing, while the epithelium becomes rubbed off, and small vessels are torn.

The pathological changes may either disappear entirely when the catarrh is cured, or, if it becomes chronic, may lead to conditions which we shall subsequently consider.

Symptoms.—Acute catarrh occurs under such a variety of conditions, dependent upon the seat of the affection, on the amount of anatomical change, and upon individual peculiarities, that it is difficult to bring them all under one clinical picture. Various forms of laryngitis, according to the intensity of their symptoms, have also been described; we prefer at first to give a general description of the symptoms, and then to add an account of modifications which may arise under various circumstances.

Laryngeal catarrh begins without a marked prodromal stage, sometimes it is preceded by slight chilliness; in mild forms there is no fever, and in the more severe varieties it is only of moderate intensity, if no complications supervene. The first symptom is a feeling of pressure, slight dryness, or pain; sometimes also there is the sensation of a foreign

body, and these phenomena tend to make the patient cough. Often these subjective troubles, together with slight disturbance of the voice, are the only symptoms by which the presence of catarrh is manifested. In other cases, however, symptoms develop which make the disease assume a grave character.

The cough, at first and in mild cases almost altogether a voluntary act in order to get rid of the disagreeable sensations, becomes severe, spasmodic, and troublesome, and, in childhood, is characterised by the occurrence of paroxysms of rapid shrill expirations with subsequent violent whistling inspirations. As the swelling and loosening of the mucous membrane and secretion increase, the cough becomes duller, or quite aphonic, or, from being accompanied by movement of the accumulated mucus, moist and loose. Only when the symptoms begin to diminish does the cough become less frequent and violent.

The secretion is very scanty at first, and, even later, is not profuse unless the bronchial mucous membrane be also attacked. It is purely mucous and transparent in the early stage, but after a few days becomes more yellow and opaque; sometimes there is a slight admixture of blood in the form of streaks.

The voice, if only the upper part of the larynx be affected, may be only slightly altered, but usually it has at the beginning a deep rough sound, and soon becomes hoarse or quite aphonic.

Pain is never severe, but the sensations of tickling and rawness may be annoying, and may be much increased by speaking. Difficulty of swallowing is only present when the parts at the entrance of the larynx, especially the epiglottis, are involved.

The general health is not much disturbed; even in severe cases in adults the fever is not high, and the patient is often not obliged to remain in his room or in bed.

We have so far tried to present a clinical picture of laryngeal catarrh, as it usually occurs when primary and when not associated with further complications, although it may vary in its intensity. According to our view, the disease described by authors as "the most severe form" of larynx catarrh always depends upon a submucous or perichondrial inflammation, as Ziemssen considers probable, and we shall describe it later. Here, we shall only consider the modifications which the clinical aspect of the disease may undergo from the anatomical form of the larynx in childhood, as also those which result from individual parts of the organ being attacked exclusively or principally.

LARYNGEAL CATARRH OF CHILDHOOD OR PSEUDO-CROUP.

The peculiarity of this affection lies in the fact that children who have been either quite or nearly well during the day, or at most

have suffered from slight hoarseness, suddenly awake at night from a quiet sleep with a characteristic barking cough and slightly laboured noisy respiration. These phenomena last only from one to two hours, the child goes to sleep, and wakens in the morning comparatively well, or perhaps a few attacks of barking cough keep the relatives in anxiety. Sometimes the first attack is also the only one; the voice may remain slightly hoarse, the cough becomes loose, and after a few days the patient is restored to health. More commonly, however, the attack is repeated during the following nights, and that with greater severity. The child wakens in great terror and with the symptoms of laryngeal stenosis, the voice becomes hoarser, and the cough more frequent. The stenosis, however, only gives cause for anxiety during the first few minutes after waking, and gradually diminishes in severity, so that after one to two hours the patient usually goes to sleep again. Even in those cases in which the attacks are repeated on several consecutive nights, the disease ends in recovery. In purely catarrhal cases the stenosis is never so severe as to produce a fatal termination directly or indirectly. How this transient stenosis is produced has not been satisfactorily explained. It has been stated that, owing to the small calibre of the glottis in childhood, a comparatively slight amount of swelling of the mucous membrane must interfere with respiration, and that the secretion, which collects and dries up during sleep, is apt to cause narrowing which results in dyspnœa. Rauchfuss states that he has been able to convince himself, by laryngoscopic examination, of rapid changes in the amount of swelling and infiltration, and believes that the sudden occurrence can be easily explained if obstruction through secretion be also taken into account. Against this we may state that, often as we have had an opportunity of examining children suffering from pseudo-croup—it is true that such examinations were always made during the day, when paroxysms of dyspnœa do not occur—we never found the mucous membrane swollen to such a degree as to justify the hypothesis of inflammatory stenosis, even when the accumulation of mucus was taken into account. We, therefore, believe that reflex spasm of the muscles which close the glottis is a much commoner cause of attacks of dyspnœa than many authors believe (Ziemssen, Rauchfuss). We are the more inclined to this view because the croupy cough is of a spasmodic character, and because we have also seen spasm of the larynx produced, through a fit of coughing, in adults whose nervous systems were irritable. (This was marked in a case of locomotor ataxia observed by the author.*) Attacks of spasm are also apt to be produced by forced expiration, *e.g.* violent cough and laughter. The secretion in pseudo-croup is seldom abundant, and usually present only in very small quantities.

* Probably an instance of laryngeal crisis (Translator).

FURTHER MODIFICATIONS OF LARYNGEAL CATARRH.

We have already stated that catarrh sometimes does not attack the whole mucous membrane of the larynx, but may involve only, or chiefly, individual portions, and it goes without saying that in this way the clinical symptoms may be modified.

Particularly noteworthy is *epiglottitis catarrhalis or angina epiglottidea.* This condition was recognised and described in pre-laryngoscopic times because, by depressing the tongue, the epiglottis can be seen as a red rounded tumour without the assistance of the mirror. According to Rühle this affection is usually produced by local injuries; in cases observed by us no definite etiological factor could be discovered. The most marked symptom is severe dysphagia, every attempt to swallow causes excruciating pain, the patient has the sensation of a foreign body which impels him to attempt deglutition, and drinking is apt to cause choking; there is also increased secretion of mucus and saliva. The voice is generally clear because the vocal cords are not affected, but speech is rendered difficult by the swollen epiglottis; respiration is only slightly interfered with, and serious dyspnœa only occurs when the ary-epiglottic folds are inflamed or œdematous.

As a special form there has been described of late a *laryngitis hæmorrhagica,* in which bleeding occurs from the mucous membrane with only slight symptoms of inflammation. We agree with those who do not think it necessary to give a special name to a condition which may occur in the course of other diseases (compare hæmorrhages), and usually results from severe paroxysms of coughing.

On the other hand, catarrh sometimes occurs with symptoms differing so widely from our previous description, that we believe ourselves entitled to differentiate this form as a special variety, and, for simplicity's sake, to name it from its most prominent symptom, *laryngitis sicca.* It consists in an anomaly of secretion, or, in other words, in the exudation of a secretion changed in quality. While in ordinary catarrh the secretion is more or less fluid, it is, in laryngitis sicca, poor in water, and has a tendency to dry into scales and to become attached to the mucous membrane. The disease is characterised by aphonia, which may several times a day give place to a nearly normal voice, and by spasmodic cough. The patient usually wakes in the morning quite aphonic, with paroxysms of cough, and sometimes moderate dyspnœa; one or two hours are thus passed until small nodules of hard, dry secretion are with great effort expectorated. If the secretion has been thus entirely removed from the larynx, the voice becomes loud with only a slightly muffled timbre, but only to become aphonic when the secretion has recollected. The voice is more rapidly lost in the open air, and sometimes the secretion is mixed with coagulated blood. On laryngoscopic examination the cords

are seen to be covered, to a varying extent, with scales; the latter are seldom absent at the margins and at the anterior commissure, and they are sometimes seen on the posterior walls and in the inferior division of the larynx; these scales are here and there tinged with blood. The mucous membrane shows changes due to inflammation, and is sometimes covered with a layer of blood. The prognosis in this disease is always favourable, but it is apt to become chronic; it only attacks adults and principally, as it seems, women.

The designation, laryngitis sicca—or dry catarrh—has been considered illogical, and has been particularly sneered at by Virchow. We understand by it, however, a catarrh in which secretion is not absent but changed in quality, and consider the name, laryngitis sicca, as the most suitable, if only on account of its brevity.

Moure states that laryngitis sicca only occurs in conjunction with pharyngitis sicca and dry catarrh of the posterior nares, but we have also seen it occur alone.

The same author found the mucous membrane below the secretion almost normal, but, so far as we have seen, it is always intensely red and sometimes infiltrated with blood in the acute form, while in the chronic variety it is of a dirty grey colour and sometimes, at the same time, injected or shows extravasations.

Manifestly, part of the cases described as hæmorrhagic laryngitis are identical with laryngitis sicca, and perhaps all, for every author describes scales of blood sticking to the vocal cords. The question evidently depends upon which of two conditions is considered the primary one—the formation of scales which leads to bleeding, or the bleeding which after coagulation produces scales. We take the former view (1) because there are cases which stop at the formation of scales without hæmorrhage, and (2) because at different periods in the same patient the scales may, or may not, be tinged with blood.

The scales are besides firmly attached to the mucous membrane, so that it is difficult to remove them mechanically, and we need not be surprised if the attempts of the patient to get rid of them by coughing lead to hæmorrhage. Most of the cases published by Navratil, B. Fraenkel, Böker, and Schäffer may be accounted for in this way.

Of course, the formation of scales may occur under conditions other than laryngitis, as, for example, in Stoerk's Blennorrhoea and in Baginski's "Ozaena laryngis," just as every hæmorrhage need not depend upon catarrh.

A laryngitis exanthematica has also been differentiated, but we shall consider it under secondary affections of the larynx.

LARYNGOSCOPIC APPEARANCES IN THE VARIOUS FORMS OF CATARRH.

These vary according to the intensity of the process and the time at which the examination is made. In mild, and in the early stages of severe cases, the mucous membrane is of a bright red colour and somewhat swollen, either throughout its whole extent or only in certain parts, as, for example, the posterior extremities of the vocal cords, the inter-arytenoid commissure, and the ventricular bands. In severe cases the swelling is more marked, and the ventricular bands may be so thickened that the cords are quite covered or can only be seen as narrow lines during phonation; the mucous membrane between the arytenoids pushes itself between the posterior extremities of the cords, and prevents closure of the glottis.

In epiglottitis the epiglottis appears as a large red tumour covering

the laryngeal aperture, and the line of demarcation between tongue and epiglottis is more or less lost. Secretion is usually not seen in any considerable quantity, and in the early stages the mucous membrane seems dry, while afterwards it appears moist. More striking are the characteristics of laryngitis sicca. In this condition pellets varying in size, and composed of dried-up, greyish black secretion, sometimes tinged with blood, are found usually on the free margins of the cords and at their anterior commissure, and their presence makes a satisfactory approximation (of the cords) impossible. Disturbances of mobility of the cords, dependent upon alterations in the laryngeal nerves or muscles, frequently occur in acute catarrh. A sickle-shape excavation may then be seen between the cords, so that the ligamentous portion of the glottis presents an oval opening, and the voice becomes wanting in clearness, owing to insufficient longitudinal and transverse tension. Sometimes, too, there is seen a gaping of the cartilaginous portion, together with insufficient approximation of the vocal processes and a longitudinal cleft between the vocal cords proper (ligamentous portion), so that a degree of aphonia, quite out of proportion to the amount of inflammation and swelling, results. It has not yet been determined how these paralyses and pareses are brought about. According to Mackenzie, the motor disturbances often precede superficial hyperæmia.

The diagnosis of acute catarrh is easy, especially in adults, on account of the history together with the subjective and objective symptoms. The laryngeal mirror makes the diagnosis certain and allows of the exact localisation of the catarrh, coincident pareses of the muscles, erosions, etc. We do not remember having seen cases of acute laryngeal catarrh, even without laryngoscopic examination, mistaken for other conditions; but we have repeatedly known suddenly occurring paresis and paralysis of the cords mistaken for catarrh, and we fully concur with Ziemssen, when he recommends that, as a matter of principle, every case of laryngeal disease, even the mildest, should be examined and studied with the laryngoscope.

Although nowadays pseudo-croup is less apt to be confounded with croupous laryngitis on account of our better acquaintance with both diseases, yet even here the laryngeal mirror is of importance, and in difficult cases may decide the point; on this account laryngoscopic examination should be attempted even in childhood, and it will be found to be much oftener practicable than is generally believed. We must not, however, overlook the fact that the early symptoms of membranous laryngitis may much resemble those of severe catarrh.

Duration, Result, and Prognosis.—Acute laryngeal catarrh may disappear in a few days, and, even the severe forms, if properly treated and if occurring in persons otherwise healthy, in from eight to fourteen days. If neglected, and especially if the vocal organ is not allowed to

rest, and if it be exposed to injurious influences, *e.g.* cold, spirituous beverages, etc., acute catarrh may become chronic. In persons who have once suffered from catarrh there exists a tendency to recurrence, and children, once attacked with pseudo-croup, suffer from it with every fresh cold. The prognosis is very good, and even in children a fatal termination is very rare, if indeed it occurs at all.

TREATMENT.

Acute laryngeal catarrh requires, like every inflammation of mucous membrane, an expectant line of treatment together with careful dieting. As during every act of phonation the mucous membrane is pressed upon and irritated, it is necessary to insist that all, or at least continued, conversation be so far as possible abstained from. In mild cases confinement to a room, especially in unfavourable weather, is necessary; in severe cases the patient should be confined to bed, and the temperature of the room regulated (14° to 15° R. or approximately 65° F.). We know of no certain remedy which shortens or aborts catarrh. In feverish cases slightly diaphoretic treatment is to be recommended (drinking warm decoctions, warm lemonade or an infusion of jaborandi 5–100), and at the same time the neck should be covered with cotton wool or with a Priessnitz compress (*i.e.* cold water compress covered with oil silk). If internal medication be considered desirable, alkalies (chloride of ammonium, carbonate of sodium), which, according to Rossbach's experiments, seem to diminish hyperæmia of the mucous membrane and to decrease the secretion of mucus, may be administered. It is of more importance to modify and diminish the tendency to cough which is often very annoying. According to experience, drinking warm milk or hot milk, with equal parts of seltzer or sweetened water, is of some value in this respect. More certain in their action, however, are opiates, *e.g.*—

℞ Morphiæ muriat. 0·05 Aq. Amygdal. amar. 10.
Ten to fifteen drops three or four times a day.
(Approximately morphiæ mur. gr. $2\frac{1}{2}$ Aq. Amyg. amar. ℥i).

or

℞ Ammon. muriat.
Succ. Liquirit. aa 3·0–6·0 (30–60 grs. or min.).
Morphiæ muriat. 0·03 (gr. $\frac{1}{3}$).
Aq. destillat. 180·0 (℥iv.).
A tablespoonful to be taken every one or two hours.

The patient must at the same time be taught not to yield to the desire to cough, and to suppress it as much as possible.

The treatment of pseudo-croup in childhood is slightly different. Children who show the first symptoms of pseudo-croup should be kept in the house, and it is better, even in mild cases, to confine them to bed. The temperature of the room should be from 14° to 15° R. (65° F.). In order to keep the air damp, wide vessels containing clean hot water

should be placed near the patient's bed ;* usually the administration of warm drinks (milk and seltzer, or sugar and water) is sufficient. As the attacks of cough and difficulty of breathing occur principally at night during sleep, the child should be wakened from time to time, especially when the breathing becomes noisy, and a warm drink administered. We can hardly consider it as a senseless proceeding that many mothers prevent their children, when suffering from pseudo-croup, from going to sleep again, under the impression that sleep is dangerous. Internally small doses of ipecacuanha and alkalies, and, in the case of older children, tartarated antimony may be given. We have seldom found benefit from spray inhalations, and it is difficult to get children to use them. Abstraction of blood and blistering can be dispensed with, the former being usually directly injurious ; on the other hand, mustard poultices, or, better, warm sponges laid upon the throat should be tried. Narcotics should be avoided as much as possible in children. If the cough be very troublesome, Rauchfuss recommends codeia as one of the surest and most easily regulated remedies, ·003 to ·01 per diem (1 gramme = 15·43 grs.).

For a long time emetics played an important part in the treatment of pseudo-croup, and this is to some extent still the case. Rühle believes that, in the early stages of inflammations of the pharynx and larynx, they may almost abort the disease. It is difficult to explain in what way they are supposed to act. Unbiassed observation, however, proves that many cases end—one might say—abortively, that is to say, the children startle those around them with attacks of croupy cough for one or two nights and soon recover, whether emetics be used or not. In other cases the catarrh runs a more severe course in spite of emetics. We believe, therefore, with Rauchfuss, that emetics may be dispensed with in the treatment of pseudo-croup, although they may be used when symptoms of stenosis are due to the collection of mucus in the larynx.

As to the local treatment of acute laryngeal catarrh, the views of authors are widely divergent. While some have seen local inflammation disappear after the application of a solution of nitrate of silver [2 to 30 (Gibb) or even 5 to 10 (Stoerk)], others disapprove of every local application ; we agree with the latter, but make two exceptions. In the first place, laryngitis sicca requires local treatment. It is here necessary to remove the dried-up secretion which causes, not only aphonia, but also spasmodic cough and dyspnœa, and to restore the mucous membrane to its normal state of secretion. This object is attained by the inhalation of steam which liquefies the secretion, or, better still, the application of a 4 per cent. solution of chlorate of potassium, to be followed by painting with a solution of nitrate of silver 4–6 per cent. (approx. 20–30 grs. ad ℥i). We have not only found this medication useful but

* In this country bronchitis kettles and croup tents find more favour (Translator).

have also seen no harm follow it, even in cases where small hæmorrhages were present.

A second exception, in which we consider local treatment desirable, is formed by those cases in which, early in the disease, a paretic condition of the muscles of the cords exists, and in which the aphonia is out of proportion to the swelling. Here the stimulation, produced by the insufflation of a powder composed of equal parts of alum and sugar of milk, or by painting once with a solution of tannin or nitrate of silver, is sufficient immediately to remove the aphonia; there afterwards remains a slight huskiness due to the injection of the vocal cords, which usually disappears without any further treatment. According to our experience, stimulation by means of the laryngeal probe and even faradisation do not act so quickly—as more particularly the insufflation of powder.

Special attention is required as to the prophylaxis of acute laryngeal catarrh. We have already mentioned that persons who have once had catarrh retain a tendency to its recurrence, and that children in particular show an exceptional sensitiveness, as regards their respiratory mucous membrane. It is the duty of the physician to increase the power of resistance. The following points must be attended to both in adults and children—sufficient exercise in the open air, and well-ventilated, roomy sleeping apartments,at a temperature of from 12° to 13° R. (59° to 62° F.). The anxiety of mothers as to clothing must be combated; the latter should be sufficiently warm (strong boots, light covering for the throat, and a flannel jersey), but should not be excessive. The hygiene of the skin should be especially attended to; children should be washed with lukewarm salt water (24° R. = 86° F.), and the body should be afterwards well rubbed; in the case of adults, the whole surface should be rubbed for two minutes with sheets wrung out of cold water, and afterwards with warm towels. Anæmic and strumous children require hygienic and therapeutic treatment, while coincident nasal or pharyngeal catarrh should be cured. In summer a residence on the coasts of the Baltic—or better, North Sea—is to be recommended, and in the case of strumous children saline baths of from 20° to 25° R. (78° to 90° F.), lasting from ten to fifteen minutes. A prolonged residence in a sheltered wooded district, at an altitude of from 400 to 600 metres, is also useful.

Persons who require to use their voice in the exercise of their profession, *e.g.* teachers, clergymen, and singers, must learn to husband their vocal organs and to give them rest after every prolonged effort. In the case of professional singers, schooling the voice according to physiological laws may be of more use than therapeutic treatment.

CHRONIC CATARRH OF THE LARYNX.

(*Laryngitis chronica.*)

Etiology.—Most frequently chronic catarrh results from the acute variety, either through carelessness or from constitutional weakness on the part of the patient, whether due to debility, struma, or phthisis. It may also occur in teachers, clergymen, public speakers, or singers, more especially if they do not understand how to husband their voice, or if they overrate the power of their vocal organs, and in persons who are obliged to live and work in an impure atmosphere, *e.g.* grinders, turners, millers, masons, and tobacco workers. In the case of the latter, the laryngeal catarrh is usually only a part symptom of disease of the whole respiratory tract, and is thus of secondary importance.

A large number of cases owe their origin to an extension of inflammation from the pharynx to the larynx, whether the former be affected by simple or granular pharyngitis. The most characteristic cases, illustrating the simultaneous occurrence of pharyngeal and laryngeal catarrh, are seen in drunkards and immoderate smokers. It seems to us that the secreted mucus, often very profuse in drunkards and giving rise occasionally to laryngeal spasm when it falls into the larynx during sleep, is, by the irritation it produces, a frequent cause of the extension of inflammation from the pharynx to the larynx. Moreover we do not consider that an elongated uvula is such a "harmless concomitant" of laryngeal catarrh as many authors believe, for we have seen cases, which would not yield to treatment, cured, either spontaneously or by means of continued treatment after amputation of an hypertrophied uvula.

Chronic catarrh occurs more commonly in middle life than in childhood or old age, evidently because persons at this time of life are more exposed to causes which lead to it; and for the same reason men are oftener affected than women.

Sometimes the "breaking of the voice" in boys is accompanied by chronic catarrh of the larynx. Measles, whooping-cough, and membranous croup may be followed by chronic laryngitis, while this affection often accompanies syphilis and phthisis. The catarrh which is often observed in laryngeal tumours is probably more a cause than an effect.

Pathological Anatomy.—The characteristics of chronic laryngitis are increased calibre of the vessels, hypertrophy of the mucous membrane in all its parts, together with a change in the quality and quantity of the secretion. The mucous membrane becomes uneven, thickened, and is often covered with numerous granulations as large as a millet seed, which represent hypertrophied glands. When the disease has lasted for some time, hyperplasia of the connective tissue elements

takes place owing to the division of nuclei (Eppinger). The secretion is either transparent, showing here and there a grey tinge, or mucopurulent, and occasionally it is dried into crusts.

Without doubt, erosions may occur in chronic catarrh, but, on the other hand, deep ulceration is always a symptom of a specific process (tuberculosis, syphilis, lupus).

Symptoms.—The clinical picture of chronic catarrh is a varied one. The subjective symptoms are usually slight—pain only after long continued use of the voice or during acute exacerbations, and a feeling of dryness or tickling, not so marked as in the acute affection. When there is much secretion, a desire to hawk or cough is often present. The most constant symptom is a change of voice, which varies from a modification of timbre to complete aphonia. If the vocal cords be but slightly changed, and if the secretion be small in quantity, the voice is usually clear, and only becomes hoarse after long continued speaking. In the majority of cases the voice is clearest in the morning after a night's rest, but in the course of the day gradually becomes more hoarse. If, on the other hand, the secretion has a tendency to form crusts, such as we have described in acute laryngitis sicca, and such as may in the same way, and accompanied by the same symptoms, occur in chronic laryngitis, the patients are aphonic when they awake, and the voice only becomes clear after the secretion has been coughed up with great effort. In this form of catarrh the voice changes several times during the day, and becomes more aphonic when the patients are in the open air. In those cases in which the cords have, owing to long continuance of catarrh, become partially thickened and rigid, the voice may, in ordinary conversation, only seem muffled, but soon tires because speaking requires a greater muscular effort on account of the diminished mobility; this symptom is also observed in many cases of muscular paralysis of the larynx.

Cough, if there be no coincident bronchitis, may be absent; it is seldom spasmodic, and occasionally, as in acute catarrh, has a rough barking character.

The secretion is scanty and transparent, studded with grey points which are due to pigmented cells. It is often expectorated in the form of small pellets. Whether in chronic catarrh the secretion ever becomes purulent, seems to us doubtful.

Dyspnœa is usually absent; only when the secretion adheres to the mucous membrane and dries into crusts (laryngitis sicca), do occasional paroxysms occur.

Laryngoscopic examination in chronic, just as in acute catarrh, of which it is often a sequel, shows various degrees of hyperæmia and swelling, which may either affect the whole mucous membrane equally or be more marked in individual parts. The mucous membrane often

shows but slight injection, and only betrays increased secretion and the presence of disease by an appearance of unusual moisture. In many cases there is a diffuse, deep-red, colouration, with a bluish or brownish tinge and velvet-like appearance, caused by loosening of the epithelium; in others some parts are of a bright red, while the remainder seems almost normal; rarely the mucous membrane appears dry and glistening, and it is usually more moist than in health. The secretion may form threads between the cords, or may assume the form of small pellets which adhere to the ventricles, to the interarytenoid fold, the cords, or the anterior commissure, and occasionally dry up into crusts.

Swelling only affects the whole mucous membrane in severe cases; usually only certain parts are thickened. Thus the epiglottis may be thickened, rigid, and immovable, especially, as we have observed, in drunkards. The ventricular bands may be so swollen that the ventricles are concealed, and the cords only appear as narrow lines; they may also be so thickened that they are in apposition during phonation, when they vibrate together with, or even instead of the cords, so that the voice acquires a hoarse, rough tone. The swollen interarytenoid fold may force itself between the vocal processes of the cords, and thus prevent complete closure and cause loss of mobility. The cords themselves may not only become thickened, with the result of their more delicate vibrations becoming impeded, but the edges may become uneven and nodulated.

Thickening of the aryepiglottic folds occurs, according to Lewin, in clergymen, because the epiglottis is lowered in the production of "pathetic, deep, and hollow notes," and thus the muscles, which run in the aryepiglottic fold, are habitually contracted. We have not been fortunate enough to verify this observation.

Marked development of the veins, such as occurs frequently in the epiglottis but less commonly on the cords, has inclined Morell Mackenzie to the view that this is a special form of disease (phlebectasis laryngea), which he regards as the result of a constitutional condition, and as a cause of hoarseness. It is probably more correct to consider venous congestion and dysphonia as common results of chronic catarrh, as does Duchek.

A nodulated appearance of the cords has been described by Türk as chorditis tuberosa, or trachoma of the cords. According to Wedl these nodules are only the result of connective tissue hypertrophy, and an accumulation of cell elements; clinically these changes do not produce any special symptoms, so that we do not consider their classification as a distinct disease justifiable.

Laryngitis granulosa has been described as analogous to granular pharyngitis, together with which it often occurs. We have never observed in the larynx a disease as marked as granular pharyngitis. In chronic catarrh small red points are sometimes seen on the cords, but anatomical proof has not been forthcoming that in these cases, as in the case of pharyngitis, there is hypertrophy of the lymphoid tissue surrounding enlarged glands. It is also well known that such glands are entirely absent from the upper surface of the cords. We consider the red points as papillary enlargements, from which, under certain circumstances, we believe that polypi may be developed.

Erosions occur more frequently in chronic than in acute catarrh, particularly on the cords and in the interarytenoid fold. In the latter situation there occurs the special form of fissure described by Stoerk,

which consists of a longitudinal cleft in the posterior wall of the larynx, denuded of epithelium, and situated between two slightly raised folds of mucous membrane. This fissure is accompanied by great pain, tickling, and inclination to cough.

As regards ulcers, we agree with those authors who state that they never occur in primary laryngeal catarrh; but to this point we shall again allude.

Disturbances of motion, dependent not upon the previously considered mechanical obstruction of the cords by thickened mucous membrane, but upon muscular paresis, are not uncommon. In such cases, the ligamentous portion of the glottis may assume an oval form on attempted phonation, or the cartilaginous portion may remain open, in the form of a triangle, owing to the vocal processes being insufficiently approximated. Sometimes closure of the glottis is normal, while there is paresis of the tensors and, consequently, aphonia. Such paresis may also be unilateral, and then there results a vicarious action of the sound cord, which oversteps the middle line, the glottis thus acquiring an oblique position, while the cartilage of Santorini on the healthy side slightly overlaps its fellow.

Diagnosis.—For purposes of exact diagnosis it is necessary, not only to ascertain the presence of pathological changes in the mucous membrane, but to note which part of the larynx is affected, and in what manner. It must be remembered that many patients refer their disease to the larynx without that organ being affected, and that disturbance of voice may be due to the presence of secretion from the bronchi or trachea remaining in the larynx, and thus interfering with phonation. Only a careful laryngoscopic examination can establish this point. A few acts of coughing on the part of the patient will remove the secretion, and we can then assure ourselves that the mucous membrane of the larynx is healthy. On the other hand, it must be remembered that visible changes of the mucous membrane may be very slight, and may be only manifested by changes in secretion; the cords are then found more succulent than in health, while the colour is only slightly altered. When there is thickening it will have to be decided whether this is caused by simple inflammation, œdematous swelling, or specific infiltration. To this important question we shall return when discussing secondary diseases of the larynx, and we shall content ourselves with remarking here, that in simple chronic laryngitis the natural contour of the parts is usually maintained, while the thickening is commonly bilateral. Finally, it cannot be too strongly impressed that in all cases of chronic catarrh it is necessary to examine the condition of the lungs, and to inquire as to the general state of the patient and any possible hereditary tendency.

Course of the Disease and Prognosis.—The course of chronic

laryngitis is usually slow, particularly as most patients are with difficulty persuaded to pay attention to necessary hygienic precautions, *e.g.* rest of the vocal organs, abstinence from tobacco and alcohol. When marked changes have occurred in the mucous membrane, the disturbance of voice is apt to resist treatment for a long time. In general, however, the prognosis is satisfactory, as, under prolonged local treatment, and with avoidance of everything injurious, a cure is almost always effected. A fatal termination has probably never been known in primary catarrh. The view of some authors (Tobold, Stoerk), that a simple chronic laryngitis may lead to extensive ulceration and phthisis of the larynx and lungs, cannot be considered in accordance with the now existing views on tuberculosis. While Tobold, in support of his view, states that simple laryngitis in persons of robust health may, if the patient be repeatedly exposed to injurious influences, result in ulcerative laryngitis and pulmonary phthisis, we incline rather to believe that obstinate laryngeal catarrh may be the first symptom of constitutional disease, and further that this symptom may occur at a time when the general condition of the patient seems good, and when the results of physical examination of the lungs are negative; we shall, however, elucidate this point more fully in the chapter on laryngeal phthisis.

Treatment.—In chronic catarrh local treatment takes the first place and is followed by the best results.

We prefer astringents to all other remedies, and, among these, place nitrate of silver first, and tannin second. The author considers the use of medicated sprays as unsatisfactory, and the insufflation of powders as less sure and more disagreeable to the patient than the application of solutions with brush or sponge, which, moreover, meets every requirement. Whether a brush or sponge be used depends upon the inclination of the physician; to this we have already referred, and it is certain that with both good results can be obtained, if only the indications be recognised and the treatment be properly carried out. The point of primary importance is that the application should be made under guidance of the mirror, and should not, if possible, be left to the patient even in mild cases. Nitrate of silver is used in degrees of concentration varying from 2 to 10 per cent. We have never seen benefit from a solution weaker than 2 per cent., and usually begin with 4 per cent. (*i.e.* 20 grs. ad. $\bar{3}$i). This is at first used every day, and, after an interval of fourteen days, every second day, a cure being thus effected in mild cases in from four to six weeks. In severe cases also, we begin with the 4 per cent. solution, but afterwards, sooner or later (according to the sensitiveness of the patient), use it stronger. In cases in which a solution stronger than 6 per cent. is used, the application should only be made every second or third day. Solid nitrate of silver, particularly recommended by

Ziemssen in obstinate cases, we have not found necessary, and we confine its use to cases of fissure of the mucous membrane between the arytenoids (as described by Stoerk), and its application is then effected by applying a suitable probe covered with the caustic. Erosions require no special treatment.

Instead of nitrate of silver, other astringents may be used in like manner. Mackenzie prefers chloride of zinc, 3 parts to 30 * of water or glycerine. The application is made daily for a week, every second day for two weeks more, twice in the fourth week, and so on, the intervals becoming gradually longer, until finally a cure is effected. Modifications are, of course, necessary in individual cases. Glycerine as a vehicle, by virtue of its consistence, serves better in cases where prolonged action is required. Steam inhalations (compare Part I.), especially when medicated with oil of pine, creosote, and juniper, repeated two or three times daily for ten minutes at a temperature of 60° C. (140° F.) are, according to this author, useful adjuvants.

Besides nitrate of silver, tannin and alum are much used in Germany, more especially the former (10 parts to 100 of glycerine); but both are less certain in their action. We are at one with Stoerk, in so far, that we have found no benefit from the use of tincture of iodine or iodised glycerine in old standing cases with hypertrophy of the mucous membrane. The most difficult cases to treat are those in which excessive secretion of mucus is the only symptom (laryngorrhœa), which usually occurs in vocalists in whom the voice is worn out or has been badly cared for. The cords are, as we have seen, of normal appearance and function, but yet seem abnormally succulent, while, at every effort to sing, the secretion is increased and the voice becomes hoarse. In these cases we have seen no good results from local treatment, but long abstention from singing sometimes produces relief. According to Mackenzie, the local application of turpentine is sometimes useful. In laryngitis sicca with the formation of crusts, we recommend the same treatment in the chronic as in the acute form, viz. painting with a solution of chlorate of potassium followed by the application of nitrate of silver (4–6 to 100). Mackenzie has in these cases found a solution of carbolic acid and glycerine useful (acid carbolic 2–4, glycerine 30).

In cases of muscular paresis the percutaneous application of electricity in both its forms has been found useful. Ziemssen believes that by means of this agent absorption of exudation and diminution of hyperæmia are favoured.

Derivatives applied to the neck (blisters, croton oil, etc.) we consider

* So far as the translator is aware Mackenzie specially recommends a solution of chloride of zinc, gr. 30 ad ℥i or 3 to 48 (see vol. i., p. 282, and Lond. Th. Hosp. Pharm.).

obsolete; neither have we seen benefit from the Priessnitz compress,* which has usually been applied by the patient for weeks before consulting the physician.

In all cases of chronic laryngeal catarrh irritation of the organ, by prolonged speaking or singing, must be forbidden. We would especially recommend that, after every local application, the patient should maintain absolute silence for some time, so that the mucous membrane, rendered hyperæmic by the operation, should not be further stimulated. As a matter of course, all injurious influences such as are apt to produce laryngeal catarrh must be avoided, *e.g.* dusty, smoky atmosphere, smoking, alcohol, and highly-spiced food.

If the laryngitis be complicated by pharyngitis the latter should be treated by means of astringents, for which purpose somewhat stronger solutions are suitable (argent. nitrat 10–25 to 100, grs. 50–125 ad ℥i). If the mucous membrane of the pharynx be much thickened, as also in granular pharyngitis, the galvanic cautery should be tried, while an elongated uvula or hypertrophied tonsils should be removed.

The use of internal remedies can usually be dispensed with if rational local treatment be adopted. Ziemssen advises the use of saline aperients in plethoric persons, *e.g.* Ofner Bitter Wasser or Carlsbad salts taken every morning.

Baths and mineral springs, without local treatment, are unfortunately used more than is justifiable. It cannot be denied that patients, when they are removed from their everyday life and from fatiguing occupations, during a residence in a bathing resort, feel relatively well, but, on the other hand, a cure of the local condition is seldom thus effected. It is often necessary to send a patient to a bath in order to withdraw him from injurious influences at home. Among mineral springs, the muriated saline waters of Ems have acquired a special reputation. The alkaline waters of Obersaltzbrunn and the waters of Reichenhall and Ischl are useful in delicate persons in whom struma has existed, or when there is a suspicion of phthisis. The same applies to the sulphur springs of Weilbach, Nenndorf, Eilsen, the sulphur waters of the Pyrenees (specially Les Eaux Bonnes), and the warm sulphur springs of Savoy, while in chronic catarrh of plethoric individuals waters containing sulphate of sodium are useful, especially Kreutzbrunnen in Marienbad and Luciusquelle of Tarasp.

No matter what bathing resort be chosen, it is always advisable to let its use be preceded by appropriate local treatment. We prefer, after local lesions have been cured by topical medication, to send our patients to the North Sea coast or to a sheltered wooded health resort, situated at an altitude of from 400 to 600 metres (roughly 1500 to

* A favourite popular remedy in Germany, consisting in the application of cold-water compresses covered by oil-silk.

2000 ft.). The use of a rational cold-water cure is often of undoubted value.

LARYNGITIS PSEUDO-MEMBRANACEA.

(Syn. *croup, diphtheria, laryngitis crouposa, et diphtheritica.*)

Definition and General Remarks.—Considering the subject from a purely practical standpoint, we may designate as croup that form of acute laryngeal stenosis which is caused by the presence of fibrinous exudation upon the free surface of the mucous membrane, whether such exudation be idiopathic or caused by a specific virus, whether the membrane be of a croupous or diphtheritic character, and, finally, whether the disease be due to mechanical, chemical, or thermic irritants, or secondary to other infectious diseases.

Different views are held as to the derivation of the word croup. Mackenzie derives it from crowing as applied to the stridulous respiration which is often a feature of the disease. The root of this word "crowing" occurs in various languages in the same sense; thus in Dutch *geroop* (a cry), in old German *rof*, in modern *ruf*, in Scotch *roup* (hoarseness). According to the same author, it may also be derived from the Gaelic *crup*, which signifies a drawing together. According to other authors, the word is derived from the Scotch "*croup*," the designation applied to the thin white membrane of chickens which we call "pips." To us the former hypothesis seems more plausible, because it is more likely that the appellation would be derived from the most prominent symptom—the crowing cough—than from a pathological product which is comparatively seldom exposed to view.

In our definition we have laid most stress upon fibrinous exudation, whether it occurs only on the free surface of the mucous membrane (croupous), or at the same time infiltrates the tissues (diphtheritic). It would carry us too far to enter further into the question of the identity of croup and diphtheria. The view that croup and diphtheria are closely allied etiologically and anatomically is gradually acquiring more corroboration and support, and, at all events, it is extremely difficult to distinguish clinically between a croupous and diphtheritic laryngitis. For these reasons we consider as most suitable the designation laryngitis pseudo-membranacea.

The etiology of laryngitis pseudo-membranacea coincides in the great majority of cases with that of diphtheria, or, in other words, it is caused by a specific virus, the exact nature of which we do not know. Whether the microsporon diphtheriticum, described by Klebs, is to be looked upon as the cause of the disease, further observation must determine; it may, at all events, be accepted that an organic virus is the cause of diphtheria. The latter occurs under the most varying climatic conditions, for it has been observed in every country and even in the tropics; it flourishes under all ordinary atmospheric conditions, although it seems that moisture is particularly favourable to its development. Croup occurs at every season, but most frequently in damp cold changeable weather, and when sharp north and north-easterly winds prevail. According to Mackenzie, it is much more common in country districts than in towns, whether owing to greater atmospheric moisture or to the absence of drainage, he leaves undecided. Rühle, on the other hand, considers large populous towns and sea coasts as the favourite localities of croup, and

believes that small rooms, and the unfavourable conditions brought about by residence in hospital, influence the number and severity of the cases. The disease occurs in an epidemic and sporadic form, but we do not know to what conditions its epidemic occurrence is due. A number of observations favour the theory that epidemic and sporadic croup are multiplied by infection.

Among predisposing causes age is the most important. Croup is a disease of childhood, seldom attacks children under one year, is most common between the ages of two and seven, and after this diminishes in frequency. Males are more commonly attacked than females (according to Rühle, in the proportion of 3 to 2). It appears that hereditary tendency may favour the development of diphtheria and particularly of croup, and that, on the other hand, it may furnish a certain immunity from the disease. It is completely unproved that robust, well-nourished children are more commonly attacked by croup than delicate ones, and those afflicted with other diseases. One attack of croup gives no immunity from a second. Cases are recorded of repeated attacks, which are rendered all the more remarkable and important because the number of those who survive the first attack is well known to be small. The specific poison seems to attach itself more readily to a mucous membrane when in a catarrhal state.

A remarkable case was observed by the author in 1879, in which a croupous was developed from a catarrhal inflammation almost under his eyes. R., a teacher from Mitau in Courland, thirty-four years of age, consulted us on the 26th of June on account of long-continued, but slight, hoarseness. Laryngoscopic examination showed the appearances of chronic catarrh, the interarytenoid commissure in particular being affected. A 4 per cent. solution of nitrate of silver was applied daily until the 30th. When the patient returned on the following day (1st July), the hoarseness had increased, the mucous membrane appeared intensely red, and, on the ventricular bands, were seen diffuse white shining spots resembling those which occur after the application of nitrate of silver either in the solid form or in strong solution; an accumulation of false membrane was, however, not present, and the general health was not disturbed. We could not explain the change, for croup was not thought of on account of the patient's age, and also because the mucous membrane of the pharynx was quite normal. The application of nitrate of silver was given up, and the patient was advised to rest; during the night, however, his condition got worse, he became aphonic, and suffered from dyspnœa. In spite of this, he came to our consulting-room on the 2nd of July and showed us a membrane almost as large as a small plate, which he had coughed up on his way, and which presented a complete cast of the laryngeal cavity. The dyspnœa was marked, and laryngoscopic examination showed that, in spite of the recent expectoration of membrane, the inner surface of the larynx—more especially the ventricular bands near the base of the epiglottis—was covered with false membrane which was partly adherent and partly free. The patient, who was only here on his way and had therefore no home comforts, was advised to go into hospital at once and have tracheotomy performed. Dr Schnabel performed the operation upon the same day in one of our hospitals, but the patient died after twenty-four hours. The post-mortem examination showed that the fibrinous exudation extended into the smallest bronchi.

Whether, or how, the patient was exposed to diphtheritic infection was never ascertained; he had a few days before come from Berlin, and both there and in Breslau the disease is usually present all the year round.

Although, in the majority of cases, a connection with diphtheria can be demonstrated, or at all events assumed as probable, there still remains a certain number (especially of sporadic cases) in which the connection cannot be shown, and which are spoken of as true croup; whether in reality a special non-specific and unknown influence is responsible for these cases is still doubtful. We shall see further on that the pathological and clinical distinctions which have been attempted between diphtheritic and true croup do not hold.

Laryngitis pseudo-membranacea, as a result of mechanical, chemical, and thermic irritants, is of great rarity. Croup has been observed after the inhalation of chlorine, swallowing corrosive fluids, scalding (children drinking out of a kettle), and the action of heated air (case by Bartels after a fire). Cases of this kind, just as those instances in which fibrinous laryngo-tracheitis has been caused experimentally (by ammonia, corrosive sublimate, and alcohol), certainly serve to show that irritants, other than specific, may produce inflammatory changes of the mucous membrane, leading to the exudation of a fluid which, by virtue of its spontaneous coagulation, resembles fibrin.

As secondary or symptomatic croup, is designated that variety which occurs in the course of infectious and constitutional diseases—pyæmia and chronic morbid conditions. To croup, occurring after the exanthemata, we shall again refer. We must leave it an open question whether the croup which accompanies epidemic diphtheria is to be regarded as secondary, or whether it be not rather a part of the general disease. Croup is a rare complication of whooping-cough, typhoid, pneumonia, and cholera.

Pathological Anatomy.—The characteristic of croup is the membrane produced by the fibrinous exudation. It can only be ascertained by the use of the laryngoscope that in the first stages of the disease hyperæmia and considerable swelling of the mucous membrane are present, because in this stage the affection is not fatal; at the same time the mucous membrane is red and inflamed; at a later stage, and subsequent to the appearance of the exudation, the latter itself appears first in the form of dots and lines which are not unlike a delicate layer of hoar frost, and which much resembles the appearance which can be produced in any mucous membrane by the application of nitrate of silver, and also the mucous patches which are found within the mouth in syphilis (compare the case recorded under Etiology). When the exudation has become more marked, a greyish or yellowish white membrane is produced which can be pulled off from the mucous membrane and varies in thickness and extent. According to Virchow, the fact that the membrane can be removed from an apparently intact mucous surface, affords a characteristic of croup in contradistinction to diphtheria, in which it is said that the false membrane does not rest upon, but is embedded in, the mucous

membrane, so that, before it can be detached, the latter must be injured. This distinction does not, however, hold, because both forms of exudation may occur in the same case and merge into one another, and because there are also undoubtedly non-diphtheritic membranes which can only be removed with difficulty and after injury to the mucous membrane (Weigert's pseudo-diphtheritic membranes).

Microscopically the membrane is seen to consist of fibrin and leucocytes in varying proportions. The fibrin forms a network whose homogeneous glistening fibres and meshes appear of various dimensions. In the meshes there are found leucocytes whose quantity is inversely proportionate to that of the fibrin, and also, but not always, epithelium in irregular masses and without nuclei. The fibrin comes from the blood and the membrane is formed by the transudation from the mucous membrane being changed into fibrin, owing to complete loss of vitality on the part of the whole epithelial covering. The mucous membrane itself is either in a state of simple inflammation or participates more or less in the gangrenous process. Upon this it depends whether the membrane is loosely attached (*i.e.* croupous), or whether detachment can only occur with injury to the mucous membrane (*i.e.* pseudo-diphtheritic or diphtheritic).

The croupous exudation either fills the whole interior of the larynx, or is irregularly scattered upon its different parts. The cords are often covered with large accumulations, so that the glottis is either much narrowed or completely closed ; in other cases the lower surface of the epiglottis and the aryepiglottic folds are the chief seats of the membrane, or the exudation fills the ventricles of *Morgagni*. The process is seldom confined to the larynx and, in the pharynx, there is usually found false membrane, or, at all events, marked evidence of hyperæmia and inflammation ; in like manner the process often extends to the trachea and bronchi, in which situations there are often found cylindrical and even branched casts ; in the smaller tubes also croupous cylinders or exudation may be found. The lungs show appearances of hyperæmia ; sometimes they are emphysematous, and occasionally rupture of the alveoli gives rise to interlobular or mediastinal emphysema. When the bronchi are filled with secretion and the respiratory muscles become paralysed, more especially in delicate children, there may be atelectasis. Pneumonia is not rare, and, according to Rühle, occurs most frequently on the left side and at the base. The heart is sometimes hypertrophied, rarely fatty, while acute swelling of the spleen has been observed by Gerhardt and Steiner. The kidneys are either normal or show inflammatory changes. The solitary follicles are always enlarged, more especially in the small intestines. Finally, there results, from the dyspnœa and the deficient expansion of the chest, venous congestion, which shows itself especially in the brain.

Symptoms.—There is probably no disease which, at its height, is so characteristic and yet, in its early stages, so uncertain and so ill defined as croup. The initial symptoms are sometimes so slight, that many authors believe the affection may develop suddenly into an attack of suffocation with marked evidence of stenosis. It is more probable that in these cases the initial stage is not altogether wanting, but has been overlooked. The affection begins with catarrh, the child is languid, cross, without appetite, complains of chills, and is slightly hoarse ; but, as there is often also a cold in the head, the symptoms are usually put down to this. Sometimes older children complain at this stage of pain on deglutition, and an examination of the pharynx reveals hyperæmia, or the presence of greyish yellow spots on the tonsils, uvula, soft palate, or posterior wall of the pharynx. Croup, which begins in the pharynx, is spoken of as descending. In other cases the pharyngeal symptoms are entirely absent and the larynx is immediately attacked (*croup d'emblée*) ; very rarely the disease begins in the trachea (*croup ascendant*). Besides the pharyngeal affection, which, when present, points to danger as imminent, a frequent dry characteristic barking cough is the most prominent symptom at this stage. On laryngoscopic examination there is seen marked redness and swelling of the mucous membrane, and sometimes delicate deposits resembling hoar frost ; this stage lasts from two to ten days, usually from three to four. The first symptom, calculated to alarm even careless relatives, is the appearance of laryngeal stenosis which marks the beginning of the second stage. While still moderate in amount, the stenosis is characterised by laboured and prolonged respiration, accompanied by a rough snoring sound. The voice goes on becoming more hoarse, while finally both it and the cough become quite aphonic. To the permanent dyspnœa already present there are added, at gradually diminishing intervals, suffocative paroxysms, and a clinical picture is developed than which one more sad could hardly be imagined, and the characteristics of which, when once seen, rarely escape recollection. All the muscles of respiration come into action, the back is stiffened, the head thrown back, the scapulæ and upper ribs are raised, the ensiform cartilage and the cartilages of the lower ribs are drawn inwards and form a deep groove at the junction of thorax and abdomen, the larynx descends at every inspiration (owing to suction), the alæ nasi work rapidly, the expression is one of great anxiety, and the most painful restlessness drives the child from the bed to the nurse's arms and then again back to bed, where it often after a few minutes falls into a sleep (carbonic acid poisoning), from which it is wakened after a time by a fresh paroxysm of suffocation. Finally, at the beginning of the third, and generally last stage, there is no intermission of the dyspnœa, venous congestion, cyanosis, and coma become marked, respiration becomes paralysed, the small frequent pulse grows intermittent,

convulsive twitching of the extremities and tetanic spasms are added, and, eventually, death follows, either from exhaustion or suffocation. Recovery in the third stage rarely, if ever, occurs; on the other hand, in a few cases, the symptoms become less marked during the second stage, paroxysms of suffocation diminish in frequency and severity, the remissions last longer, until finally the dyspnœa disappears entirely, the cough gets looser, and quantities of muco-purulent secretion, mixed with flakes and shreds, are expectorated, while the fever abates and the general condition returns to the normal.

We have so far attempted to describe the disease as it generally occurs, but the individual phenomena are subject to modifications which we shall now discuss.

Alteration in the voice is constant; it occurs at the beginning, and is the last symptom to disappear. In the first stage the voice is sometimes only roughened as in slight catarrh, it then becomes hoarse and, finally, simultaneously with the occurrence of stenosis, completely aphonic; even at the beginning of the second stage, when exudation has already occurred, deep, rough, or high-pitched tones may be produced; when the patient is convalescent and when false membrane is no longer present, the voice may remain hoarse either from catarrhal swelling or paresis of the vocal muscles.

The peculiar rough barking of the "croup cough" is in no way characteristic of membranous laryngitis, because it is more constant and continuous in pseudo-croup (catarrhal laryngitis of children), and because, even in adults, it may be observed in other laryngeal diseases; besides in croup it is very soon replaced by an aphonic choking cough.* At first the cough is laryngeal and caused by stimulation of the extremities of the sensory nerves resulting from hyperæmia, the peculiar sound being caused by the severity of the expiratory efforts and by stenosis; at a later stage it is due more to the accompanying bronchitis, and is caused by irritation of the tracheal mucous membrane brought about by the secretion accumulated below the point of constriction. If the lining membrane of the windpipe be also the seat of fibrinous exudation, cough is no longer thus produced.

Expectoration is absent in the catarrhal stage; after exudation has occurred false membranes, in the form of shreds or casts, may be expectorated, but more commonly tough masses of mucus are brought up after severe coughing and retching.

Disturbances of respiration are shown both by dyspnœa and suffocative paroxysms. The character of the dyspnœa is mixed, being both inspiratory and expiratory; the symptom is doubtless mechanical, and due to the narrowing of the glottis; the number of respirations is diminished when the stenosis has reached its height, because a longer time is

* The author has observed a case where cough was entirely absent.

required to inspire and expire a sufficient quantity of air, both stages of respiration being thus prolonged. As to the paroxysms of suffocation, which are from time to time added to the dyspnœa, various hypotheses have been advanced. Schlautmann and Niemeyer ascribe them to a serous saturation of the laryngeal muscles, which, they say, produces paralysis of the abductors. Rudnicky believes that they are due to want of co-ordination in the respiratory movements, produced either by the exudation irritating peripheral nerve endings, and thus affecting the numerous ganglia with which they are connected, or that a cause is to be sought in the changed composition of the blood; he thinks both causes may possibly act together. Others have attempted to furnish an explanation by assuming spasm of the adductors. The most probable explanation is that the paroxysms are caused by obstruction of the already narrowed glottis by loose shreds of membrane and secretion, as well as by muco-purulent exudation below the point of stenosis, and that the attacks are analogous to those which may be observed in chronic laryngeal stenosis, when the aperture becomes obstructed by tough mucus during sleep.

The disturbance of the general health and fever are dependent upon the local inflammation, and also upon the extent to which the trachea, bronchi, and pharynx are involved. If pharyngeal diphtheria has preceded the laryngeal affection, a high temperature is observed from the beginning (104° F.). In many cases the temperature remains always under 38·5° (approximately 101° F); generally, however, it increases as the stenosis becomes more marked, as a consequence of fresh exudation occurring. According to Rauchfuss, slight elevations of temperature after tracheotomy are of favourable omen. If croup be complicated with extensive bronchitis or pneumonia, the temperature may rise to 104° or even 105·8°. High temperature, with little variation and accompanied by frequent respirations (40 to 60), make it probable that the plastic inflammation has extended to the bronchi, and, if this condition lasts for more than two days, the prognosis becomes extremely unfavourable (Rauchfuss). The pulse is generally rapid, usually from 105 to 130 or even 140, and marked slowing is a forerunner of syncope.

Swelling of the lymphatics occurs when there is concomitant pharyngeal diphtheria.

Besides catarrhal and plastic bronchitis, pneumonia is the most important complication of croup; it usually occurs in the lobular, rarely in the lobar, form. It is difficult to diagnose, because the physical signs are masked by the laryngeal stenosis, and usually runs an acute course, while its presence renders the prognosis worse.

Duration, Result and Prognosis.—Croup is always an acute disease, and its average duration, up to the time of marked cessation in the stenosis or fatal termination, is from six to eight days. Cases

in which death occurs within twenty-four hours (croup foudroyant) are rare, but, at the same time, it must be remembered that it is often very difficult to determine when the disease has begun. In cases which result in cure either with or without tracheotomy, the cessation of threatening symptoms usually dates from the sixth or seventh day. Generally, even in fatal cases, the duration of life is prolonged by tracheotomy. Death rarely occurs during a paroxysm of suffocation, but is commonly due to general paralysis, the result of carbonic acid poisoning, and sometimes to pulmonary complications.

Croup is rarely followed by sequelæ. The prognosis is always doubtful, but somewhat better in sporadic than in epidemic cases, while in some epidemics the mortality is greater than in others. The prognosis is best in localised croup, but, when complicated with pharyngeal diphtheria, fibrinous or plastic bronchitis, and pneumonia, it is worse in proportion to the severity of the complication. The mortality diminishes as age increases, and is greatest between the ages of two and four. Mackenzie estimates the mortality in England, where tracheotomy is comparatively rarely performed, at 90 per cent., and by means of this operation it may be reduced to from 60 to 70 per cent. Cases which begin with marked symptoms are the most unfavourable. The expectoration of even large quantities of false membrane does not by any means ensure a favourable issue, and only when this is followed by continued freedom from dyspnœa and diminution of fever, does it warrant a hope of cure. Great and continued dyspnœa, high fever with a rapid, small, intermittent pulse, vomiting and diarrhœa, are certain forerunners of death.

The diagnosis of croup at the height of the disease, in the second and third stages, presents no difficulties. Even severe cases of pseudo-croup do not give rise to such continually increasing dyspnœa and such severe paroxysms of suffocation, as fibrinous laryngitis. The diagnosis is rendered certain by the appearance of false membrane in the expectoration, and still more sure by laryngoscopic examination, if the age of the child makes this possible. On the other hand, the differentiation of the first stage of croup from pseudo-croup is more difficult, as the former begins with catarrhal laryngitis; yet, even here, there are points of distinction in the majority of cases. Pseudo-croup nearly always begins suddenly, the general health is almost quite undisturbed, and fever slight or absent. In croup, the onset of the disease is usually preceded by general malaise, as shown by irritability, loss of appetite, etc. In rapid cases of croup, in which premonitory symptoms are absent or slight, the second stage, with increasing dyspnœa and aphonia, is so rapidly developed that all doubt is soon removed. The presence of diphtheritic membrane on the fauces, and the simultaneous occurrence of other cases, in the same house or in the same district, increase the

probability of croup; at the same time, it must be remembered that simple laryngitis may—although rarely—be etiologically connected with diphtheria.

We consider that careful attention to the history and symptoms of the case should exclude the possibility of mistaking œdema of the glottis, retropharyngeal abscess, and laryngeal perichondritis for this disease.

THERAPEUTICS.—In spite of the many vaunted specifics for croup, we must, unfortunately, admit that we do not at present possess any remedy capable of preventing or checking fibrinous exudation in the larynx. The duty of the physician lies in prevention, and, after the disease has occurred, in combating dangers which may result, partly by loosening or dissolving the false membrane, and thus promoting its removal, and partly by limiting and removing obstruction to respiration.

The prophylactic rules, which we have laid down for pseudo-croup, are also of value in relation to membranous laryngitis. By rendering children more hardy, their power of resisting atmospheric influences will be increased; bedrooms and sitting-rooms should be well aired, and the fear of anxious mothers, as to letting children go out in windy weather, should be combated. As croup is an infectious disease, contact with those already attacked should be strenuously avoided. Even the most trivial symptoms, pointing to pharyngeal or laryngeal disease in childhood, require most careful attention, and the line of treatment, recommended in pseudo-croup, should be adopted. If there be evidence of false membrane in the pharynx, appropriate remedies must be used. We do not approve of energetic local treatment, and believe, with Oertel, that mechanical irritation of the mucous membrane may tend to increase the spread of the disease. We rest content, in adults and older children, with gargles of lime water—pure or mixed with equal parts of water; in younger children we use no local treatment, and only take care that the atmosphere of the apartment is kept warm and moist by means of an appropriate steam apparatus.

As to the treatment of the disease itself, we shall only allude to bloodletting, cold applications, and mercury, although a large number of remedies have been recommended as tending to diminish the process of exudation.

BLOODLETTING.—Both venesection and leeching have been recommended in order to diminish hyperæmia. If we had to do with a simple hyperæmia or inflammation, and not a specific process, this treatment might be justified on theoretical grounds, but, as it has been found that, in epidemic and diphtheritic croup, it exercises an unfavourable influence, it should for this reason be avoided. If it be thought indispensable in sporadic cases occurring in very robust children, from two to six leeches (according to the age of the child and the severity of the symptoms) may be applied to the manubrium sterni, but never directly

over the larynx, as the bites might in this situation interfere with subsequent tracheotomy. Even here, however, their utility is but transitory.

Cold, in the form of ice-bags or frequently changed compresses, applied to the neck, has also been recommended with the same object, *i.e.* checking inflammation. In so far as these remedies are carefully and energetically applied, this treatment may be tried, as it occasions no great discomfort; at the same time, it must only be continued so long as no symptoms of depression are present. Small pieces of ice may also be given to the little patients, especially if painful pharyngeal diphtheria be also present.

It has been stated that by the use of calomel, corrosive sublimate, and inunction of mercurial ointment, the tendency of the fibrin to coagulate may be diminished, and in this way the specific manifestations of the disease checked. Calomel has disappointed even moderate expectations and has fallen into disuse; on the other hand, the perchloride and inunction have warm advocates in Burow (younger), Bartels, and Rauchfuss. Burow recommends

Hydrarg. perchlorid.	·06 (gr. $\frac{1}{4}$).
Alb. ovi 1	(gr. 4).
Aq. destillat. 120	($\bar{3}$i).

One teaspoonful every hour until ·2–·25 grammes have been used (1 gramme = 15·43 grs.).

Rauchfuss combines the use of perchloride with inunction, or confines himself to the latter in case the intestinal mucous membrane prevents the employment of the former.

Of mercurial ointment 1·25 grammes are rubbed into various parts of the body until the whole surface, with the exception of the face and head, has been anointed once or more. Rauchfuss seldom uses less than 40 grammes and rarely more than 50.

At the same time the mercurial treatment has not only a large number of opponents (Bohn, Monti), but even its advocates only claim for it a value relative to the utter inutility of other remedies, which have been recommended as having a specific action on fibrinous exudation, and they can find no good ground for unconditionally putting it aside.

The more hopeless are our efforts to cure the process which lies at the root of the disease, the more important does a symptomatic treatment become, which has for its object to prevent the dangers arising from stenosis. This problem it has been attempted to solve in two ways, viz. either by dissolving or loosening the fibrinous exudation to aid its removal, or by artificially opening the air passages to find a free passage for the respiratory current.

Among the remedies used with the object of dissolving, loosening, and removing false membrane, emetics have always maintained an important place. We cannot join in the praise which their use has received from various authors; we do not believe, with Rühle, that they can prevent the formation of firm coagula by forcing the exudation out before it has solidified, nor do we believe that the act of vomiting raises, loosens, or removes false membrane which is firmly attached. On the other hand, we do not doubt that already loosened membrane, together with muco-purulent secretion which blocks up the opening of the glottis, may thus be removed, and that, in this way, a transitory diminution in the dyspnœa and suffocative paroxysms may result. Emetics should be given early, *i.e.* so soon as there is reason to believe that false membrane has formed, and, in order to make their action sure and quick, large doses should be administered. Among emetics, ipecacuanha, tartar emetic, and sulphate of copper are the most useful. Tartar emetic is said to be directly injurious by many authors, because it tends to weaken the action of the heart; we, however, believe that, if administered early (in the early part of the second stage, at which time alone we believe it to be indicated), this injurious effect need not be feared. If, however, diarrhœa be present, or if, owing to preceding pharyngeal diphtheria, the heart's action is already depressed, it is better to choose another emetic. The following prescriptions may be used:—

Pulv. Ipecac. ·8	(gr. 12).
Antimonii Tartar. ·06	(gr. $\frac{9}{10}$).
Sacchar. alb. 2	(gr. 31).

F. pulv. Divide in partes sex æqual. One powder to be taken every ten minutes until emesis follows.

Cupr. sulphat. ·6	(gr. $3\frac{1}{2}$).
Aq. destil. 80	($\bar{3}$i).

A teaspoonful every ten minutes until emesis occurs.

We consider it wrong to give emetics continually. If, after their use, no membrane comes away and no diminution of dyspnœa occurs, it is useless to repeat them.

Probably no one nowadays believes that the expectorants, such as senega and carbonate of ammonia, have a solvent action upon false membranes.

Of more importance are local remedies, by which we attempt to act upon the diseased mucous membrane, or more correctly upon the false membrane.

Mackenzie removes the exudation by direct mechanical means, and accomplishes his object by passing into the larynx a brush made of a squirrel's tail (the hairs of which are directed upwards) attached to an aluminium wire. The inhalation of warm vapours and sprays, used with a view to dissolving the false membrane, has of late found great favour.

Steam inhalations have been much advocated by Oertel. In the general part of this work we have already explained that, according to this author, the combination of heat and moisture produces a rapid and sufficient formation of pus, which hastens the cure of the local disease. At all events, there is no doubt that keeping the interior of the larynx moist, by means of steam, tends to liquefy and loosen crusts of mucus, which increase laryngeal obstruction, as also to favour the expectoration of the membrane. In all cases of croup, then, the atmosphere of the apartment should be kept moist, and this is best accomplished by placing around and under the bed several wide-mouthed vessels filled with hot water, while a steam kettle is placed near the head of the bed. In older children, steam may be inhaled every half hour by means of special apparatus, which we have already described.

Medicated spray inhalations are used either as disinfectants or solvents of the croupous exudation. Among disinfectants carbolic acid in solution (a quarter to a half per cent.) has been found most useful, while among solvents, lime water and lactic acid have acquired the greatest reputation. Both remedies undoubtedly possess the power of dissolving croupous exudations after its removal from the mucous membrane on which it grows; but the extent of their action, so long as it is in contact with living tissue, is unknown. It is of primary importance that a sufficient quantity of the dissolving fluid should come in contact with the membrane, and we are convinced that this does not take place by means of inhalations repeated every ten or fifteen minutes. If such inhalations seem to do some good, it is because they moisten the walls of the larynx (just as in the case of steam); for a sufficient quantity of fluid is never collected within the larynx to dissolve but a small piece of membrane—not even if the two were put into a test-tube together. The following prescriptions may be used:—

Aq. Calcis 15–20 (min. 75–100).
Liq. Natr. caust. 3–6 (min. 15–30).
Aq. dest. 100 (℥i).

or

Acid. lactic. 4–6 (min. 20–30).
Aq. dest. 100 (℥i).

To be used as inhalations for five or ten minutes every half hour.

The steam spray apparatus should always be used, and, as both lactic acid and lime water may produce eczema of the lips and face, it is a good plan to paint these parts with an ointment containing boracic acid, *e.g.*:—

Acid. borac. 1.
Vaselin. 9.
Cer. alb. 1.

In order to bring a larger quantity of fluid into contact with the false membrane, the author, in 1869, used repeated injections of lime water with Stoerk's laryngeal syringe, under guidance of the mirror, and was able to prove the solution of the false membrane. This method, perhaps on account of the difficulties of executing it, has not received the attention which we believe it to deserve. We have used it repeatedly, but have, unfortunately, not been able to demonstrate such an immediate result as in the first case, although we are assured that no serious consequences have ever been due to it. At all events, this plan deserves just as much theoretical support as the inhalation of lime water in the form of spray, although it is less convenient and requires more dexterity. We would recommend its employment in older children in whom laryngoscopic examination is possible ; the injections should be repeated several times a day, and, at each sitting, the syringe should be compressed two or three times.

Other remedies which have been recommended are caustics and astringents, diluted hydrochloric acid (1 to 3 or 4 parts of water), powdered alum, sulphate of copper, and, above all, nitrate of silver in strong solutions (8–10 per cent.). We agree with those authors who consider such remedies to be useless and even injurious.

Should the remedies we have mentioned prove useless, and should symptoms of dyspnœa increase to a dangerous extent, and, above all, if signs of carbonic acid poisoning set in, no time should be lost in performing tracheotomy. In a disease which we cannot eradicate, and the first and principal, if not the only, danger of which is suffocation, due to obstruction of the larynx, the establishment of a temporary artificial opening in the air tubes is a distinct duty ; and this all the more so because all other internal and local remedies, calculated to relieve or diminish stenosis, are of doubtful value. It is only a question as to the time of operating, and the experience of all surgeons proves that the results of tracheotomy are more favourable the sooner the operation is performed. The time chosen should be before the powers of the little patient have sunk too low, while the pulse is strong and regular, the general condition still fairly good, and appearances of carbonic acid poisoning are still absent or slight. The presence of fibrinous bronchitis, although it renders the prognosis worse, should not contra-indicate tracheotomy, because this operation is only directed towards relieving the stenosis of the larynx, and does not exclude the possibility of curing the bronchitis. Should there be marked asphyxia, together with a semi-comatose condition, the case is all but hopeless, but the operation is not contra-indicated if the action of the heart be good. As to the operation itself, we must refer the reader to works on surgery ; but, in view of the importance of after treatment, we must further allude to this point, as the result is in a great measure dependent thereon. That all antiseptic

precautions should be attended to, at and after the operation, hardly requires to be mentioned.*

An experienced and trustworthy nurse should remain at the bedside for some days afterwards, while the patient should be seen several times daily by the surgeon. The apartment should be well ventilated, the temperature from 65° to 70°, while the atmosphere is kept moist by means already described. The tube should be constantly watched, and cleared of secretion and false membrane. In order to keep the air moist, a damp cloth may be laid lightly over the canula, or disinfectant sprays † may be applied through it. Many authors continue inhalation of lime water. The wound itself should be examined daily, cleansed, and treated according to surgical principles, while the diet should be nourishing and consist principally of milk and wine.

The tubage de la glotte, recommended by Bouchut (the introduction of small silver tubes which are allowed to remain *in situ*), has not succeeded in replacing tracheotomy, because the larynx becomes irritated and the tubes are easily blocked, so that this treatment is nowadays hardly ever practised in croup.

Catheterism of the larynx, on the other hand, as recommended by Weinlechner, in order to relieve suffocation before or during tracheotomy, when the surgeon can hardly hope to complete the operation during life, is a useful palliative, which allows the operator time to perform tracheotomy when sudden asphyxia is threatened. Only in extremely rare cases can catheterism be substituted for tracheotomy. Hard rubber or silver catheters may be used for the purpose.

Although treatment of the stenosis is the principal duty of the physician in cases of croup, yet, in the course of the disease, individual symptoms occur which require special reference. It is of importance to keep the fever within bounds, and this is best done by the administration of large doses of quinine. To meet symptoms of asphyxia, as also threatened paralysis of the heart, both before and after tracheotomy, stimulants should be used in considerable quantity (wine, musk, camphor, benzoin, carbonate of ammonia, and cold douching).

Cold douching in the treatment of croup was introduced by Harder, and has been recommended by the most experienced physicians (Bartels, Rauchfuss, and others) as the best remedy for promoting increase of the heart's action, and, in rapid sinking of the respiratory power, to cause deeper respirations, relief of cerebral congestion, and increase of cough and expectoration.

The child should be placed on a leather cushion, in an empty bath, or laid upon its face, while one or two buckets of water at a temperature of from 55°–60°, are poured from a height of from one to two feet over head, neck, and trunk, while chest and back are rubbed energetically until the skin is reddened; the child is then dried and put to bed. If, during the douching, the child be seated in a tepid bath, the action is less powerful, and Bartels uses this method when the temperature is low.

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* Whether antiseptic precautions beyond the rules of ordinary cleanliness are of much use in such an operation as tracheotomy is, I think, extremely doubtful for obvious reasons (Translator).

† This line of treatment would require great care both in application and in the choice of an antiseptic (Translator).

After having mentioned and discussed the various methods of treatment recommended for croup, we shall give a short description of the means to be adopted in the various stages of an ordinary case.

First Stage. (Slight hoarseness, short, dry, barking cough, general malaise, rapid pulse, and temperature above normal.) The hygienic conditions of the surroundings should be attended to, and an ice-bag or compress applied to the throat, while older children are made to suck ice. If the temperature be high, quinine; steam inhalations, or sprays of lime water or lactic acid. If pharyngeal diphtheria be also present, gargles of lime water and the internal administration of chlorate of potassium and large doses of quinine.

Second Stage. (Aphonia, aphonic cough, occasional expectoration of false membrane, symptoms of stenosis, prolonged sighing inspiration, with rough whistling accompaniments, occasional paroxysms of dyspnœa.) An emetic should be ordered and repeated after several hours—ice-bags and steam inhalations, or sprays of lime water or lactic acid, as in the first stage. (In older children injection of lime water into the larynx.) Diet, milk and wine. If after use of emetics no improvement occurs, and the suffocative paroxysms become more frequent and of longer duration, tracheotomy becomes an urgent duty.

Third Stage. (Constant dyspnœa, marked indrawing of the sternum and intercostal spaces, cyanosis, stupor, feeble pulse.) If tracheotomy has not been before performed, it should be now. Stimulants, musk, camphor, and cold douche.

A complication with bronchitis and catarrhal pneumonia does not appreciably alter the treatment.

ACUTE SUBMUCOUS LARYNGITIS.

(Corresponding to *œdematous laryngitis* of English authors.)

Under this heading we describe an affection in which the most marked inflammatory changes occur in the submucous tissue of the larynx.

Even now considerable confusion exists in the nomenclature and descriptions of inflammation of the submucous tissue. In pre-laryngoscopic times, and even much later, the classification of Bayle, who in 1808 first fully described the affection, was adopted, and inflammatory, together with serous, infiltration of the submucous tissues were described under the name œdema glottidis. When these affections came to be differentiated, submucous infiltration was described under various names, of which, however, none have yet come into general use. Some authors treat of submucous inflammation under "laryngeal catarrh," and describe it as "the severe form of laryngitis," while serous infiltration is spoken of as "œdema of the larynx." Ziemssen, like Bayle, groups all inflammatory processes of the submucous tissue together as laryngitis phlegmonosa. The same term, however, is restricted by other authors (Rauchfuss, Eppinger) to fibrinous and purulent infiltration of the submucous cellular tissue. We consider a distinction between the two forms as necessary, and, with Friedreich, term the purely inflammatory form "laryngitis submucosa," while we reserve the term "œdema laryngis" for a serous infiltration.

Etiology.—The causes of laryngitis submucosa are partly identical with those of acute catarrh; frequently it depends upon a spread of the inflammatory process from the mucous membrane to the submucous tissue. We are convinced that all severe cases of laryngeal catarrh—both in adults and children when complicated with dyspnœa—are due to this cause, because, on account of the extreme delicacy of the laryngeal mucous membrane, it is not conceivable that infiltration of this alone could produce such threatening symptoms. Cases have been repeatedly observed in which catarrh has, owing to injurious influences (cold, excessive use of the voice), developed into submucous laryngitis. Finally, it may be due to mechanical injuries, *e.g.* direct lesions, impacted foreign bodies, especially if they be sharp, chemical irritants, the application of concentrated acids and alkalies to the pharynx or laryngeal inlet, excessive heat, scalding of the larynx through boiling water, etc. Sometimes the disease is caused by infection which attacks the larynx alone or may be general; it may be due to diphtheritic laryngitis, or occur in the course of typhoid, pyæmia, and smallpox; again, it may accompany facial erysipelas (laryngitis submucosa erysipelatosa of the English), in which case it is to be looked upon not only as a direct continuation of the dermoid inflammation to the pharynx and larynx, but as caused by a specific poison. The chronic infectious diseases (syphilis, scrofula, and tuberculosis) may also be followed by submucous laryngitis, and that without antecedent ulceration and perichondritis.

Anatomical Changes are characterised by localised or diffuse unilateral or bilateral dark red swelling of the affected part. The exudation is either dense, with a marked tendency to coagulate, or it is manifestly purulent; and if the infiltration be circumscribed, an abscess may result. Such abscesses, which are rare, have been observed on the tubercle of the epiglottis, on the epiglottis itself, the aryepiglottic folds, and the interarytenoid commissure.

Lately we have seen one on the upper border of the epiglottis which was not the result of an inflamed mucous follicle alone, but was due to submucous infiltration.

Only in exceptional cases is the whole larynx involved, the infiltration being usually localised in one or other of the following parts—the aryepiglottic fold, the epiglottis, or the false cords. The region under the vocal cords also seems to be the seat of submucous infiltration much oftener than has hitherto been recognised. In such cases the swelling forms two thick symmetrical tumours, which are in contact throughout almost their whole length, and thus cause severe symptoms of stenosis, with paroxysms of suffocation (laryngite sousmuqueuse sousglottique, Cruveilhier; chorditis vocalis inferior, Burow; laryngitis hypoglottica acuta gravis, Ziemssen).

Since, so far as we know, pathological records of the last-named form are not in existence, we here give details of a case which, although

accompanied by tuberculosis, offered in other respects the characteristic appearances of laryngitis hypoglottica.

C. R., aged thirty-three, consulted us in the summer of 1882 on account of cough and hoarseness.—Infiltration of both apices and tubercular ulcer in the interarytenoid commissure. *Treatment*—Narcotics, milk, local application of carbolic acid (1–100 of glycerine). The patient so far improved that he was able to resume his work, but in October he returned considerably worse, and suffering from breathlessness and suffocation at night. Laryngoscopic examination gave the following results: Mucous membrane of the upper and middle portion of the larynx injected but not swollen, ulceration of the interarytenoid fold, vocal cords reddened, and underneath them two red tumours almost touching in the middle line, which did not separate even on deep inspiration (Fig. 22). Respiration could only occur through a narrow opening which remained between the vocal processes, and the patient was advised to go into hospital in order to have tracheotomy performed. He was admitted on the 17th, and everything was ready for the operation, which was only delayed because the patient felt fairly well when at rest. On the morning of the 20th he was found in bed threatened with asphyxia, and, while tracheotomy instruments were being brought, insensibility occurred. There was marked cyanosis, respiration at intervals of fifteen seconds, and a rapid weak pulse. Tracheotomy was performed as quickly as possible, and a small quantity of blood flowed into the trachea, respiration became better, the pulse improved, but there was no return of consciousness, the patient dying forty-eight hours after the operation. A complete autopsy was not allowed and only the larynx was examined, with the following result: Epiglottis, vestibule, and false cords reddened; apices of the arytenoids slightly œdematous; from the lower margins of the cords arise two symmetrical tumours, which become less marked, and finally lose themselves towards the trachea, the most marked swelling being immediately beneath the vocal cords (Fig. 23 *a*). Microscopic examination reveals subepithelial tubercular infiltration, together with numerous small round cells. In the vocal cords themselves there are no tubercular nodules, but only round cells, and the same applies to the subglottic swellings. In the latter the infiltration extends into the lax submucous tissue, although the cells are less numerous here than in the subepithelial layer. The infiltration is most marked in the glandules, but the individual acini are only here and there separated from one another by round cells, maintaining everywhere their normal shape, and thus affording evidence that the infiltration is recent. Around divided blood vessels are seen leucocytes, while muscles, perichondrium, and cartilage are normal.

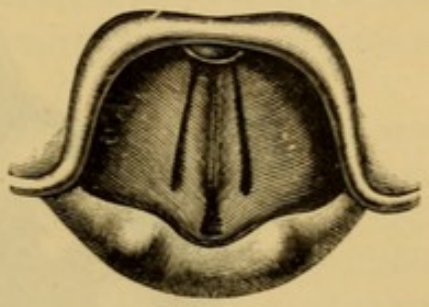


FIG. 22.

LARYNGOSCOPIC APPEARANCE IN A CASE OF LARYNGITIS HYPOGLOTTICA observed by the Author.

SYMPTOMS.—Acute diffuse submucous laryngitis begins with the symptoms of severe catarrh—hoarseness, croupy cough, and stridulous respiration; the latter becomes more and more difficult, and assumes the character of laryngeal stenosis. The symptoms of obstructed respiration when only the upper or middle portions of the larynx are affected, however, rarely assume such grave proportions as those of œdema glottidis, afterwards to be described.

The severity of the symptoms is much greater in those cases in which the lower part of the larynx is involved, described by old authors (Sestier, Cruveilhier) as oedème sousglottique, laryngite sousmuqueuse sousglottique, and described more recently by Burow as chorditis

vocalis inferior, and by Ziemssen as laryngitis hypoglottica acuta gravis.

We accept the last-named term, although we prefer the older name proposed by Cruveilhier (laryngitis submucosa subglottica), because, in our opinion, the inflammatory process chiefly affects submucous tissues, as we have explained above.

Acute laryngitis hypoglottica attacks children as well as adults. The initial symptoms also are those of simple catarrh, but they merge rapidly,

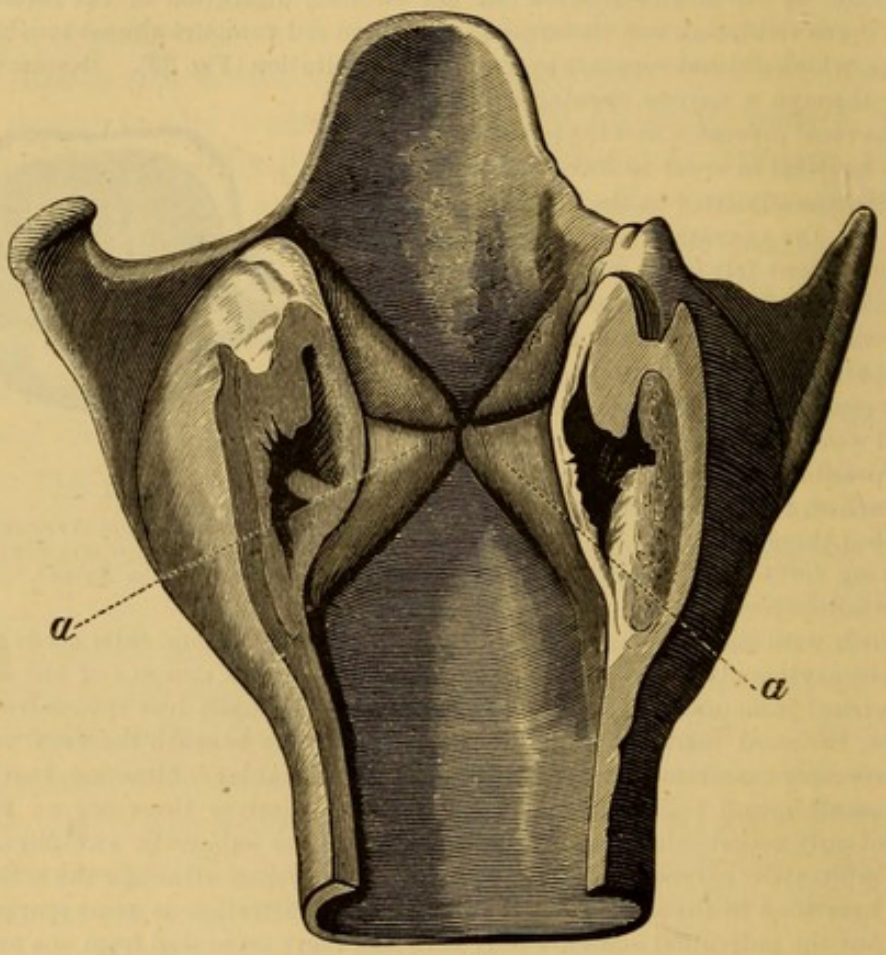


FIG. 23.
LARYNX OPEN FROM BEHIND.
a a Subcordal swellings.

often after a few hours, into those of severe stenosis; inspiratory and expiratory stridor, marked dyspnœa, cyanosis, and a rapid weak pulse demonstrate the great danger of the patient, or even lead to rapid death through asphyxia if tracheotomy be not immediately performed. Sometimes the course of the disease is sub-acute, especially when the subcordal infiltration is secondary to syphilitic or tubercular affections of the larynx, and it may then even become chronic. Laryngoscopic examination shows the upper and middle portions of the larynx to be free or slightly injected; the cords are either normal or injected, while beneath them are seen two red symmetrical swellings bulging towards the middle line, and immovable, which reduce the glottis to a narrow cleft, and are sometimes covered with grey or yellow incrustations.

Circumscribed submucous laryngitis is very rare, and its etiology is unknown; it leads to abscess, and runs an acute course in a few days. The symptoms consist of moderate fever, localised shooting pain, increased by swallowing and pressure from without, and an inclination to cough. Dyspnœa or aphonia are only present when the movements of the cords are impaired owing to the position of the abscess; disturbances of respiration also are dependent upon the locality and size of the abscess, but may be very marked owing to œdema of the surrounding tissues. Laryngoscopic examination shows a circumscribed tumour of a dark red colour; sometimes the swelling points and yellow matter is seen through the mucous membrane. After spontaneous evacuation a marked attack of spasm usually occurs, followed by copious muco-purulent expectoration and relief of dyspnœa.

The diagnosis of diffuse submucous laryngitis is not always easy, and only laryngitis hypoglottica produces a laryngoscopic image so characteristic that it cannot be confounded with other diseases. When laryngoscopic examination is not possible, it must always remain doubtful whether the case be one of croup, œdema glottidis, or other affection liable to produce acute laryngeal stenosis. When the upper and middle parts of the larynx are inflamed, it is possible to mistake the affection for catarrhal inflammation or perichondritis. In the former dyspnœa is never so marked as in the submucous variety, and in the latter the swollen arytenoids are always immovable. The differential diagnosis from perichondritis is more difficult, and, besides, this condition may coexist from the beginning or arise as a secondary result; usually the further course of the case alone can decide as to the participation of the perichondrium. Differentiation from laryngeal œdema we shall consider later. The diagnosis of laryngeal abscess also depends upon laryngoscopic examination which demonstrates a round, sharply-defined swelling. If the tissues around the abscess be œdematous, the diagnosis becomes more difficult. According to Bruns, the appearance of yellow matter through the red mucous membrane is the only certain sign of abscess. It is better in doubtful cases to make a small puncture with a laryngeal knife, as this proceeding is always free from danger.

Duration, Result, and Prognosis.—The disease usually runs its course in a few days, though convalescence is not so rapid, and vocal disturbance may last for weeks. In the most severe cases, especially in the subcordal variety, death may result rapidly from asphyxia, and the same is true of abscess if it be surrounded by much œdematous swelling. Submucous laryngitis, when secondary to tuberculosis or syphilis, has a tendency to become chronic and produce induration.

Treatment.—Submucous laryngitis requires energetic treatment. If the swelling be moderate, antiphlogistic remedies should be used; in the primary form, when it occurs in full-blooded robust persons, local blood-

letting, cold compresses, ice-bags on the neck, and sucking pieces of ice and ice water are to be recommended. When syphilis is at the root of the affection, we have seen the best results follow the use of iodide of potassium. The symptoms of stenosis are, however, often so marked that tracheotomy dare not be delayed; particularly in the subcordal variety, delay may have disastrous results, as in the case we have recorded. In the circumscribed variety, an incision should be made as soon as an accumulation of pus is suspected. If, owing to difficult manipulation, or for other reasons, opening the abscess be not possible, or if the result of incision be not satisfactory, tracheotomy may be required. As a matter of course, the tube must not be removed until there is a free passage for respiration.

CHRONIC SUBMUCOUS LARYNGITIS.

Etiology.—Chronic submucous laryngitis either follows an acute attack or is developed from chronic catarrh by the action of injurious influences (continued speaking, cold, etc.); an inflammatory process may also extend from the perichondrium to the submucous tissue. In many cases the history points to no definite cause. Of acute infectious diseases typhoid alone, and of chronic affections only struma, syphilis, and tubercle gives rise to chronic hyperplasia within the larynx. In drunkards we have often observed marked thickening of the epiglottis, which we believe to be due to infiltration of the submucous structures. Some authors connect the etiology of this affection with that of endemic blenorrhœa of the upper air passages as described by Stoerk (Ganghofner, Catti) and with rhinoscleroma (Catti); but further observations are required to establish a connection between these conditions and that which we are considering.

Pathology.—The anatomical changes consist of uniform hyperplasia of parts of the larynx, especially of the epiglottis, the posterior wall, the vocal cords, and the region beneath them; the submucous tissue is markedly thickened, hard, and difficult to cut. In a case observed by Türck, and in which the microscopic examination was made by Wedl, there was found adventitious tissue in the mucosa and submucosa. A favourite seat of such hyperplasia is here, as in the acute variety, that portion of the larynx beneath the cords; and this condition, on account of the characteristic laryngoscopic appearance presented by it, has received the special designation, laryngitis hypoglottica chronica hypertrophica (Ziemssen).

The question as to the nature of this condition has of late given rise to numerous discussions, upon which we cannot here enter. This much seems certain, that no valid reason exists why it should be pathologically distinguished from the hyperplasia which is found in other portions of the larynx. Certainly the subcordal affection may occur by itself, but it exists just as often together with infiltration of other parts, especially the

cords, the interarytenoid commissure, and indeed the greater portion or even whole of the larynx. Further observations are required to show how far anatomical conditions, such as the structure of the submucous tissue, the distribution of vessels, and other factors, favour the occurrence of infiltration and induration beneath the vocal cords. Even with regard to etiology this condition cannot be separated from a similar infiltration of other parts, as Schroetter has already shown. All the conditions just described as causes of submucous inflammation apply with more or less force to the subcordal variety; and we shall only use the term laryngitis hypoglottica in so far as it represents certain clinical and laryngoscopic distinctions.

Symptomatology.—Thickening of the epiglottis alone, often observed in drunkards, produces no special symptoms; the patient sometimes complains of a feeling of weight, or as if a foreign body were present in the throat. Infiltration of the posterior laryngeal wall, as also of the upper and middle divisions of the larynx, is seldom so marked as to be the cause of much respiratory trouble, and the principal symptom in these cases is loss of voice; it is only when the vocal cords and the parts beneath are infiltrated that noisy respiration, and at a later stage dyspnœa, with suffocative attacks, occur. The dyspnœa may finally be so continuous and severe that the patients die of chronic asphyxia, as observed by Trousseau, Bellocq, Rühle, and others. Laryngoscopic examination shows reddish, circumscribed, or diffuse firm swelling of the affected parts; the false and true cords may increase in breadth until they assume the appearance of irregular rigid masses, and by their immobility increase the difficulty of respiration.

The laryngoscopic appearance in chronic subglottic laryngitis is characteristic.

When the disease is only slightly developed, the free edges of the cords have the appearance of being longitudinally divided into two segments —an upper and a lower—so that there seem to be two cords, one below the other. When the disease is more advanced, there are seen, descending from the inner margins of the cords, two more or less red, smooth (rarely nodulated) tumours, which extend into the lumen of the larynx, so that they are more or less in contact, and only a narrow cleft is left for the passage of air. The cords themselves may retain their mobility on phonation and respiration; but frequently, especially if they be also infiltrated, their movements are slight or absent, and they remain in the position of adduction, thus increasing the dyspnœa.

In a case observed by us in which tracheotomy had to be performed, the right cord was rigid and immovable in the middle line, and the left remained in the cadaveric position even on deep inspiration, while the free margin was markedly concave; it approached the middle line on phonation, but still retained its hollowed-out appearance. The subcordal hyperplasia in this patient, after lasting for a year, gradually disappeared almost entirely, so that the tube could be removed; but the condition of the cords has, during two years, remained the same. We believe these disturbances of mobility to be due to inflammatory changes in the muscles.

The affection is usually bilateral, although Mackenzie found it uni-

lateral in more than half of his cases; the stenosis is rarely circular, and only when the anterior and posterior walls are also infiltrated.

Laryngitis hypoglottica is a very grave affection, and is associated with severe laryngeal dyspnœa. Sometimes suffocative attacks occur produced by an accumulation of tough mucus during sleep, and possibly also by mechanical difficulties in the way of expectoration. The most dangerous cases are those in which the cords and the interarytenoid commissure are also infiltrated.

We have observed a case in which the subglottic tumours were comparatively small; at all events, there was a wide opening left between them posteriorly, which, however, was so obstructed by swelling of the interarytenoid fold that tracheotomy was required.

The voice is always altered, but complete aphonia is only present when the cords are implicated.

Diagnosis.—Laryngoscopic examination, only, can determine the extent of the disease. The thickening is distinguished from œdematous swelling by its firmer consistence, so that no mistake is possible. The subglottic tumours, when they exist, are so characteristic that they can be easily recognised by means of a mirror. It is more difficult, and often impossible, to decide whether the infiltration be primary or secondary; the history and the condition of other organs must then be considered. The exclusion of perichondritis can be accomplished by the absence of tenderness when pressure is made on the cartilages, the gradual progress, and the absence of suppuration.

Duration, Course, Prognosis.—The disease is developed very slowly, and may exist for years. The result depends partly on the general condition (syphilis or tuberculosis). Spontaneous resolution of the infiltration may occur, although rarely; usually a permanent induration of the submucous tissue remains. The prognosis depends upon the intensity of the submucous laryngitis, its situation, and the amount of stenosis.

Treatment.—If the infiltration be situated in the upper portion of the larynx, attempts may be made to reduce the thickening by scarification or the galvanic cautery. Internally iodide of potassium may be tried, although, according to our experience, it is only useful in those cases which depend upon syphilis.

In a woman on whom tracheotomy had been performed on account of syphilitic chronic subglottic laryngitis, we saw the affection disappear entirely in a few weeks under the use of iodide of potassium.

Usually, however, the dyspnœa produced by stenosis requires rapid and energetic treatment. In these cases systematic dilatation by means of elastic bougies and caoutchouc catheters of gradually increasing calibre, as introduced by Schroetter, should be used. If the stenosis be so marked as to threaten suffocation, tracheotomy must be promptly

performed, and attempts afterwards made to dilate the stricture by means of Schroetter's tin bougies.

ACUTE ŒDEMA OF THE LARYNX.

(*Acute serous infiltration of the submucous tissue.*)

Etiology.—It is open to doubt whether serous infiltration of the larynx ever occurs as a primary affection. In the great bulk of cases it is a sequel of local diseases. Thus we often see acute œdema follow those forms of laryngeal catarrh which are associated with pharyngitis; it may also occur in croup (very rarely), perichondritis, tubercular or syphilitic ulcers, swelling in the cervical region, parotitis, inflammation of the thyroid gland, and disease of the cervical vertebræ. In all such cases the œdema is to be considered as inflammatory, and may be looked upon as the periphery of the acute exudation which causes it. The exact cause of the œdema sometimes associated with acute infectious diseases, such as pyæmia, septicæmia, ulcerative endocarditis, typhoid, smallpox, scarletina, measles, and erysipelas, is not yet clearly defined. It is difficult to decide whether in such cases the inflammation is gradually propagated along the course of the vessels, or whether it be due to a localisation of the infective process in the larynx.

Simple serous infiltration, as distinguished from inflammatory œdema of the submucosa, may be due to, or associated with, general dropsy, malaria, waxy disease of the kidneys, congestion from heart disease, pressure on one or other jugular vein (tumours of the neck or anterior mediastinum, enlargement of the thyroid, swollen lymphatic glands, aortic aneurism, etc.).

Acute laryngeal œdema is rare in childhood, and most common between the ages of eighteen and fifty, manifestly because the causes which lead to it are most apt to affect those of this age. For the same reason males are more frequently attacked than females.

Pathology.—Laryngeal œdema is characterised anatomically by a pale yellow, rarely pink, transparent swelling, which is tense, and vibrates like jelly. It occurs most frequently where submucous connective tissue is most abundant, and hence in the upper part of the larynx—the epiglottis, aryepiglottic folds, mucous membrane covering the arytenoids and ventricular bands, but rarely in the vocal cords. If the œdema be developed round an inflamed area, it is more localised and less symmetrical, while the form which is due to congestion is more diffuse and more characterised by symmetry. Histological examination shows the connective tissue fibres of the submucous tissue to be separated while the endothelial cells become distinct. In the lymph spaces there is found a regularly punctated coagulum, in which are suspended lymph corpuscles, which are not coloured by hæmatoxylin (Eppinger).

Symptoms.—The symptoms caused by laryngeal œdema are various, and depend partly upon the position, the extent, and the degree of the swelling, and partly upon the primary disease. It is not at all unusual to find circumscribed œdema associated with other local diseases, without the presence of any symptom which can be ascribed to the œdema alone; œdema may also reach a considerable degree before producing symptoms of stenosis, so that then a very slight increase of the affection suffices to produce suffocation. In œdema of the upper part of the larynx, patients feel as if they had a foreign body in the throat. The disturbance of voice—in so far as it is not due to other coincident laryngeal disease—consists in the note being rough and deep. Cough and pain are not characteristic of œdema, and the most marked symptom is difficulty of respiration. The stenosis may occur so suddenly that death results in a few hours, if tracheotomy be not immediately performed. Threatening œdema is apt to be produced by impacted foreign bodies (pieces of bone, tobacco, splinters of wood), but also occurs in weakly patients who are recovering from acute disease (especially typhoid), in the course of Bright's disease, in mediastinal tumours and aortic aneurism without any preceding laryngeal disease. Fortunately, those cases in which dyspnœa progresses slowly, and does not reach this height, are the more common. The dyspnœa is at first only inspiratory, and depends upon the fact that during inspiration the swollen œdematous aryepiglottic folds are pressed in a valve-like manner against the ventricular bands, while on expiration they are again separated. If the swelling increases, or if the œdema is from the first secondary to already existing thickening of the interior of the larynx (perichondritis or submucous infiltration), inspiratory and expiratory dyspnœa are both present, and we have a complete picture of marked apnœa such as we have described in croup (laryngeal stridor, descent of the larynx on inspiration, falling in of the jugular and epigastric regions, slow and deep inspiration, etc.).

Laryngoscopic examination, which alone can make the diagnosis certain, shows portions of the larynx, varying according to the seat and amount of the affection, markedly swollen. The epiglottis loses its normal shape and gives the impression of two shapeless masses pressed against one another, or resembles a spherical tumour. When the affection is slight it seems turned in at the edges, swollen, and immovable, either in an upright position, or depressed, so that a view of the larynx cannot be obtained; its margins are lost in the œdematous aryepiglottic folds, which form two oval tumours, almost meeting in the middle line. The œdema of the ventricular bands never reaches such an extent as that of the vestibule of the larynx. The cords themselves are rarely œdematous, although Risch has recorded a case which ended fatally in a short time, and in which, in addition to œdema of the upper portion of

the larynx, the cords were so swollen that they produced perfect closure of the glottis. The author has several times seen œdema of one cord so that the affected part resembled a long narrow polypus. The œdematous portions appear tense, gelatinous, and of a transparent yellow colour.

If for any reason laryngoscopic examination be impossible, exploration with the finger sometimes gives information concerning the upper portions of the larynx.* The upper parts of the larynx may occasionally be inspected by pressing down the tongue until retching is produced.

Diagnosis.—As the most important symptom of laryngeal œdema (viz. stenosis) is by no means characteristic, it is clear that a positive diagnosis can only be made after inspection. The use of the mirror makes it impossible to mistake spasm, polypus, retropharyngeal abscess, or foreign bodies, for œdema. Œdematous swelling is distinguished from inflammatory submucous infiltration by its pale yellow colour, its tenseness, and its softer, more transparent appearance. Of course, additional aids are derived from the history of the case and examination of other organs, *e.g.* the neck, the venous circulation, heart, mediastinum, or from evidence of hydræmia or albuminuria. On the other hand, it must not be forgotten that œdema is always a secondary disease, and that it is necessary, in forming a diagnosis when œdema is present, to find out the primary malady.

Course, Result, and Prognosis.—Acute laryngeal œdema may become developed very rapidly, or, at all events, may in a short time increase from a slight affection which produces no symptoms to a disease most dangerous to life. As it is always, or nearly always, a secondary disease, whether it be curable, or how soon a cure may be effected, are questions which must depend upon the primary condition. If it be a part symptom of general dropsy in consequence of acute or chronic nephritis, hydræmia, etc., it may disappear entirely with the dropsy; again, if it be the result of local congestion through pressure on the jugular vein, the serous exudation may be rapidly absorbed when the cause has been removed. Circumscribed œdema in the neighbourhood of an abscess rapidly disappears after evacuation, although in such cases it may take such an acute course that death from suffocation may result before the primary cause can be removed or tracheotomy be performed. For these reasons, acute laryngeal œdema, particularly if several portions of the organ be affected, must be looked upon as very serious, and the prognosis is always doubtful, because the rapidity with which the stenosis may increase cannot be foretold.

Treatment has a twofold object—(1) to remove the œdema and the disease which has caused it; (2) to be on the watch, so that threatening suffocation may be promptly relieved. The first indication can only be carried out in a few cases, because the primary disease is apt to defy our

* The finger is rapidly introduced along the edge of the tongue.

therapeutics. If the œdema be only the result of acute inflammation, occurring in robust individuals, local depletion, by means of a considerable number of leeches applied to the sides of the larynx, may be of use. It has further been recommended to apply astringents locally, *e.g.* nitrate of silver (1 to 20 or 1 to 30), by means of a brush or sponge once a day, spray inhalations of tannin in solution, alternated with a spray containing bromide of potassium and morphia, or gargling with fluid containing alum. We have not been able to convince ourselves that it is possible in this way to promote absorption of serous exudation. Some comfort is derived by the patient from swallowing small pieces of ice, which may also be applied externally in a bag, or the throat may be surrounded by warm, moist compresses. In œdema, occurring as part of a general dropsy, energetic action of the skin and bowels is of undoubted value. Rühle warmly advocates the use of large blisters, which are applied one after the other to the throat, neck, thorax, and extremities. Instead of these, the use of stimulating foot baths or diaphoretics may be tried.

In a case of intense laryngeal œdema observed by us, which was associated with œdema of the extremities, occurring in the course of chronic nephritis, we saw the laryngeal œdema disappear completely after an injection of pilocarpin, while in other parts it was only diminished.

In order to produce watery stools, drastic purgatives, which act rapidly, such as croton oil or salts, may be given. If, however, the œdema has begun with symptoms threatening suffocation, or if a moderate amount of œdema—in spite of the employment of the above-mentioned remedies—goes on steadily increasing, more decided measures to prevent and subdue dyspnœa must not be delayed. For this purpose scarification of the œdematous parts, as recommended by Lisfranc, may prove useful. The most efficient instrument for this purpose is a laryngeal knife either with or without a guard, or, if this be not at hand, a long sharp bistoury, which is covered up to within half a centimetre of its extremity with sticking plaster. If scarification does not produce the desired result, or if it be impracticable, it is of vital importance to perform tracheotomy, and we can but agree with Mackenzie that it is better to perform this operation early than to wait until the almost moribund state of the patient renders surgical aid hopeless. After the performance of tracheotomy, attempts to remove the œdema must be continued.

Of course, all hygienic and dietetic rules, such as are required in every severe laryngeal disease, and which we have described under acute laryngeal catarrh, must be carefully attended to.

CHRONIC ŒDEMA OF THE LARYNX.

(*Chronic serous infiltration of the submucous tissue.*)

Etiology.—Chronic laryngeal œdema often results from the acute

form, and is, without exception, secondary. It usually accompanies deep structural changes within the larynx, appearing in the neighbourhood of extensive phthisical or syphilitic ulcerations, or as a symptom of malignant disease; it is consequently almost always localised.

Symptoms.—The symptoms are similar to those of acute œdema, but respiratory troubles are never so marked as in the latter; even if the lumen of the larynx be much narrowed, the dyspnœa is seldom so severe that surgical means are necessary to relieve the stenosis, although, occasionally, acute exacerbations may occur. Laryngoscopic examination gives the same picture as has been described in acute œdema, only the mucous membrane is paler and less turgescent. Together with chronic œdema there are always found other deep lesions, but the latter may be so situated as to be concealed by the œdematous swelling.

The prognosis depends upon the primary disease, and is therefore bad in tuberculosis and cancer. The œdema, which accompanies syphilitic ulcers, disappears when these heal.

Treatment.—Chronic œdema rarely requires active treatment to prevent suffocation, and it is only when an acute exacerbation occurs that tracheotomy is required. Œdema of the epiglottis often renders deglutition so difficult that scarification is required to afford relief. Syphilis, of course, requires suitable general treatment.

ULCERATION OF THE LARYNGEAL MUCOUS MEMBRANE.

Etiology.—In the great majority of cases, ulcers of the larynx result from a dyscrasia and have specific characteristics, that is to say, they result from specific infiltration, such as tubercle, syphilis, cancer, leprosy, or lupus, but even ulcers which follow simple non-specific inflammation are more prone to occur as a result of dyscrasia or infection; consequently they are very seldom seen in simple catarrh, but more commonly in both acute and chronic infectious diseases, such as typhoid, lupus, lepra, glanders, tubercle, and syphilis.

As to the etiology of ulcers, they sometimes develop as a result of simple necrosis of the epithelium (erosive ulcers). The latter rarely occur in simple catarrh, and, according to Virchow, never extend beyond the pavement epithelium; they are also seen in syphilis, when the secretion from pharyngeal ulcers infects a laryngeal mucous membrane which has become less resistant from catarrh, and thus ulcers are produced (corroded ulcers according to Eppinger). Such ulcers are also seen in typhoid fever, when superficial necrosis of the mucous membrane results from the general disease. Under this category are included also those flat, shallow ulcers which have a tendency to spread, and are believed by many authors to be non-tubercular, but which occur in the course of phthisis (aphthous or erosive ulcers). As to these ulcers, it is not certain whether they are, as Heinze believes, purely accidental and of no signifi-

cance, such as may occur in the course of any laryngeal catarrh; or whether they are infective, resulting from the irritating action of the secretion contained in pulmonary cavities upon a mucous membrane, the surface of which has become sodden by long-continued inflammation; or, finally, whether they result from the breaking down of miliary nodules.

In all these ulcerations there is only loss of epithelium, or, at most, of the upper layer of subepithelial tissue.

A second group, more important from a pathological and clinical point of view, is formed by ulcers which are developed in an opposite direction; that is to say, normal inflammatory processes in the mucosa, submucosa, or perichondrium result in a destruction of tissue which finally affects the epithelium and produces more or less extensive and deep ulceration. Whether a simple inflammatory cellular infiltration can produce ulceration in this way, is more than doubtful; but, on the other hand, this result ensues when submucous exudation ends in diffuse or circumscribed suppuration, and the mucous membrane is thus perforated; ulceration is also produced when primary or secondary perichondritis ends in necrosis of cartilage; the most common cause of all is specific infiltration of the submucosa as it occurs in typhoid, tubercle, and syphilis.

We shall return to these conditions and discuss their histology under secondary laryngeal disease; it is only intended here to allude to the general conditions under which ulceration occurs.

As to the seat of ulceration, we have already stated that simple erosions only occur on mucous membrane which is covered with pavement epithelium, and, consequently, they are seen almost exclusively on the vocal cords; aphthous ulceration occurring in phthisis is always multiple, and attacks chiefly the vocal cords, the posterior surface of the epiglottis, the inner surface of the arytenoids, and the mucous membrane below the ventricles. Superficial syphilitic ulcers are found, as one would expect from their etiology (contact with infectious pharyngeal secretion), on the epiglottis and the upper part of the larynx. Ulcers which result from infiltration, specific or otherwise, may be seen in any part of the larynx, although certain parts are oftener attacked than others, as, *e.g.* the aryepiglottic ligament and the posterior wall in tubercle, the epiglottis in syphilis.

Symptoms.—The subjective symptoms resulting from ulceration depend upon the primary disease, as well as upon the locality and extent. Erosions and small ulcers in the lower part of the larynx may be present without exciting any special discomfort, or the sensations produced by them may be completely masked by the primary disease. Ulceration of the epiglottis or arytenoids, on the other hand, produces the most severe pain, which radiates towards the ear, and renders deglutition difficult. Cough is only produced when ulceration occurs

in the interarytenoid commissure; this symptom may then, however, be so severe that the most painful attacks of spasmodic cough result, as we have observed in a case of specific ulceration situated in this locality.

Laryngoscopic examination must be made with great care. It is not difficult to recognise deep and extensive ulcers; the physician must, however, be on his guard not to mistake thin masses of secretion, which rest upon the mucous membrane and resemble an ulcerated surface, for small ulcers. In doubtful cases repeated examination should be made after the patient has been told to cough. The author has often seen beginners mistake the inequalities which are sometimes seen on the edges of the infiltrated vocal cords for loss of tissue, whereas this appearance really depends upon thickening. As a point of distinction, it may be remembered that loss of tissue corresponds to a surface which secretes pus. The greatest difficulty is experienced in detecting ulceration of the posterior wall of the larynx, because this part can never be thoroughly brought into view, and irregular edges of papillary growths alone may be evident. If the head be bent well back and the handle of the mirror slightly depressed, it is sometimes possible to see the surface of the ulcer. If the ulceration be situated in the middle or lower portion of the larynx, it is sometimes so covered by collateral œdema that it cannot be seen. In such a case the presence of localised œdema, pain, and the history of the case may lead to a probable diagnosis.

To the differential diagnosis of various specific ulcers, especially tubercular and syphilitic, we shall refer in considering the diseases which cause them.

Treatment.—The treatment of ulcers is associated with that of the primary disease, and no further special therapeutics are required. Simple erosions usually heal without treatment, but if they are painful they may be lightly touched with nitrate of silver. Painful ulcers may be treated by brushing with narcotic solutions,* *e.g.*—

Morphiæ muriat. ·3.
Glycerini 10.

For tubercular ulcers we have found brushing with the following solution useful:—

Acidi carbol. ·1.
Glycerini 10.

Above all, the patient must avoid as much as possible speaking, as also the consumption of spiced foods and irritating drinks.

* Cocaine has also been found very useful for this purpose in solutions varying from 10--20 per cent. (Translator).

CHAPTER II.

DISEASES OF THE PERICHONDRIUM AND CARTILAGE.

LARYNGEAL PERICHONDRITIS.

Etiology.—Inflammation of the laryngeal perichondrium rarely occurs as a primary disease. It is sometimes produced by trauma, such as pressure on the larynx, stabbing, cutting, gun-shot wounds, and also excessive use of the voice. According to Dittrich, pressure of the posterior margin of the cricoid against the spine may cause trophic changes, and consequent inflammation of the perichondrium analogous to the ulceration over the sacrum seen in typhoid. Ziemssen describes a case in which perichondritis of the cricoid occurred as a result of the injury inflicted in passing an œsophageal bougie in an old man whose cricoid was ossified. When definite causes cannot be demonstrated it is usual to blame a rheumatic tendency. It must be left an open question whether we must not give up our belief in spontaneous suppuration, as Eppinger is inclined to do, and assume the existence of localised septic infection in all such cases.

Secondary perichondritis is much more common, and is seen as a result of acute and chronic infectious diseases. It may be said to occur in two forms, either as a metastatic process in septicæmia, variola typhus, and so-called cholera typhoid, or as a result of ulcerations, whether diphtheritic, variolous, tubercular, syphilitic, lupoid, or carcinomatous.

Finally, inflammation and suppuration of the submucous tissue may extend to the perichondrium, as also may suppuration of the external soft parts which cover the larynx.

It is not certain, although probable, that in tubercle and syphilis inflammation of the perichondrium may occur without antecedent ulceration.

Pathology.—Perichondritis never attacks the whole larynx, but is always confined to one or other cartilage, or even portion of a cartilage. The cricoid and arytenoids are most frequently affected, while the epiglottis is rarely involved. The disease is characterised by marked swelling, due to thickening of the perichondrium; the swelling is

further increased by resulting œdema of the surrounding submucous tissue. Suppuration soon follows, and the perichondrium is more and more separated from the cartilage; the nutrition of the latter is thus interfered with, and necrosis threatened. The necrosed portions are of a pale, dirty yellow or dark colour. Only after pus has accumulated to a considerable extent does perforation of the soft parts and evacuation of an abscess occur; the abscess may point, according to its position, into the pharynx, the interior of the larynx, or externally, in which case the skin finally gives way and a laryngeal fistula is produced. The necrosed cartilage is thrown off in larger or smaller fragments. If the perichondritis has resulted from a deep ulcer, the swelling is never so marked, and the abscess is evacuated early because the egress of the pus is less impeded; the opening of the perforation is also larger, and the necrosed cartilage lies uncovered at the base of the ulcer.

Microscopically the intercellular substance of the adjacent cartilage in the early stage of perichondritis is found thickened and dimmed owing to infiltration with pus cells; the cartilage cells become degenerated, and the surface of the necrosed cartilage assumes an uneven appearance. If the necrosed cartilage be exfoliated and the causes removed, the abscess collapses, its cavity becoming filled with granulations, and cicatrisation results.

In rare cases the exudation becomes organised; it infiltrates the neighbouring parts, and new formations of connective tissue thus are produced, or it may penetrate the cartilage and there produce further development of connective tissue (sclerosing perichondritis), or even new formation of cartilage and bone. This form of perichondritis is usually traumatic (after laryngotomy) or syphilitic, and results when exudation is slow and in small quantities.

Symptoms.—The symptoms of perichondritis are at first by no means characteristic; circumscribed pain, increased by pressure on the larynx or by moving the cartilages upon one another (in affection of the thyroid or cricoid), by speaking and swallowing (when the arytenoids or plate of the thyroid are affected); moreover, there are present cough, hoarseness, and swelling of the lymphatics, all of which may, however, be associated with other diseases. The laryngoscopic image also is more or less masked by the primary disease and by the secondary œdema. A certain diagnosis is only arrived at when, after spontaneous or artificial evacuation of the abscess, necrosed cartilage is thrown off, or when the laryngeal probe, introduced through the ulcer or opening of the abscess, strikes upon bare cartilage. A perichondritic cannot be distinguished from a submucous abscess, and may, owing to the associated œdema, give rise to a marked degree of stenosis.

The affection is characterised by certain features which vary according to the locality affected. Perichondritis of the arytenoids is usually

secondary to ulceration of the posterior laryngeal wall, and is always associated with great pain in swallowing, radiating towards the ears, œdema of the soft parts of the laryngeal vestibule, and partial or total immobility of one or both cartilages; it is sometimes possible in these cases to demonstrate the existence of bare cartilage by means of the probe. Among a large number of typhoid patients Ziemssen observed several cases of arytenoid perichondritis both during life and after death, in some of which there was complete and in others partial necrosis of the arytenoids. In partial perichondritis, which is the rarer form, this author has noticed that the affection, especially if localised in the vocal process, does not necessarily lead to necrosis of the affected part, and to participation of the whole cartilage, but may appear as a very painful swelling of the vocal process, which, with care, may disappear; if, on the other hand, it be irritated, it may, even after prolonged convalescence, rapidly result in threatening stenosis. If the cartilage be exfoliated, the abscess collapses, and in rare cases, when the conditions which favour suppuration are removed, cicatricial contraction results, owing to the formation of cicatricial or even ossifying connective tissue; this condition is characterised on laryngoscopic examination by sinking in of the cartilage of Santorini on the affected side. On the other hand, the diseased side may seem thickened, and the absence of the necrosed cartilage may be hidden, owing to hyperplasia of the submucous tissue; but in either case there is immobility of the corresponding vocal cord.

Partial exfoliation of the necrosed arytenoid may occur without producing marked symptoms. Thus the author has seen a patient who, while suffering from syphilitic ulceration of the interarytenoid fold, was attacked by perichondritis and exfoliation of the right arytenoid. The affection lasted for several months, and did not prevent the patient from following his arduous occupation. The exfoliation of the cartilage occurred on the street, and caused him so little trouble that he did not consider it necessary to seek medical aid. When the author saw him a month later the ulcer was cicatrised, the right cartilage of Santorini was lower than the left, there was immobility of the right cord and complete aphonia.

Perichondritis of the cricoid rarely attacks the whole cartilage, but usually affects the plate, and sometimes the sides and front. It also is often associated with deep phthisical ulcers, and is often combined with necrosis of both arytenoids. The symptoms are pain on swallowing hard substances, if these pass over the inflamed part, and dyspnœa, which sometimes reaches such an extent that tracheotomy is necessary. Owing to paralysis or destruction of both posterior crico-arytenoid muscles, the cord of the affected side (if both sides be involved, both cords) is seen to be stationary in the middle line.

Perichondritis of the thyroid may attack one or both plates, and the

disease may be situated either on the laryngeal or external surface. It is always associated with circumscribed pain over the affected part, increased by external pressure, and, especially if the outer surface be affected, there is swelling which masks the usual prominences of the larynx (pomum Adami). If the abscess points internally, the swelling within the larynx becomes more defined, and is apt to cause symptoms of stenosis. If the abscess opens externally, the introduction of a probe gives information as to the condition of the cartilage and the extent of the necrosis; sometimes a fistula is formed which communicates with the laryngeal cavity.

Diagnosis.—Laryngeal perichondritis can only be diagnosed with certainty by the demonstration of bare cartilage, or after the expectoration of fragments. The presence of perichondritis may be conjectured when there is a dull pain on deglutition, and when laryngoscopic examination shows swelling of the parts covering a cartilage without there being evidence of primary affection of the mucous membrane.

Course, Result, and Prognosis.—The disease is usually developed slowly, but becomes acute whenever pus is formed. Death is the most common result, owing to the primary disease being unfavourably influenced by the perichondritis and long-continued suppuration; or owing to the exfoliation of large pieces of cartilage, the larynx falls in and suffocation is produced; finally, a fatal termination may be due to choking, owing to the encroachment of the abscess or to a fragment of cartilage becoming impacted in the glottis. The course of traumatic or syphilitic perichondritis is more favourable. A relative cure may result when cicatrisation occurs after exfoliation of necrosed cartilage, or when the exudation from the beginning shows a tendency to become organised into fibrous tissue. Under these circumstances, however, important changes in the larynx always remain, which produce considerable disturbance of function. Cicatricial contraction or fibrous thickening may produce permanent stenosis; and further, anchylosis of the crico-arytenoid articulation may probably also result from sclerosing perichondritis, as Semon has lately pointed out.

Treatment.—The treatment of primary perichondritis is in the early stage the same as that of submucous laryngitis, with which it is usually combined, and from which it is often indistinguishable, viz. two to three leeches applied to the neck, and the external and internal use of ice. For secondary perichondritis we can do but little. If an abscess is formed, it should be opened as soon as possible; œdema should be treated by repeated scarification. Tracheotomy is often necessary to prevent suffocation. Little can be expected from local treatment of the diseased mucous membrane, for, the ulcers being due to a dyscrasia, treatment must be directed to the primary cause. In all cases a tonic line of treatment should be adopted to counteract the debilitating

effects of suppuration. In syphilitic perichondritis, where the prospect is more favourable, mercury and iodide must be administered. If the abscess has healed with resulting hyperplasia and stenosis, or if sclerosing perichondritis, with new formation of fibrous tissue, has existed from the beginning, dilatation, by Schroetter's method, as described in the early part of this work, may yield favourable results.

CHAPTER III.

WOUNDS AND INJURIES OF THE LARYNX.

Wounds are usually produced by the knife, the result of attempted suicide; punctured wounds, inflicted by the bayonet, dagger, rapier, or other sharp instrument, are less common. Incised wounds usually extend across the larynx, and vary in their effects according to locality and extent. They usually pass through the thyro-hyoid membrane or thyroid cartilage, and, next to this, their most common seat is the crico-thyroid ligament or cricoid cartilage. If the cartilage be completely severed, the wound gapes, because the upper and lower fragments are drawn from each other by muscles which act in opposite directions. There is rarely much bleeding; if blood gets into the air passages, it is removed by coughing, although a clot formed in the trachea or bronchi may lead to death from suffocation, especially in wounds with small external orifices such as stabs. Danger of suffocation may also exist when the epiglottis or the arytenoids are cut through by the fragment falling into the larynx. Symptoms of stenosis also may be produced later by swelling due to hæmorrhage into the tissues (hæmatoma), œdema, suppuration, exfoliation of necrosed cartilage, and the formation of granulation tissue which may grow into the larynx. Punctured wounds, if the opening in the skin do not correspond with that in the larynx, may cause extensive cutaneous emphysema with considerable dyspnœa. Gun-shot wounds are usually complicated, and may produce irregular fractures of the cartilage, dislocation, and even tearing away of large portions of the larynx. The passage of bullets through the larynx without producing any serious symptoms (Langenbeck) is probably extremely rare.

In all serious wounds of the larynx there is complete aphonia.

Course, Results, and Prognosis.—Usually wounds of the larynx run a comparatively favourable course, if they be not too extensive, but even at a late period death may result from accidental conditions of the wound (septic infection, widespreading suppuration, phlegmon, and perichondritis), through retention of pus, or owing to impaction of necrosed and loose pieces of cartilage. One of the commonest results

of cicatrisation is the formation of membranes within the larynx. Thickening of the cartilage, due to chronic inflammation and other pathological changes, may also result.

More rare is the formation of a permanent fistula, resulting from inversion of the margins of the wound, which finally become adherent to the mucous membrane. The prognosis is unfavourable as regards restoration of function, even when danger to life has passed. More or less disturbance of voice remains, and often cicatricial contraction of the larynx presents a fresh danger.

The Treatment of wounds of the larynx begins with the removal of any fragments of fractured cartilage, and checking bleeding. If blood flows into the larynx, and if, owing to the small size of the wound, the bleeding vessels of the mucous membrane cannot be reached, tracheotomy should be performed and a tampon canula introduced. Closure of the wound by means of sutures is not to be recommended, because we thus lose control over the hæmorrhage, and there is danger of emphysema. The patient should be made to sit up in bed, and be supported in this position by means of pillows; the head is then bent forward and fixed, to prevent, as much as possible, gaping of the wound, which is covered with a moist fold of gauze. Nourishment should be administered by means of an œsophageal tube, while emphysema, when it results from a punctured wound, is treated by scarification. Stenosis, due to formation of membranes and thickening, must be treated according to rules already laid down.

Small fistulæ may heal after rawing the edges and insertion of a deep suture, but when of large size they often resist every effort.

FRACTURES OF THE LARYNX.

Fractures of the larynx are on the whole rare, and when they occur are due to force applied directly to the neck, as, for example, compression of the larynx by strangling, or the organ being forced from before backwards against the spine. Ossification of the cartilages predisposes to fracture, so that the latter occurs more commonly in old people, although it has been observed in the young.

The thyroid cartilage is most commonly injured, and, next in frequency, the cricoid, both being often simultaneously fractured; the arytenoids are rarely involved. It depends upon the nature of the violence employed whether the fracture be longitudinal, irregular, or comminuted. The latter variety usually results from being run over by wheeled vehicles, and is sometimes associated with fracture of the cornua of the thyroid cartilage.

Symptoms are pain increased on pressure upon the larynx, cough, expectoration containing blood, together with disturbance of voice and

respiration. Particularly in fracture of the cricoid, dyspnœa may be very marked and result in asphyxia. Dislocation of the cartilage, crepitation, and often marked deformity of the organ can be demonstrated. Very often emphysema of the neck is present owing to injury of the mucous membrane, and this may increase until the cellular tissue throughout the body is affected in like manner.

Prognosis is always very grave, as, even in cases in which respiratory difficulty is not marked at first, death from suffocation may result at a later period owing to swelling, dislocation of fragments of cartilage, and even after slight movements of the head.

Treatment.—It is advisable in all cases of laryngeal fracture to perform tracheotomy as a prophylactic measure, even when dyspnœa is but slight. Afterwards an attempt may be made to replace the fragments by an appropriate instrument, *e.g.* forceps passed through the tracheal wound. Paras proposes to keep the fractured cartilage in position by means of an india-rubber bag introduced into the larynx through the tracheal wound, and which can then be inflated to the desired size. Most commonly, however, fractures produce complete closure of the larynx, so that the tube must be permanently worn. If there be great pain and marked inflammatory swelling, the external and internal use of ice is indicated. In all cases it is desirable to forbid speaking entirely.

CHAPTER IV.

ADHESIONS AND CICATRICIAL CONTRACTIONS.

These occur in the larynx after deep ulceration, wounds, and extensive caustic action. Among ulcers it is principally the syphilitic which, through their great tendency to destruction and cicatricial contraction, produce various changes within the larynx.

Schroetter described several cases in which the most careful inquiries could not elicit any etiological cause. Without doubt congenital membranes exist in the larynx. The author has seen a membrane form in the case of a boy, from whose larynx numerous papillomata were removed after thyrotomy by means of a sharp spoon and the galvanic cautery.

The Symptoms consist in the disturbance of voice and respiration, the former being always hoarse, and usually aphonic. Small membranes, especially if they pass from before backwards and do not encroach much upon the lumen of the glottis, affect the breathing but slightly; on the other hand, in extensive cicatrisation, and more especially if a membrane be formed stretching from one side to the other, dyspnœa may be so great that tracheotomy becomes necessary. Laryngoscopic examination in these cases gives the most varied results. Sometimes there is a membranous connection between the cords, so that only a small opening remains for the passage of air, or membranous partitions may be seen arising from both sides of the cords and extending horizontally, so that between their margins in the middle line there is left only a very small cleft; then, again, there may be a circular band of cicatricial tissue surrounding the upper part of the larynx or diaphragm; similar membranes may be noticed beneath the cords. The contraction and cicatrisation may be so marked that it is impossible to identify individual parts of the organ.

Cicatrisation is not always so favourable to the patient as in the case mentioned above, which resulted from laryngotomy and the subsequent removal of papillomata. Here on the left side (Fig. 24) a crescentic, tendon-like membrane, several millimetres in breadth, extended from the base of the epiglottis, at about the level of the lower edge of the false cord, to the posterior wall of the larynx, completely covering the cord on the corresponding side. The cord on the right side appeared only as a small stripe in consequence of atrophy, and thus a sufficient cleft was left for the passage of air. On phonation the false

cords approach one another until they meet (Fig. 25) and produce a note; when the glottis is thus closed, only the posterior segment of the adventitious membrane is seen. The boy was thus not much inconvenienced in either respiration or phonation, although in speaking his voice sounded rough and hoarse.

The author has not for years omitted to show this boy to his class, and the membrane is almost always taken for the left cord by the students. It is only after they are shown that the right cord does not lie on the same level with the membrane that the laryngoscopic image becomes plain to them, and that they are convinced that adventitious tissue is present.

FIG. 24.

MEMBRANE FORMED AFTER THYROTOMY.

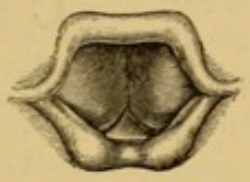


FIG. 25.

THE SAME DURING PHONATION.

TREATMENT.—As formation of membranes is almost invariably a result of morbid conditions which have run their course, the indication consists only in making the passage for respiration as free as possible by operative means. If ulcers be still present, these must be treated. If the membrane be fortunately so placed that respiration and voice are but slightly interfered with (as in the case above detailed), no operation is called for. If membranous union has occurred between the cords, attempts should be made to sever it by the knife or galvanic cautery, and when possible to remove the adventitious tissue by cutting forceps. Firm cicatrices may be destroyed either by the galvanic cautery or caustics (caustic potash). It is always a good plan to relieve the stricture by means of Schroetter's method, already described (catheter or tin bougies).

CHAPTER V.

NEOPLASMS OF THE LARYNX.

A. BENIGN NEOPLASMS.

PRELIMINARY REMARKS.—Tumours of the larynx in pre-laryngoscopic times were usually observed accidentally during dissection ; they were but rarely diagnosed during life, and that only when small portions of a growth were coughed up, or when they were so situated as to be visible when the tongue was forcibly depressed. In 1854 Middeldorpf was only able to find descriptions of sixty-four cases. To Kaderik is ascribed the credit of having been the first who successfully removed a laryngeal tumour *per vias naturales* (1750). In 1833 Braueis of Lüttich attempted to remove a polypus by thyrotomy ; and in 1836 Regnoli extirpated a tumour from above, having first, however, performed tracheotomy. Of the sixty-four cases collected by Middeldorpf, in nine only were attempts made to remove the neoplasm ; in the great majority the affection was not recognised during life ; and when a diagnosis was made, it was one of probability only. Anatomically, growths had already been described by Morgagni, and later by Lieutaud, but it was only in 1850 that a careful monograph on the subject was published by Ehrmann. In the following year Rokitansky added to Ehrmann's work and made important additions to our pathological knowledge.

After the introduction of the laryngoscope a marked change occurred. It became possible to recognise a tumour early and certainly, and the number of observations increased to such an extent that the total number of cases described in pre-laryngoscopic times was soon greatly exceeded. After Von Bruns in 1861 removed a pedunculated fibroma from the larynx of his brother *per vias naturales* with the best result, this method was imitated on all sides, and endo-laryngeal surgery became developed to an almost incredible extent. It is now impossible to give even approximately the number of successful cases, or even to collect those which have been recorded ; it is sufficient to state that single authors can refer to hundreds of cases operated upon by themselves (Fauvel, 343 up to 1877 ; Mackenzie, 223 up to 1878).

All laryngeal tumours, and more especially when pedunculated, have been designated polypi without regard to their structure. This is not

justifiable either on histological or practical grounds; and we prefer to divide tumours into (1) benign and (2) malignant, not only because of histological distinctions, but because each of these divisions runs a different course and requires different treatment.

Etiology.—The cause of laryngeal tumours is uncertain, although catarrh, and more particularly the chronic variety, has been most blamed for their development; positive proof of this it is, however, impossible to obtain. The author does not remember that among many thousand cases of laryngeal catarrh observed by him for a longer or shorter time he ever actually saw a tumour develop. It is, however, certain that many forms, especially papillomata, are accompanied by chronic catarrhal inflammation of the laryngeal mucous membrane; but, on the other hand, tumours are not uncommonly found with absolutely healthy surroundings. In the first case it is doubtful whether or not the catarrh be caused by the tumours, and in the second a localised cause may be assumed as probable. Klebs has pointed out that the most common position of fibromata is on certain parts of the vocal cords, and that these correspond to the nodal points. Schnitzler, who agrees with this view, calls such growths "inflammatory nodes" (Entzündungsknoten). This comparison with the stationary or nodal points in the graphic representation of sonorous vibrations is, however, not apt, because on the one hand free vibrating membranes such as the cords show different vibrations, and therefore different nodal points, with the production of each tone. It must remain for future investigation to establish whether certain anatomical and physiological conditions of the cords predispose them to the formation of tumours at certain points (anterior commissure and anterior half of the ligamentous portion); and if so, for what reason these parts are more prone to be attacked.

Tubercle and syphilis do not favour the development of tumours properly so called, but only give rise to polypoid hypertrophy of the mucous membrane, especially at the margins of ulcers in the interarytenoid fold.

French laryngologists believe in a so-called "polypoid diathesis," characterised by the appearance of warts in various situations, such as the hands, eyelids, and feet (Poyet). Heredity has also been spoken of in connection with laryngeal tumours, but observations in support of this view are so few that they cannot be considered as conclusive.

A number of observations, on the other hand, go to prove the congenital occurrence of laryngeal growths, in so far that the voice has been found hoarse and aphonic from birth. In a case described by Arthur Edis a child died from suffocation thirty-seven hours after birth, and dissection revealed a cyst as large as a hazel nut.

Mechanical irritation of the laryngeal mucous membrane through excessive use of the voice in the exercise of a profession (*e.g.* vocalists,

teachers, clergymen, and public speakers) seems to favour the development of neoplasms. Mackenzie was able to ascribe the condition to this cause in ninety-one per cent. of his patients.

As to age, the liability seems greatest between twenty and fifty, and next in frequency comes childhood, more particularly during the first year; in many cases which were first observed later in life the voice was abnormal from a very early age. Laryngeal growths rarely appear after sixty. Interesting from an etiological point of view is a case which was verbally described to the author by Sommerbrodt. A clergyman eighty years of age had been in the habit of preaching with a powerful clear voice, but six weeks after he had resigned his appointment he became hoarse without any apparent cause. When Sommerbrodt examined him four months later there was a mucous polypus as large as a pea on the anterior commissure. In this case, it is to be remarked that a neoplasm became developed in old age just after the patient had given up his clerical duties. Men are more apt to be affected than women; and it is more than doubtful whether the cause lies only in the occupation of males which exposes them more to laryngeal irritation, for even in childhood the masculine larynx is much more frequently affected.

Pathology.—Of benign neoplasms the following occur in the larynx: viz. papillomata, fibromata, cysts, lipomata, myxomata, enchondromata.

(*a*) Papillomata are the most commonly observed neoplasms of the larynx, and that more especially during childhood. The vocal cords, particularly their anterior two-thirds, the ventricular bands, and the aryepiglottic folds are the favourite situations for papillomata, and they sometimes occur on the posterior surface of the epiglottis. They are either single or multiple, and are usually sessile, although sometimes pedunculated, while in size they vary from a mustard seed to a walnut. According to Oertel, there are three types of papillomata which are to be distinguished, not histologically, but by their external configuration:—

1. Small, usually multiple, scattered, warty growths of a dark red colour; they are commonly situated on the margins, the lower surface, or anterior commissure of the cords, and rarely exceed the size of a bean.

2. Tumours of villous structure and marked papillary structure; they are attached by means of broad bases almost without exception to the cords, and appear as groups of smaller or larger conical processes of a greyish white colour.

3. Large reddish tumours (resembling a grape, mulberry, or cauliflower) showing a partly villous and partly warty structure; they are rarely solitary, and in extreme cases fill the whole interior of the larynx. This is the form most commonly seen in children, and not unfrequently leads to death from suffocation.

Histologically, papillomata are composed of connective tissue traversed

by numerous thin walled capillaries and covered by layers of epithelium.

(*b*) Fibromata appear as hemispherical or spherical, usually pedunculated neoplasms, having commonly a dirty white, reddish, or even dark red colour, and a more or less firm consistence. Fibromata do not occur in the larynx nearly so frequently as papillomata, but still more often than other neoplasms. They are almost always single, and grow by preference from the cords being attached either to the upper or under surface. In size and form these tumours are subject to very great variations. We have already referred to the small nodules, ranging in size from that of a pin head to a mustard seed, which are sometimes seen on the margin of one or both cords; they almost always occur at one spot, viz. the centre of the ligamentous portion, and should both cords be affected the nodules are symmetrical. According to all authors, they are principally found in vocalists, and have hence been designated by Stoerk "Sängerknoten" (singers' nodules). It seems doubtful whether as a matter of fact over exertion of the voice leads to the formation of these nodules. We have often seen them in persons in whom this cause could be excluded; and we have now under treatment a girl of ten years of age who, according to her mother, is "a good child," and has never over exerted her voice in crying, etc. These nodules may often last for years without increasing, and they may also disappear spontaneously. The more common form of fibroma, however, is a circumscribed tumour firmly attached by a broad base, hemispherical in shape, and about as large as a lentil, or it may be more elongated or club-shaped. As the lower attached portion of the tumour becomes thinner and longer, the fibroma becomes pedunculated (Fibroma polyposum propendens). The size of a fibroma rarely exceeds that of a hazel nut; when pedunculated it is usually smaller, seldom exceeding the size of a bean; in exceptional cases sessile tumours may attain the size of a walnut. The colour may be dirty white, pale or dark red, while the consistence may be hard or soft.

Histologically, fibromata are composed of connective tissue containing elastic fibres, while the vascularity varies in different cases.

(*c*) Cysts are comparatively rare in the larynx. When they occur they appear as hemispherical, spherical, or oval projections which have a tense fluctuating feeling, and are slightly transparent. They are surrounded by a simple thick membrane, and sometimes contain a transparent, watery, serous-like fluid, while again their contents may be thick and viscid. Cysts are to be looked upon as tumours caused by retention of glandular secretion, and consequently occur most frequently in parts where there are glands, and where these can increase in size without hindrance, *e.g.* the ventricles and the anterior surface of the epiglottis; they rarely exceed a cherry in size.

(*d*) Lipomata of the larynx are extremely rare. Of three cases recorded,

in two (E. Wagner and Tobold) the point of origin of the growth is not stated; but in the third, operated upon by Bruns, the tumour originated in the left half of the posterior laryngeal wall, filling the whole aperture of the larynx, was smooth, shining, and of a light red colour and soft elastic consistence. It was composed of an external membranous covering, which contained two firm masses, the latter being united with one another, and with the capsule by loose connective tissue. The capsule was found to be the expanded mucous membrane of the left arytenoid, and its epithelium consisted of numerous layers. The contained bodies represented two oval hard fatty tumours of equal size, in which the fat cells were of medium size, connected with one another by fibrous tissue, and partly filled with margarine crystals.*

(*e*) Myxomata.—Tumours of purely myxomatous structure seem to be very rare in the larynx. Mackenzie observed a neoplasm on the right cord which was partly mucous in its structure, while Bruns saw one which was found by the microscope to be a hyaline myxoma; the latter grew from the right wall of the laryngeal cavity, was irregularly pyriform in shape, of reddish yellow colour, firm but elastic in consistence, and nearly filled the upper division of the larynx. It consisted of a capsule and gelatinous contents; the former, which was not sharply separated from the gelatinous mass, was composed of fibrillar, connective tissue with few nuclei, and was covered with epithelium, which was composed in parts of a simple layer of large granular pavement cells, with distinct round nuclei, while at other points it was arranged in layers, so that its deepest division consisted of short cylindrical cells, outside of which were polyhedral, and finally plate-like cells. Numerous transverse partitions divided the tumour into a number of irregular lobes and lobules. The gelatinous mass had all the characteristics of mucous tissue,—cells few in number and varying in shape and size, imbedded in a quantity of almost homogeneous intercellular substance.

(*f*) Enchondromata or cartilaginous tumours which arise in connection with pre-existing cartilage originate, according to Virchow, from the cricoid or thyroid cartilage, and usually grow inwards towards the laryngeal cavity, but sometimes, according to Mackenzie, downwards in front of the trachea; sometimes they are smooth and diffuse, sometimes circumscribed and nodulated.

(*g*) Tumours composed of thyroid gland tissue may appear in the lower part of the larynx. These have been observed three times—once by Ziemssen and twice by Bruns—and in all three cases the laryngeal stenosis was very marked. Probably such tumours originate in a lobule of the gland becoming caught, or from the struma accessoria, as it has been called by Albers.

* Schroetter has recently described a case of extensive lipoma of the larynx (Monatsschrift für Ohrenheilkunde, 1884) (Translator).

Besides these forms of tumour, single observations have been made pointing to the occurrence of angiomata, adenomata, lymphomata (observed by Eppinger post mortem as a metastatic tumour in lymphomatosis, affecting all the lymphatics, and originating in disease of the retroperitoneal glands). These tumours are of no special clinical interest.*

Symptoms.—The symptoms of benign neoplasms of the larynx depend less upon their nature than upon their seat and extent. Change in the voice is usually present, and very often this is the only symptom. In the majority of cases there is complete aphonia or hoarseness, but sometimes the voice is only rough. Tumours of the epiglottis, and sometimes of the aryepiglottic folds, when non-pedunculated and of small size, so that they do not encroach upon the vocal cords, may exist without affecting the voice or producing any other symptom, and their presence is often only discovered by chance. Dysphonia is most constant and marked in tumours of the cords; its degree, however, depends not upon the size of the growth, but upon its place of attachment and shape. Small sessile tumours of the cords may produce much more marked vocal disturbance than comparatively large pedunculated ones, which are not caught between the cords in phonation, but hang freely into the larynx; in like manner, small growths on the upper surface of the cord interfere with the voice less than those which are attached to its free margin. Diffuse papillomata always produce aphonia; in pedunculated growths the voice may be subject to frequent changes, because during inspiration the growth may be drawn down beneath the cords and admit of their approximation, while, again, a strong expiratory effort may drive it up between them. So also in polypi, which so long as they were small produced marked loss of voice, when they grow larger and become pedunculated the voice gets louder and clearer. Subcordal tumours may, if they be sessile, produce no symptoms; if, on the other hand, they reach a considerable size, they often produce aphonia by diminishing the column of air which passes through the larynx; the same happens if they be pedunculated and forced between the margins of the glottis during phonation. Sometimes during phonation a valvular sound is produced by the growth striking against the walls of the larynx, or the voice is rough, or apt to assume the falsetto form through the formation of nodal points; this is especially the case in the nodular variety of fibroma which we have already described. In this affection the vocal disturbance is often so slight that medical aid is not sought.

The author does not believe in the usually accepted theory that these nodules usually

* Elsberg has recently described several cases of vascular tumour, and from these observations it would seem that angiomata can usually be diagnosed by their dark colour, and their occurrence is of clinical importance, in so far that their removal may be attended with considerable hæmorrhage (Translator).

occur in vocalists, but thinks that they are most often seen in this class of persons, because they interfere with the exercise of the patient's profession.

Difficulty of respiration due to laryngeal neoplasms is much less common than vocal disturbance. It occurs perhaps in a third of all cases, and depends upon the size and attachment of the growth. The dyspnœa is mixed, being partly inspiratory and partly expiratory, and is either paroxysmal or constant, with occasional exacerbations. The attacks are caused, just as we have seen to be the case in other forms of laryngeal stricture, by mental excitement, physical exertion, or a collection of mucus. In pedunculated growths the dyspnœa may occur only in certain positions, because in the case of a movable tumour the glottis may be covered or not, according to the position of the head. Large diffuse papillomata on the cords always oblige the patient to keep the upright posture. In this form of tumour the dyspnœa may increase to extreme severity, and in pre-laryngoscopic times a large number of observations were made of patients being suffocated in this way.

Pain is almost never present, nor is dysphagia, excepting in large tumours of the epiglottis ; many patients, on the other hand, complain of abnormal sensations. The feeling of a foreign body is seldom present, but sometimes there is a sensation of pressure.

Cough is usually not present, but patients often require to clear the throat ; sometimes there is a dry cough with a hoarse, aphonic, or croupy sound. Mackenzie has recorded two cases in which cough occurred in the most fearful paroxysms.

Laryngoscopic examination almost invariably enables us to detect the presence of a neoplasm in the larynx ; only small growths near the anterior commissure may be overlooked if the epiglottis be strongly inclined backwards. It is more difficult, particularly in the case of large

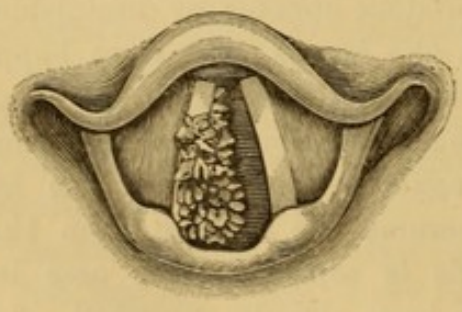


Fig. 26 *a*.

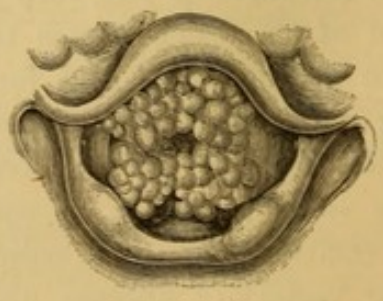


Fig. 26 *b*.

growths, to make out the point of attachment, and it may be only possible to ascertain this by the use of the probe, or even after operative removal. In the case of small growths in the neighbourhood of the anterior commissure it often remains doubtful whether the point of

attachment is the angle formed by the cords, or the anterior part of one of the latter. The most common points of attachment are the cords, and the least common the arytenoids and the aryepiglottic folds. As to the nature of a neoplasm, the mirror only gives so much information as can be derived from the shape and appearance of the tumour as described in the section on "Pathology." Speaking generally, we can only say of papillomata and fibromata (the growths which are most commonly met with) that the former appear as sessile, cauliflower, or mulberry-like masses (Fig. 26 *a*, *b*), while fibromata are generally pedunculated, and sometimes nodulated (Fig. 27 *a*, *b*).

Course and Results.—Neoplasms of the larynx are formed gradually and grow slowly. When a certain stage has been reached, they often

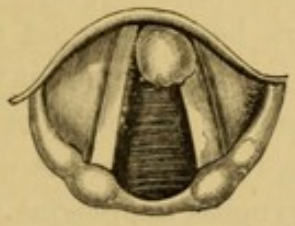


Fig. 27 *a*.

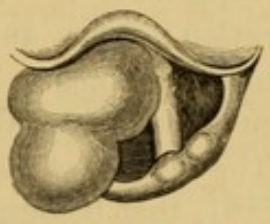


Fig. 27 *b*.

remain stationary for years; papillomata, however, may become developed quickly, and have also a tendency to grow and extend. Gerhardt writes very much to the point when he says: "Their common occurrence in numbers points to a tendency to extend approaching contagion. One is all the more reminded of this by observing how a point in the vocal cord which has been accidentally injured in operating on a papilloma may also become the starting-point of a similar growth."

A good illustration of this is afforded by a case which is still under the author's treatment, and which we shall briefly describe. H. S., a washerwoman, æt. 44, applied for advice on account of hoarseness which had lasted for several months. The cause of this was found to be a papilloma as large as a pea, situated on the margin of the anterior third of the right cord, the left cord was seen to be quite healthy. After due preparation, the tumour was removed by means of the snare; and as afterwards some small granulations remained, they were cauterised with the galvanic cautery. After this the voice became clear, and the patient was believed to be cured; so that we were much surprised when she returned three weeks afterwards, completely aphonic, and suffering from dyspnœa. On both cords there were seen papillomata which covered the margins of the glottis. It seemed almost as if the operation had given rise to this sudden development of tumours, for before no tendency to increase had been noted. The author succeeded in removing portions of tumour with his tube forceps, but in a few days the laryngoscopic appearances were as before; indeed, the papillomata increased in size and extent, so that lately tracheotomy was necessitated owing to great dyspnœa. After Prof. Fischer had opened the windpipe, another partially successful attempt to operate through the mouth was made. The subcordal space down to the tracheotomy tube was, however, so filled with papillomata that further endo-laryngeal operations were abandoned, and removal by thyrotomy advised, and the latter operation was successfully performed by Prof. Fischer. After the introduction of a Trendelenburg's canula, an incision was made through the soft parts from the thyroid notch to near the opening in the

trachea, and the cartilage divided. The growths, which were situated mainly on the right cord, and had a conical-pointed appearance like condylomata, could be easily scraped off with a sharp spoon. The wound healed rapidly under the application of iodoform. The growths when removed were found to be exceedingly soft, and were seen under the microscope to be very vascular papillomata. Four weeks after the operation the voice was still aphonic, and the vocal cords were seen to be reddened, but met in the middle line, though deficient in tension.

Papillomata always show a marked tendency to return; not only do they recur at the primary point, when their removal has been incomplete, but even after perfect extirpation they appear on previously healthy parts. The other forms of tumour found in the larynx show no tendency to return after removal. It very rarely happens that a growth is coughed out spontaneously, when, of course, the voice returns, but occasionally small fragments are expectorated. Papillomata rarely undergo fatty or amyloid degeneration; a few authors have recorded instances of their development into epithelioma. Benign neoplasms may cause death from suffocation if their timely removal has been neglected or found impossible.

Prognosis.—The dictum of Rühle, repeated in his work on Laryngeal Disease, dated 1861, that benign laryngeal neoplasms had hitherto been almost always malignant for the patients in whom they occurred, because only a few cases of successful operation had been hitherto recorded, and that, looking at it from the point of view of these unsatisfactory results, it was quite immaterial whether innocent connective-tissue or cancer caused suffocation, has in the present day entirely lost its significance and its terror. The prognosis of benign neoplasms is, so far as the preservation of life is concerned, by no means unfavourable; it is better in proportion as the conditions for endo-laryngeal interference are favourable; and even when this is not possible, and when suffocation threatens, the prognosis is only unfavourable in so far as tracheotomy, which becomes necessary, is a dangerous operation. In those cases, however, where operative removal of the growth is not possible and tracheotomy is refused or neglected, the danger increases in proportion to the size, the rapidity of growth (especially as we have seen in papillomata), and the possibility that the tumour, either because of its attachment near the glottis or its pedunculated character, may produce sudden choking. We have seen small fibromata last for a decade and more without causing any danger to life. In childhood the prognosis in less favourable, because (1) laryngoscopic diagnosis and endo-laryngeal operations are more difficult, or even impossible; (2) papillomata are more common in childhood; (3) the small size of the larynx increases the danger of suffocation; (4) children are more prone to spasm of the larynx; (5) tracheotomy gives less favourable results than in adults.

As to the restitution of voice, even in cases where endo-laryngeal removal of the growth succeeds, the prospect is not always equally

favourable. Pedunculated fibrous tumours yield good results; but if there be multiple sessile tumours not sharply defined from the surrounding tissue, slight inequalities and thickenings which interfere with the functions of the cord are apt to remain.

Diagnosis.—The only certain means of diagnosing neoplasms is the laryngeal mirror, and for this reason we must remain in doubt in all cases in which laryngoscopic examination is impossible, *e.g.* young children. Neither functional disturbance, digital exploration, nor auscultation can give definite data. Neither do we agree with Mackenzie, that an experienced laryngologist can diagnose with probability the presence of a growth from a peculiar and changing character of the voice, a croupy cough, and paroxysmal dyspnoea. If laryngoscopic examination be possible, the following conditions may be mistaken for a tumour: (1) The pathological products of phthisis, syphilis, or lupus; (2) malignant tumours; (3) eversion of the ventricles.

Tubercular infiltration is distinguished from neoplasms by the fact that it shades off gradually into the surrounding catarrhal mucous membrane. In phthisis there are often seen inflammatory granulations very like papillomatous growths on the interarytenoid fold, especially on the edges of tubercular ulcers. True tumours are extremely rare on the posterior surface of the larynx, and these polypoid tubercular growths may be recognised by the fact that they are always situated on an infiltrated base or on the edges of ulcers.

Syphilitic growths only result from ulceration and subsequent cicatrisation. They appear as irregular projections from the margins of recent or old ulcers.

Gummata do not form circumscribed tumours with a sharp demarcation from the surrounding parts, but gradually pass into the congested tissue.

Lupoid thickening is easily distinguished from tumours by its tendency to ulcerate.

The differentiation between innocent and malignant growths is often more difficult, especially in their early stages; the latter show a more uniform infiltration, produce greater congestion of the mucous membrane, and soon ulcerate. In doubtful cases microscopic examination of portions of a tumour which have been expectorated or removed, may establish the diagnosis.

Prolapse of the mucous membrane of the ventricles is very rare, and where it occurs is the result of severe paroxyms of cough; a tumour of considerable size is then produced which simulates a neoplasm. The absence of the normal hollow of the ventricle affords aid in arriving at a diagnosis.

Treatment.—Innocent tumours can only be removed by operation, and

the following questions arise: (1) Under what circumstances may operation be abstained from? (2) What should be done if for some reason an operation cannot be performed, or if after it has been recognised as necessary, it is refused by the patient? (3) How are we to choose from among the different methods of operating for each individual case? (4) What are the bad results as to life or function which may follow the various methods of operating?

As to the first point, it cannot be denied that many tumours—especially those situated on the epiglottis or false cords—cause such slight symptoms that in nervous patients an operation may be avoided. We have already stated that fibromata in particular cease to grow when they have attained a certain size; but it is always advisable to examine the patient from time to time. Even on the cords small growths may interfere so little with the voice as to warrant their being left alone.

We are acquainted with an advocate who is not prevented from pleading by the presence of a fibrous growth on the right cord, which has been there for five years; his voice is rough, but has not become worse during this time.

On the other hand, operative removal is urgently indicated in all tumours which impede respiration; for one can never be certain that the dyspnœa, slight as it may be at first, will not increase to a dangerous extent either owing to increased size of the neoplasm or some intercurrent affection. If in such a case operative removal be not practicable, tracheotomy becomes necessary in order to obviate immediate danger.

When possible, however, the radical operation must be preferred to the palliative.

Radical treatment may be carried out by one of two methods—(1) *Per vias naturales* (endo-laryngeal operation); (2) opening the laryngeal cavity from without.

Endo-laryngeal Operations.—This method requires dexterity on the part of the surgeon, aided by assistance and the manifestation of a certain amount of intelligence on the part of the patient. A surgeon who is not sure of his hand, and who has not practised with the laryngeal sound upon the living larynx (as well as a phantom), should not undertake an endo-laryngeal operation. The patient must afford assistance by keeping steady and by carefully following the instructions of the operator.

We have already, in a previous chapter, described the difficulties encountered in the introduction of instruments, and what means may be adopted to diminish the sensibility of the pharynx, and more especially of the larynx. We will only mention that for the great majority of cases we consider local anæsthetics as unnecessary, and that it is

sufficient to blunt sensibility by introduction of the sound during some time prior to the operation.*

When the surgeon has convinced himself that the patient has learned to keep quiet, to respire freely after the introduction of mirror and probe, to avoid swallowing, and specially to bear contact with the probe when applied to various parts of the larynx without coughing, spasm, or retching, he may proceed to the actual operation.

It is necessary to warm instruments before their introduction into the larynx, as they then cause less irritation. Endo-laryngeal removal of growths is accomplished by tearing, crushing, abscision, incision, puncture, snaring, and caustics, the latter being either chemical or thermal (galvanic cautery). The choice of method depends upon the structure and seat of the growth, and in part also on the preference of the operator; it is often necessary to combine several methods.

Tumours may be torn out by means of the author's laryngeal forceps. This method is almost exclusively employed in France for all cases (hence spoken of by Fauvel as *méthode française*), and it also finds favour in England. As it does not exclude the possibility of injuring neighbouring parts, it should be confined to such cases as are unsuitable for other methods (especially soft sessile tumours).

Crushing neoplasms is carried out by means of the same instruments, but the branches should be flatter and rougher. This method is useful for small very hard growths, and the modus operandi is that repeated powerful compression of the tissue produces mortification, and subsequent throwing off of the dead portion.

Tumours which are loosely attached may be removed by strong pressure or by traction. For this purpose may be used an instrument resembling a laryngeal probe, whose extremity is provided with a deep groove from two to three centimetres long, and having sharp but not cutting edges (Bruns' scraper); chisel or file like instruments are also sometimes employed. The surgeon attempts to rub or scrape off the growth with these instruments. The sponge method introduced by Voltolini acts in like manner. A sponge about as large as a pea or bean, firmly attached to a bent copper wire, is introduced into the larynx below the neoplasm, and an attempt is then made to tear off the growth by moving the instrument up and down. This method is only useful in soft pedunculated tumours; it may, however, be successful where other means have failed, but it is unpleasant and painful to the patient.

Abscision, incision, and puncture are carried out by means of knives, scissors, cutting forceps (Mackenzie), and guillotines. We consider abscision by means of a lancet-shaped knife as the most rational

* This remark hardly applies since the introduction of cocaine for this purpose by Jellinek, who employs a 20 per cent. solution, and applies it by means of the brush. Two or three applications seem to be often quite sufficient (Translator).

proceeding, because in no other operation can the instrument be so accurately followed by the eye up to its last act. It is true that this method requires a steady hand to make cutting in the desired direction possible, and it is particularly adapted for pedunculated and pyriform tumours when projecting into the lumen of the larynx. In tumours of the anterior commissure a knife cutting in the transverse direction is used, while for a tumour the axis of which is horizontal, situated on the aryepiglottic folds, a probe-pointed blade is employed.

In many cases the surgeon does not succeed in completely cutting through the base of the tumour; in such cases repeated incision of the growth may produce its death and cause it to fall off. In like manner, small broad flat neoplasms may be caused to mortify and disappear by repeated punctures which destroy their nutrition. In cysts a single incision is sufficient.

Instead of lancet-like knives, cutting forceps or guillotines may be used; their application is, however, limited, because (1) only small growths situated on the margins of the cords can be thus removed, and (2) because they inconvenience the patient by their size.

Snaring tumours by means of a wire loop or laryngeal ecraseur comes next to abscision in practical value. This method is useful in neoplasms which are not too large, and which are either pedunculated or project into the lumen of the larynx, so that the wire loop can be applied to them; the snare must be applied quite close to the base, so that part of the growth may not be left behind.

The snare does not always act as an ecraseur, for traction is sometimes employed; thus a growth is sometimes removed before the wire has been drawn quite tight. In a case operated on by the author a long narrow fibroma growing from the anterior commissure was divided by the snare into two unequal portions; the smaller anteriorly rested on the cords, while the larger posterior part hung down between them, and thus on phonation the portion where the snare was applied was grasped between the cords. The operator did not succeed in getting the snare nearer the base of the tumour; but, fortunately, the latter was entirely removed by the traction unavoidably exerted in drawing the wire home; probably the resistance of the tissue of the growth was greater than at its point of attachment. The tumour which has been preserved still shows an hour-glass contraction.

The removal of tumours by cauterisation is not now very often practised. The application of a solution of concentrated nitrate of silver has little effect except in the case of the small fibrous nodules which we have described as occurring on the cords (Sängerknoten). Touching small growths with solid nitrate of silver is not of much use, but this plan is adopted by a few authors with the hope of preventing recurrence in cases of papillomata. Chromic acid is more powerful in its action than nitrate of silver; the crystals are applied by means of a covered port caustique, and produce extensive action. This method produces spasm, and some-

times severe inflammation of adjacent parts, and should be employed with caution.

The author uses the galvanic cautery instead of chemical caustics for the following purposes: (1) Destroying the remains of a growth; (2) to cauterise the base of an extirpated papilloma or sarcoma; (3) to prevent recurrence in diffuse sessile tumours. The galvano-caustic snare can, we consider, be dispensed with; and we believe that it is unjustifiable to make use of this method in all operations, as is done by some.

The Removal of Tumours by Opening the Larynx.—This method is older than laryngoscopy; for in 1833 Brauers of Löwen, and in 1844 Ehrmann of Strassburg performed thyrotomy for the removal of tumours. Laryngoscopy has, however, given us more definite indications for this operation.

Access may be obtained to the interior of the larynx for the purpose of removing tumours by three methods: viz. (1) Division of the thyroid cartilage in the middle line or thyrotomy; (2) division of the crico-thyroid ligament or infra-thyroid laryngotomy; (3) division of the thyro-hyoid membrane or sub-hyoid pharyngotomy (Malgaigne).

As thyrotomy exposes the greater portion of the interior of the larynx, and is apt to interfere with the function of the organ, this operation is spoken of as total laryngotomy in contradistinction to opening the larynx without injuring the thyroid cartilage, which is called partial laryngotomy.

1. The removal of tumours by thyrotomy is performed in one or other of the following ways: viz. (*a*) Division of the cartilage from its lower to its upper border; (*b*) without carrying the division quite up to the top; (*c*) complete division of the cartilage, the crico-thyroid ligament, the cricoid cartilage, and several rings of the trachea. As complete division of the cartilage may, after healing, produce changes in the position of the cords with resulting incurable aphonia, it is better when possible to adopt partial division. After opening the larynx, the two plates of the thyroid are held apart by strong hooks; the interior of the cavity is then illumined by reflected light, and the tumour removed by means of scissors, a snare, galvanic cautery, or, indeed, with whatever instrument is suitable for the individual case. In the case of pedunculated growths, and when there is plenty of room, the tumour may be caught by means of hooks or forceps.

2. The removal of tumours by means of infra-thyroid laryngotomy comprises division of the crico-thyroid ligament alone or of the cricoid cartilage also; it is rarely necessary to divide the first rings of the trachea as well (crico-tracheotomy). The neoplasm is extirpated through the opening so made, as in thyrotomy.

3. The removal of tumours by sub-hyoid pharyngotomy is carried out by means of an incision through the thyro-hyoid membrane along

the lower edge of the hyoid bone and parallel with it. The edge of the epiglottis is seized and pulled through the opening, and then the tumour is removed by knife, scissors, or forceps.

As thyrotomy exposes nearly the whole interior of the larynx, it enables a tumour to be removed from any part. Infra-thyroid laryngotomy is only applicable to neoplasms which are altogether below the cords or attached to their inferior surface; by sub-hyoid laryngotomy only tumours situated in the upper part of the larynx can be reached.

We must next consider the endo and extra laryngeal methods, with reference to their relative values. We have no doubt that the operation *per vias naturales* (endo-laryngeal) is indicated whenever its performance is practicable. Extra-laryngeal operations are only justified when the other method cannot be employed, and when marked symptoms are present (marked dyspnœa, complete aphonia, or dysphagia).

Endo-laryngeal removal of a tumour is, whatever method be adopted, a slight, comparatively simple, usually painless proceeding, unattended by appreciable hæmorrhage; it often at once restores the function of the organ; and when this is not the case, as in diffuse papillomata, the fault lies not in the operation, but in the morbid condition. It is, moreover, free from danger to life and function. When serious injury is accidentally inflicted, this is due to want of skill or care on the part of the surgeon.

Thyrotomy, on the other hand, which is the extra-laryngeal method most used for the removal of tumours, must be looked upon as an operation difficult to perform, dangerous to life, and doubtful as to the influence it may have on the function of the organ.

The difficulty lies not so much in the division of the cartilage, which, however, may be serious owing to calcification (especially in patients of advanced years), but in the extirpation of the growth. The parts are by no means so well seen as one is inclined to expect. Even complete laryngotomy affords only limited room; and drawing aside the pieces of the divided cartilage, a process not always devoid of danger (Bruns recorded a case of fracture of the ossified thyroid cartilage produced in this way), does not always afford sufficient space.

A further difficulty is encountered in the free bleeding, which is particularly apt to occur in the case of papillomata. This is due not only to the danger of blood getting into the trachea and bronchi, thus producing suffocation or inflammation, which may be prevented by first performing tracheotomy and then inserting a Trendelenburg's canula, but the small surface exposed is apt to be concealed by hæmorrhage. The introduction of sponges to prevent bleeding causes severe cough whenever the anæsthesia is diminished. Paul Bruns says rightly, "A sufficiently profound anæsthesia cannot be maintained during the whole operation, which on account of interruptions may last from one to two hours, and the exciting scene is changed from time to time; sometimes the violent paroxysms

of cough require the production of increased anæsthesia, and sometimes cessation of respiration requires the removal of the chloroform and artificial respiration."

We shall not here enter upon the dangers which may develop during the process of healing, but only refer to the effect of thyrotomy upon the voice. Bruns founds the following conclusion on his statistics, viz. that thyrotomy in the majority of cases is fraught with danger to the voice.

Simpler, easier, less serious, and with better prospects of a good result, is extirpation by means of partial laryngotomy and sub-hyoid pharyngotomy; the space so obtained is, however, so small that their utility is extremely limited. Sub-hyoid pharyngotomy, in particular, only gives access to those parts which are most easily reached by the mouth.

A consideration of all these facts brings us to the following result: In all cases of benign neoplasms of the larynx their removal by the endo-laryngeal method should be attempted. If there be great dyspnœa, and if an endo-laryngeal operation cannot be performed quickly enough, or if it be impossible, then tracheotomy should be carried out, and afterwards endo-laryngeal treatment again attempted. If the surgeon be convinced that this cannot be accomplished, and if suffocation occurs on closing the tracheotomy tube, then, and then only, is thyrotomy to be performed, and if practicable, only partial thyrotomy.

Tumours of large size situated below the cords which cannot be reached by the mouth may be removed by sub-thyroid laryngotomy. Slight vocal disturbance by no means justifies thyrotomy for the removal of a tumour. If there be complete aphonia, and if the patient insists upon it, division of the thyroid cartilage may be undertaken after the patient has been warned of the severity of the operation and of its dubious results as to restoration of voice. In innocent tumours sub-hyoid pharyngotomy is hardly ever indicated.

The author has only been obliged to resort to laryngotomy three times on account of severe dyspnœa—twice in children in whom there were diffuse papillomata. He can only say that the removal of growths through the divided thyroid cartilage is, at least in children, one of the most difficult and painful of operations. Exactitude in operating so as to spare sound tissue can hardly ever be attained in the case of diffuse sessile tumours. In one case, that of a boy seven years of age, the process of healing resulted in the formation of a membrane as depicted in Figures 24 and 25. Cases are also recorded by other authors in which after division of the larynx chronic inflammation (Navratil, V. Bruns), narrowing of the glottis such as occurs after ulceration (Buck), cicatricial distortion of the right cord (Holmes), partial destruction and thickening of the cords (Beschorner), partial thickening of the cords (Czerny), etc., occurred.

B. MALIGNANT TUMOURS OF THE LARYNX.

Malignant tumours may be primary or secondary; the latter rarely occurs from metastasis or cancerous infection, but usually results as an extension from parts adjacent to the larynx.

Etiology.—The causes of malignant tumours of the larynx are here, as in other parts, uncertain. It has been said that chronic irritation may give rise to their development, and, according to Fauvel, inflammation precedes the development of cancer. In a few cases the disease was observed to be due to trauma, and it appears that under certain unknown conditions papillomata may undergo cancerous degeneration. Advanced age is a common predisposing cause; according to Mackenzie, 83 per cent. of all cases occur between forty and seventy, and males are more liable to be attacked than females. Trade and occupation seem to exercise no influence.

Pathology.—Carcinoma and sarcoma may be met with in the larynx.

(*a*) Cancer appears most commonly as epithelioma, medullary cancer comes next in frequency, but is much rarer, while scirrhus is least common. Epithelioma appears either as circumscribed, hemispherical, warty, cauliflower-like, or roughly nodular masses of varying size, or as slightly uneven infiltrations which are only a few millimetres in height. Medullary cancer occurs as a soft vascular growth composed of large nodules which rapidly ulcerate, while scirrhus is firm and hard. All three forms may lead to deep ulceration of the soft parts and perichondritis, with the formation of abscess and necrosis of cartilage, but in scirrhus the destructive process is usually slower.

Histologically, laryngeal cancer does not differ from that of other organs.

Primary cancer usually takes its origin from the cords or ventricular bands, and often extends over the whole upper and middle part of the larynx.

(*b*) Sarcoma is much less common in the larynx than carcinoma, and displays great diversity in its appearance, colour, extent, and consistence. The tumour is usually sessile, sometimes smooth, sometimes warty, or even lobulated, while the colour is either light or dark red, with a tinge of yellow.

The histological characters are those of round, spindle or fibrous sarcoma.

Symptoms.—The symptoms and functional disturbances in cancer of the larynx are but slightly characteristic, as they may occur both in innocent tumours and in other diseases.

The earliest and most constant symptom is hoarseness, which, although slight at first, gradually extends to complete aphonia, particularly when the tumour is situated on the cords. Hoarseness may for a long time be the only symptom, but sooner or later pain in the larynx or deep parts of the pharynx is superadded. Ziemssen characterises this symptom as one to which weight may be attached, under certain circumstances, in the differential diagnosis of cancer; it must, however, be observed that pain may be absent, and that it also occurs in other

ulcers of the larynx. The pain radiates to the ear of the affected side, probably on account of stimulation of the sensory fibres of the superior laryngeal nerve, which is propagated to the auricular branch of the vagus. If the tumour be situated high, there is marked dysphagia. As the ulceration progresses the breath becomes fœtid, and sometimes hæmorrhage occurs either in quantity or as streaks in the muco-purulent secretion. Symptoms of laryngeal stenosis are rarely wanting; they gradually increase with the growth of the tumour, and may necessitate tracheotomy. At a later stage the lymphatics at the inner edge of the sterno-mastoid become enlarged, and the cancerous cachexia is not always so marked as in other forms of malignant disease.

Laryngoscopic examination shows varied, and not always characteristic, images. In the early stage, when indeed the disease is seldom observed, a diffuse swelling is seen on the affected part (vocal cord, ventricular band, epiglottis, etc.), which has nothing characteristic in its appearance; scirrhus and sarcoma, in particular in their early stages, differ but slightly from innocent growths, such as fibromata or papillomata. The appearance is more characteristic when the tumour assumes a nodular form, as in medullary cancer. At a later stage ulcerations occur which either, as in epithelioma, attack the neighbouring mucous membrane, or, as in medullary cancer, become covered with sprouting vegetations, and leave the mucous membrane intact for a long time. The surface is then covered by a fœtid purulent or muco-purulent secretion.

Course and Prognosis.—The course of malignant tumours of the larynx is usually very protracted, especially if the stenosis does not lead to suffocation, or if this result be prevented by tracheotomy. Medullary cancer is slowest, and its average duration is estimated at about three years. Hæmorrhage, perichondrial abscesses, perforation of the œsophagus, or pulmonary disease may hasten the fatal termination. Successful excision of the larynx may prolong life for a time, but experience hitherto scarcely points to permanent cure. The prognosis is bad in all forms of cancer, but in sarcoma it is slightly more hopeful, as cure has been obtained by extirpation of the tumour by the mouth (Mackenzie, Navratil, Tüerk, Gottstein), by thyrotomy (Balassa), and by extirpation of the larynx (Bottini, Foulis).

In the author's case, which was published in the Wiener Medizin., Wochenshrift (No. 105, 1868), a boy aged seven years was operated on for sarcoma of the larynx (pathological anatomy by Waldeyer). He was able to convince himself of the complete character of the cure by laryngoscopic examination thirteen years afterwards; the voice, too, left nothing to be desired.

Diagnosis.—The account which we have already given of the symptoms of malignant tumours of the larynx is sufficient to show the difficulty which often besets their diagnosis. In the early stages even

laryngoscopic examination leaves it doubtful whether a case be one of innocent tumour, malignant growth, syphilitic, tubercular, or cancerous infiltration. The history, advanced age, and general health must be taken into account, together with local appearances. In spite of every precaution, however, mistakes are liable to occur, and confusion with syphilis is the most likely. A syphilitic ulcer is developed rapidly on an infiltrated base, and often remains single and unilateral; a cancerous ulceration takes weeks to form, is irregular, and always shows nodules on its margins. A history of primary disease, simultaneous affection of the pharynx, etc., will aid in distinguishing syphilis from cancer. In doubtful cases it is always better to try the effects of anti-syphilitic treatment, more particularly iodide of potassium.

Ziemssen describes a case in which "he felt himself obliged to arrive at the conclusion that he had to deal with a cancerous ulcer by the laryngeal appearances (moderate ulceration on the right margin of the epiglottis and pyriform sinus, and tumour-like swelling of the right ventricular band)—advanced age, pain, stridor, etc.;" a complete cure by means of iodide of potassium convinced him that this was an instance of late isolated laryngeal syphilis.

The differentiation of tubercle from syphilis is easier. The evidence of pulmonary disease, and the marked anæmia of the laryngeal mucous membrane, usually make the diagnosis certain.

How, even here, a combination of circumstances may occur to make the diagnosis for a time uncertain, is shown by the following case. A man, æt. sixty-one, was taken into hospital on account of hoarseness and sore throat which had lasted for some time; he stated that his illness began from the time that a piece of bread stuck in his larynx after laughing; there was no cough or fever. The laryngoscope revealed great swelling over the left arytenoid, but no ulceration; there was no detectable pulmonary disease; on the right side there were several enlarged and tender sub-maxillary glands but no history of syphilis.

The advanced age of the patient, the pain in the throat radiating towards the ears, and the absence of pulmonary disease gave grounds for diagnosing cancer. The patient after a time left the hospital without any change in his condition. When fourteen days afterwards he again sought admission, there was an ulcer on the left arytenoid involving the interarytenoid fold; the right arytenoid was œdematous, but the epiglottis normal. The patient coughed little, but there was now a small infiltrated area in the left apex (of the lung). The previously expressed opinion was now no longer tenable, and all idea of extirpating the larynx was given up. The author now believed the case to be one of tubercle, probably originating in perichondritis; he was led to this diagnosis, less by the evidence of pulmonary disease than by the marked pallor of the whole laryngeal mucous membrane, and the uniformly smooth (not nodulated) appearance of the swollen arytenoid. Death followed soon from pulmonary œdema. Post-mortem examination showed disseminated, cheesy, peri-bronchial inflammation of the upper lobes of both lungs, tubercular ulcers of the larynx and trachea, and exfoliation of the left arytenoid cartilage. Evidently the disease in this case began with tubercular perichondritis, and was either an instance of primary laryngeal tubercle, or, as we consider more probable, appeared before the miliary infiltration of the lung was sufficient to produce physical signs. The cause described by the patient had no connection with the disease, and the glandular swelling was probably accidental.

Treatment.—The radical treatment of malignant disease can of

course only be operative; the result is doubtful, sometimes lengthening the patient's life, but with few exceptions not checking the disease.

Endo-laryngeal extirpation can only be thought of in sarcoma, and then only when it forms a well-defined tumour. In diffuse sarcoma, when not too extensive, treatment with the galvanic cautery may be tried.

Extirpation of malignant tumours by means of thyrotomy has not, judging by the results so far obtained, been satisfactory. In twenty cases collected by P. Bruns, in two death occurred soon after the operation; in one case only there was no local recurrence, but in this instance death occurred twenty-two months afterwards from cancer affecting the supra-renal capsules and the left kidney. In the remaining eighteen cases local recurrence took place—in some after two or three weeks—and only once was there an interval of a year and a half. Recovery of voice occurred in no instance.

Extirpation of malignant tumours by means of sub-hyoid pharyngotomy can only be practised in growths situated in the upper part of the larynx. It has hitherto been rarely performed, because cancer is seldom limited to this part. König and Clinton Wagner removed a cancerous epiglottis in this way; E. Albert extirpated a sarcomatous nodule as large as a hazel nut growing from the left arytenoid (followed by recurrence); O. Riegner operated upon a case which we had the opportunity of examining, and in which there was cancer originating in the left sinus pyriformis, and involving in part the epiglottis and the arytenoid. The lymphatics on the corresponding side were markedly infiltrated, and these were first removed; the wound healed within fourteen days, and after preliminary tracheotomy sub-hyoid pharyngotomy was performed, and the affected parts excised. Unfortunately, the patient died five days later from tracheal hæmorrhage.

Total extirpation of a cancerous larynx was first successfully performed by Billroth in 1873, and since then repeatedly.

Of thirty-two cases collected by Foulis (Transactions of the Internat. Med. Cong., London, 1881), thirty were operated upon for malignant tumours. Of these fourteen died within sixteen days (46·6 per cent.) from the effects of the operation, in ten (33·3 per cent.) the tumours recurred within a few months (often from three to six), and only once after seventeen months. One patient died in consequence of a bougie being forced into the mediastinum, the instrument being used to prevent cicatricial contraction of the œsophagus; in two cases of reported cure only two months had elapsed since the operation, and in one seven months; these intervals are manifestly not sufficient to admit of classing the cases as cured. In one case (Bottini) three years had passed, and in another (Caselli) twenty months without recurrence.

Of three cases of extirpation of the cancerous larynx which have come

to our knowledge, published since the appearance of Foulis' Tables, in one only was there no return after eleven months (Winiwarter). The two which survived longest were cases of sarcoma.

Although, up to the present, the results of extirpation of the cancerous larynx have not been favourable, they still show that the operation may in future become useful for suitable cases. Sarcomata seem to give the most favourable prognosis, and here the surgeon may, perhaps, be successful in achieving a permanent cure or preservation of life for a considerable time. If the growth be confined to the larynx, and i adjacent parts be spared, or only slightly involved, while, at the same time, dyspnœa and dysphagia are severe, extirpation is the only operation that makes the life of the patient tolerable. Cases have been recorded in which, besides the larynx, a portion of the pharynx and œsophagus (Langenbeck, Billroth, Bottini), or even the thyroid gland, and the first rings of the trachea, had to be extirpated; but the results are not encouraging, not only because the operation is most tedious, and the danger of recurrence is great, on account of the difficulty of removing all the diseased tissue, but because the life of the saved patient, after successful operation, is such that death would be preferable. In all cases it is advisable to operate soon if the diagnosis be certain.

Partial extirpation of the larynx, spoken of as "Heine's resection or sub-perichondrial resection," in which the lateral portions of the thyroid and cricoid cartilages are removed, is a less severe operation, and also gives a better result as to the voice, but its employment is limited to malignant tumours which have attacked a circumscribed portion of the cartilage, or in case they are diffused, involve only one half of the larynx (Schech). Experience so far obtained is insufficient to decide how far partial extirpation prevents recurrence.

After healing of the wound, inflicted in total or partial extirpation, it is necessary to give the patient a substitute for the removed organ, in order to free him from his aphonia, and to obviate the direct communication of the air passages with the external atmosphere—a condition by no means devoid of danger. For this purpose an artificial larynx has been constructed by Czerny, Gussenbauer, Hüter, and others, which is composed of a canula, one end of which is placed in the trachea, while the other extends upwards, and lies in the cicatricial tissue corresponding to the removed larynx. In the last-described extremity is the voice apparatus, which consists of a metal tongue attached to a frame by a spring. By means of the current of the expired air a tone of definite character may be produced, and it is further increased by the resonance of the laryngeal, oral, and nasal cavities, and can, by the movements of articulation, be used for speech. The artificial larynx should be introduced when the wound begins to heal.

Symptomatic treatment is as unsuccessful as operative interference.

The indications are to relieve dyspnœa, to remedy the bad effects of dysphagia, and to alleviate the agonising pain.

If respiration be impeded by the tumour, tracheotomy should be performed before the general condition has suffered, owing to the dyspnœa; tracheotomy produces not only an amelioration of the symptoms, but may lengthen the patient's life for several months, or even by one or two years (Fauvel). Tracheotomy may also be required as a preliminary operation preceding extirpation of the larynx.

In the treatment of dysphagia we are almost powerless. If deglutition be much interfered with or impossible, the patient must be fed by means of an œsophageal tube or nutrient enemata.

Pain is alleviated by the insufflation of morphia ·015 to ·03, with equal parts of starch, once or twice a day, or approximately from one-fifth to rather less than half a grain. Of course weakness must be combated by a tonic line of treatment.

CHAPTER VI.

LUPUS OF THE LARYNX.

Etiology.—If we only considered the experience of laryngologists, we should have to consider laryngeal lupus as a very rare affection. Thus, Tüerk, in spite of his large clinical material, only observed four cases, Tobold two, Mackenzie two, Ziemssen, Waldenburg, Jurasz, Lefferts, Grossmann, Ganghofner, Rauchfuss, Critstett, and Gerhardt one (published) case each; the author, too, has only had one opportunity of studying this affection. Lefferts has, however, expressed the opinion that if the larynx were more frequently examined in those who suffer from lupus, the disease would be more frequently detected in that organ. This is confirmed by the experience of dermatologists, especially when every lupus patient is examined with the laryngoscope, whether or not throat symptoms be complained of. Holm of Copenhagen found in ninety cases of lupus that the larynx was affected in six (about 5·5 per cent.), while Chiari and Riehl observed it six times in sixty cases (about 8·8 per cent.); in the skin clinic here, also, laryngeal lupus is not rare, as Dr Arning tells us. The causes of laryngeal lupus are similar to those influencing the outbreak of the disease in other parts, or, in other words, often unknown. Females, especially those under twenty years of age, are most commonly attacked (of thirty-three cases observed by Chiari and Riehl, twenty-five were females, and of these fifteen were under twenty; while of the eight men, four were under twenty). Only one case is recorded in which lupus was confined to the larynx (Ziemssen); in the others the disease also existed on the face, or the mucosa of the nose or pharynx.

Pathology.—Anatomically, descriptions of laryngeal lupus are but few in number; and we are thrown back upon laryngoscopic examinations and analogy to the anatomical changes produced by lupus in other mucous membranes. Virchow describes a preparation showing thickening of the epiglottis and ulceration of the vocal processes, surrounded by hard papillary growths; but this preparation evidently illustrates a late stage in the development of lupus, and the same may be said of observations by Eppinger and Idelson. Chiari and Riehl, adding their own experience to that of others, give the following description: Laryngeal lupus begins with the development of single papillary growths, varying

in prominence and size (from a millet to a hemp seed), as is the case in other mucous membranes; these either remain single, or appear in crowded groups on the slightly hyperæmic mucous membrane. The groups increase either in the neighbourhood of, or on the parts first affected, both in extent and prominence, so that at one time is seen a flat, not very prominent, and glandular-looking thickening of the mucosa, while in other cases there are produced nodular and prominent swellings.

The case of laryngeal lupus observed by the author, and depicted in Fig. 28, is characteristic of the early stage of the disease. A young girl, fifteen years of age, not affected with hereditary syphilis, and hitherto always healthy, was attacked four years ago by tubercular swelling of the left auricle, which was recognised as lupus and operated upon. A complete cure does not seem to have been obtained, for the operation had to be repeated thrice within three years, and when the author was consulted six months after the last, the auricle again showed evidence of tubercular infiltration; the voice was slightly rough, the general health undisturbed, and nutrition normal. Examination of the throat showed the tonsils to be slightly hypertrophied, the uvula thickened and covered with nodules as large as a millet seed, and the epiglottis infiltrated and nodulated; the middle of the upper edge of the epiglottis was most thickened, and slightly overlapped the lateral parts; cicatrisation and ulcers were absent, the right aryepiglottic ligament and the right arytenoid were also infiltrated, but showed a more even contour. The right cord was covered by the ventricular band; the patient had neither pain nor discomfort in the throat, and was much astonished on being told that her throat was affected by the same disease as her ear. That the changes in the epiglottis were of a lupoid nature could not be questioned. The patient is still under treatment.

The infiltration may, after it has lasted for months, become absorbed, clinical evidence of which is afforded by gradual flattening and sinking of the nodules, or ulceration may result, so that, more or less, deep, round, or irregular ulcers, with slightly infiltrated edges and bases covered with pus, result. Perichondritis, chondritis, and necrosis seem seldom to attack the laryngeal cartilages, with the exception of the epiglottis.

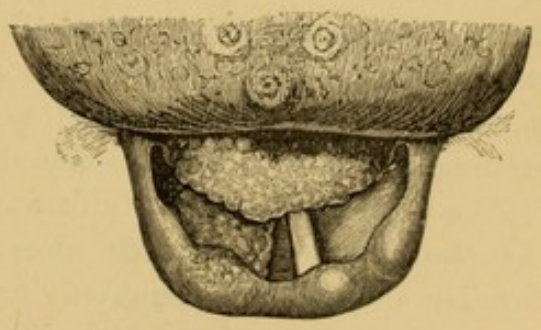


Fig. 28.

The different parts of the larynx are attacked in the following order of frequency: (1) The epiglottis; (2) aryepiglottic folds and arytenoids; (3) the vocal cords. Exfoliation of the arytenoid cartilage was once observed by Eppinger, and partial destruction of the thyroid cartilage by Idelson.

As to the histological structure, lupoid nodules consist of a proliferation of granular cells which, according to Eppinger, attach themselves firmly to the epithelial elements covering the epiglottis, but in them-

selves proceed from proliferation of connective tissue, and are evidently peri-vascular in their nature. The cell growths are not only superficial, but are also found around the gland ducts and between the gland lobules; they further contain giant cells, and, according to recent researches, also the tubercle bacillus of Koch (Demme and Pfeiffer).

In the case above described, observed by the author, the infiltrated uvula was removed and handed to the local pathological institute for pathological examination. As the result is interesting, we shall give shortly the details of an examination by the assistant, Dr Hanau. The uvula showed a layer of connective tissue covered by several layers of flat epithelium, and containing numerous mucous follicles; on the connective tissue there were besides a considerable number of round cells, small circular nodules composed in part of giant cells, and showing points of *coagulation necrosis* in their centre. In one of the sections coloured by Ehrlich's method a single bacillus of the size of the tubercular variety was found within a giant cell.

Symptoms.—Laryngeal lupus may, particularly in its early stages, often produce but slight symptoms, and for this reason laryngologists observe the disease less frequently than dermatologists, whose aid is sought for the skin affection. This statement is emphasised when we consider the difference between statistics based on an examination of all lupus patients on the one hand, and of those only who complain of throat trouble on the other. According to the statistics of the skin clinic in Vienna, when patients who suffer from laryngeal symptoms alone are examined, only ·8 per cent. are found affected with laryngeal lupus, while systematic examination of all cases gives the numbers at from 5·5 (Holm) to 8·8 (Chiari and Riehl) per cent. The first symptoms are rawness and difficulty in swallowing, the voice is slightly hoarse, and sometimes aphonic. At a later stage, if the infiltration increases, or as a result of cicatricial contraction, dyspnœa may occur. Laryngoscopic examination shows at first isolated or grouped nodules, which afterwards become confluent on the infiltrated mucosa, especially of the epiglottis. As the disease progresses ulcers and cicatricial contraction occur. Similar changes are commonly found on the mucous membrane of the pharynx, uvula, or hard and soft palate, and lupus of the pharynx is rarely wanting.

Course, Duration, Result, and Prognosis.—The course of laryngeal lupus is very gradual and slow. Observations are not sufficiently numerous to determine the question whether the disease can heal spontaneously, or whether pulmonary phthisis, which occasionally follows lupus, is immediately dependent upon the lupoid ulceration of the larynx, as one might suspect from the fact that the same etiological factor (tubercle bacillus) occurs in both diseases. The prognosis is always doubtful, because we cannot foresee how far the destruction of the organ may proceed, and what dangers may result to respiration from the thickening of the parts.

Diagnosis.—In all cases in which laryngeal lupus is associated with lupus of the skin—and this is usually the case—the diagnosis presents no difficulty. The local condition in the larynx may lead to confusion with tubercle, syphilis, and cancer. A consideration of the history and course of the disease, together with the examination of the whole body and attention to local characteristic changes, will make the diagnosis certain even when lupus of the skin is absent.

In tuberculosis cicatrisation is extremely rare, but in lupoid ulcers cicatrices and papillary nodules co-exist. Phthisical ulcers extend more rapidly, and have not such a well-defined line of demarcation.

Confusion with syphilis is more excusable. Syphilitic ulcers are usually round, and have well-defined, thickened reddened edges, while in lupus the latter are relaxed and not infiltrated. The cicatrices of lupus are seldom so extensive as in syphilis, and on the latter one never finds freshly-developed nodules, such as are often seen on lupoid scars; but in doubtful cases it is always desirable to give iodide of potassium.

Cancer is distinguished by pain, its unilateral origin, the absence of cicatrices, and its common occurrence in old persons, while lupus most frequently attacks those under puberty.

Treatment.—According to the few observations so far made, energetic cauterisation, together with the use of remedies which favour absorption (glycerine of iodine, iodoform), seems to exercise a favourable influence. For cauterisation brushing with iodine or a strong solution of nitrate of silver may be employed, or the solid nitrate, and better still, the galvanic cautery, may be used, while cod-liver oil and tonics are given internally.

CHAPTER VII.

LEPROSY OF THE LARYNX.

Etiology.—Leprosy of the larynx only occurs as a part symptom of the general disease, and its causes are similar. To these we shall not allude further than to state that the parasitic nature of the affection is now open to no doubt. No positive data as to the frequency with which the larynx is attacked are forthcoming, but that it is considerable, is probable; for, as Virchow says, the physicians of former times considered hoarseness(*vox rauca*) and shortness of breath as a characteristic symptom of the disease, and in the middle ages the *vox rauca* was almost sufficient to fix the taint attaching to leprosy upon an individual.

Pathology.—The first change consists in nodular infiltration of the laryngeal mucous membrane, which, according to Virchow, is not unlike syphilitic papules or follicular abscesses; the surrounding mucosa is hyperæmic and swollen, so that the nodules seem set in it. Sometimes nodules are absent, or perhaps it is more correct to say that they are so closely packed as to give the appearance of uniform infiltration. The leprous parts (epiglottis, ventricular bands, and aryepiglottic folds) are thickened, rigid, immobile, and have a rough surface. The nodules in the mucosa have a great tendency to ulcerate, and considerable destruction and even perforation of the cartilage may result. These ulcers not uncommonly heal, and produce stenosis, which may be so great as only to leave an opening of the diameter of a pencil, and thus cause suffocation. Histologically the nodules are found to consist of numerous closely packed spindle and stellar cells, between which may be seen free nuclei. This formation of nuclei and cells seems imbedded in a delicate meshwork, and is particularly marked in the neighbourhood of vessels and glands.

Symptoms.—These consist of disturbance of voice of varying extent and respiratory trouble, which may even amount to suffocation. With the laryngoscope are seen chronic catarrh, the epiglottis swollen and congested, as are also the aryepiglottic folds; the mucous membrane covering the arytenoids and ventricular bands is dark red, sometimes having a bluish tinge, and secretes freely. The cords are congested, and at a later stage thickened, and reddish yellow in colour; there are also

elevations, varying in size from a pin-head to a pea, upon the mucous membrane of the epiglottis, arytenoids, and ventricular bands, less commonly on the cords. At an advanced stage there is ulceration of the epiglottis and cords, with marked thickening of the parts that are left, and the latter become covered with a thick layer of white epithelium; sometimes there is superadded acute secondary œdema, which, of course, increases the danger of suffocation.

Course and Prognosis.—Laryngeal leprosy runs a slow course if stenosis does not produce a rapidly fatal termination; the prognosis, as in leprosy elsewhere, is hopeless.

Diagnosis.—Although the changes caused by leprosy have much in common with those due to syphilis and (according to Virchow) to lupus, the diagnosis is not difficult, because they are always only part evidences of the general disease when present in a marked form.

Treatment.—Treatment is useless, and only consists in opening the rachea in proper time when suffocation is imminent.

CHAPTER VIII.

FOREIGN BODIES IN THE LARYNX.

Etiology.—A list of the different kinds of foreign bodies which have been met with in the larynx would be so large that it would be out of place to give it here. The animal, vegetable, and mineral kingdoms are represented; the bones of all kinds of quadrupeds and fishes, pieces of meat, and even leeches have been found in the larynx, the latter creeping in either from the mouth when they have been applied there, or being sucked in during the drinking of marsh water. The stones and seeds of fruits of different kinds, the shells of nuts, grain, peas, beans, pebbles, various metallic substances, such as coins, buttons, needles, and different varieties of toys, have been found. Objects of all shapes and sizes are represented; in point of size, very striking cases have occurred. Thus Johnson met with an instance in which a toy representing a small locomotive was kept in the mouth during sleep, and in the night was drawn into the larynx. Schroetter met with an example in which a set of four artificial teeth with a vulcanite plate passed into the larynx.

Foreign bodies usually pass into the larynx when inspiration and swallowing occur at the same time; this is particularly liable to happen when the individual laughs while eating. Small foreign bodies, such as beans, peas, and coffee beans which children hold in the mouth, may be drawn in by aspiration. Many children amuse themselves by throwing objects into the air and catching them with the open mouth; under certain circumstances, especially when the head is thrown far back, such foreign bodies fall into the glottis, as we have seen in the case of a nut-shell. In persons who are insensible, *e.g.* from drink, violence, or anæsthetics, quantities of vomited food may accumulate in the pharynx owing to deficient irritability of the mucous membrane, and may then fall or be sucked into the larynx. We have seen the same thing in otherwise healthy individuals, who, while suffering from dyspepsia, partook of a heavy supper; food then regurgitated, and getting into the larynx, produced marked spasms. The danger of blood getting into the air passages in operations on the mouth, throat, and naso-pharynx during anæsthesia is well known and feared. It is more difficult to explain how in healthy individuals large foreign bodies may get into the larynx

during sleep, as, for example, the locomotive and the set of teeth above referred to; we must in such cases assume diminished irritability of the pharyngeal mucous membrane, particularly as in Schroetter's case the patient's larynx contained a foreign body which was in all its dimensions larger than the glottis when wide open, and the sufferer was unaware of the fact until at breakfast he noticed the absence of the plate and teeth from his mouth. More rarely foreign bodies get into the larynx by way of the œsophagus, and this may happen by (1) fistulous openings, (2) direct perforation (bones or needles), (3) the bursting of an abscess or malignant growth. As other foreign bodies which have been found we may mention portions of necrosed vertebræ, a bronchial gland which, having become loosened by ulceration, penetrated a bronchus, and was then coughed up into the larynx (Edwards), portions of loose cartilage (necrosed) from the larynx itself which have become impacted. Finally, according to observations by Middeldorpf and Solis Cohen, the epiglottis itself may be drawn into the larynx, and so produce spasm and suffocation by acting as a foreign body.

Pathology.—If foreign bodies remain but a short time in the larynx, they only produce hyperæmia and slight inflammation. If they be long retained at one spot, violent inflammation and swelling of the soft parts occur, particularly if the foreign body be rough or uneven; this may finally result in shallow or even deep ulceration, the formation of granulations, or the development of organised connective tissue.

In the case before referred to, the nutshell was for months kept in its position (the anterior wall of the subglottic portion) by granulations. In a case reported by Bulloc, a pebble was found imbedded in connective tissue at the junction of the trachea with the larynx. The subjacent mucous membrane was ulcerated and the trachea almost stenosed.

Small sharp bodies may penetrate the larynx without producing any marked changes, and reach neighbouring parts, as, for example, the thyroid gland, and there produce inflammation and suppuration.

We had occasion to observe an unusual foreign body with peculiar changes in the larynx.

A woman in a kitchen wished to taste some broth, and did so by sipping the fluid from a teaspoon. Suddenly violent laryngeal spasm and cough set in, which only ceased after she had expectorated a portion of a small leaf such as is used by many housewives to improve the taste of broth. The patient had severe pain, and immediately became hoarse, for which the doctor who was called ordered ice compresses and narcotics. Eight days later she consulted us because she was still hoarse and the pain did not diminish. On laryngoscopic examination both cords were found reddened, and on the anterior third of each there were situated two symmetrical semicircular grey ulcers, the bases of which corresponded to the free margins of the cords, so that on complete closure of the glottis a circle as large as a lentil was produced. The ulcers healed in ten days under the application of nitrate of silver.

Manifestly, in this instance, the high temperature of the foreign body had produced a circumscribed burn with resulting ulceration.

Symptoms.—The first and most constant symptom is cough, which is often spasmodic, and combined with spasm of the larynx; the other symptoms vary according to the size, shape, and situation of the foreign body. Large objects which completely close the glottis may produce immediate death; even those which only partly close the lumen of the larynx may, owing to concomitant spasm, produce danger of suffocation. Small bodies, such as needles and fish bones, may remain for a long time in the larynx without producing further inconvenience than a disagreeable sensation; it is probably very rare that large objects, such as the plate and false teeth already referred to, remain for any time without causing symptoms.

Paroxysms of suffocation occur at varying intervals, according to the position which the foreign body assumes, owing to the posture of the patient, cough, etc. Small objects, such as beans and peas, may fall down to the bifurcation of the trachea and produce the most intense suffocation until they are thrown up by a severe paroxysm of cough and reach some portion of the larynx, such as the ventricles or the cords, and remain there for a time. All the symptoms of suffocation may then cease until, owing to a change in the position of the head or other circumstance, they fall again into the trachea, and produce suffocation, until finally death results; this we ourselves have seen. Bodies which are not large enough at first to cause obstruction of the glottis may afterwards produce dyspnœa by causing inflammation and swelling of the soft parts.

Pain is only present when sharp bodies have become impacted in the larynx; otherwise patients only complain of an unusual sensation in the throat, as if something were sticking there. They also often insert the finger to try to remove the foreign body.

Hoarseness sets in when the object, owing to its size or situation, impedes the movements of the cords, or it may be due to secondary inflammation.

Laryngoscopic examination is not easy on account of the difficulty of breathing and restlessness, but when successful, affords information as to the situation and character of the extraneous substance.

Course and Prognosis.—From a description of the symptoms it will be seen how different may be the conditions produced by foreign bodies. Fluids in small quantities (with the exception of boiling drinks) may be immediately coughed up and all the symptoms at once disappear; on the other hand, death may be immediate when the foreign body completely closes the glottis. Usually, however, the symptoms vary; the first severe attack of dyspnœa, cough, and spasm is followed by a time of comparative rest, which almost makes the presence of a foreign body doubtful until

the recurrence of the symptoms demonstrates the danger again. This change of condition may repeat itself within twenty-four or forty-eight hours until death by suffocation occurs. If the foreign substance be not large and be impacted, it may remain there for weeks and months and simulate various diseases.

Delasiauve reports the case of an epileptic who coughed up a piece of a clay pipe 6 mm. long which got into his larynx three weeks before, when he was seized with a fit while smoking. The patient after the fit experienced pain in the larynx, and afterwards there was hoarseness and cough, with occasional dyspnœa, the cause of which, however, was not recognised.

Desault, in a case in which the symptoms of "laryngeal phthisis" had lasted for two years, found a cherry-stone in the ventricle of Morgagni.

Sidlo extracted from the infra-glottic region of a man thirty-nine years of age a piece of bone 2 centimetres in length and from 3 to 9 millimetres in breadth, which had remained there for many years enclosed in cicatricial tissue.

In the case observed by us, the nutshell remained in the sub-glottic region for ten months surrounded by polypoid granulations.

The prognosis is always doubtful and most unfavourable in the case of large bodies which obstruct the lumen of the larynx, producing rapid suffocation, and in small ones which fall into the trachea, are difficult to remove, and by resting on the bifurcation produce suffocation. Childhood makes the prognosis worse, not only because the diagnosis and necessary manipulation becomes more difficult, but also because the lumen of the larynx is relatively smaller, but reflex irritability and the resulting tendency to spasm greater. Secondary inflammation of the soft parts, abscess, and ulceration are serious complications.

Diagnosis.—The diagnosis is easy when the history is clear, the symptoms of suffocation marked, and especially if the laryngeal mirror demonstrates the presence of a foreign body. As a matter of fact, the condition is not always so clear as one would think, and as it is said to be by some. Excluding those cases in which foreign bodies get into the air passages during sleep, anæsthesia, or coma, many patients, especially children, in their first alarm make such contradictory statements that one cannot tell whether a foreign body has entered, and even if it had penetrated the air passages, whether it has not been coughed up. The symptoms are not always so marked as to remove doubt, as, for example, in Schroetter's case, where the patient, after missing his false teeth and looking for them, began to notice a slight obstruction in his throat, and also felt some difficulty in breathing, from which he concluded he had swallowed them. As to laryngoscopic examination, a positive result is, of course, of great consequence in arriving at a diagnosis, but the laryngeal mirror does not always give definite information, especially when the foreign body is situated below the cords. Various circumstances may combine to obstruct the view, as, for example, the narrow glottis in childhood, the position of a foreign body, and inflammatory changes around it.

In a local hospital we had an opportunity of examining a child on whom tracheotomy had been performed, and in whom the top of a thimble had got into the air passages. This thin round object with jagged edges had taken up such a position beneath the glottis that it was impacted, edge upwards, between the anterior and posterior walls of the larynx, and could only be seen, under good illumination and by careful examination, as a dark line. After the cricoid cartilage had been divided by Dr Schnabel, the edge of the foreign body appeared in the wound, and it was removed without further difficulty.

In the case of the nutshell, which we have repeatedly cited, the presence of a foreign body was denied by a very experienced laryngoscopist, and he attempted to destroy the granulations by the galvanic cautery through the tracheal wound; when the tube was afterwards removed a suffocative paroxysm of such severity occurred on the second day that it had to be rapidly introduced. By means of thyrotomy, which was then performed, the nutshell was found and removed. Our view, on the other hand, that the foreign body was still in the larynx was based on (1) the history which showed that the nutshell had got into the air passages, but left it doubtful whether it had been coughed up; (2) on laryngoscopic examination, which detected in the sub-glottic region below the anterior commissure a symmetrical elevation composed of polypoid growths; and (3) on having observed that foreign bodies, when, for instance, they have remained long in the external auditory canal, give rise to granulations. Our attempts to remove the foreign body by endo-laryngeal means were unsuccessful, and a proposal to perform laryngotomy was refused; the case then passed into the hands of our colleague, who, six months later and ten months after the entrance of the foreign body, was compelled to operate in this way.

Just as in this case granulations covered the foreign body, so in that observed by Bulloc it was encapsuled in connective tissue. These facts must always be remembered when the case is not brought under treatment immediately after the accident. In general, a careful consideration of all the circumstances and the exclusion of other diseases will enable a diagnosis to be arrived at even in doubtful cases.

Treatment.—The indications are to remove the foreign body as quickly as possible, and if this be not possible, to prevent suffocation. Removal by endo-laryngeal means must first be tried; a foreign body impacted high up may sometimes be removed by means of the finger, otherwise the most suitable instrument is a laryngeal forceps, especially the tubular form. Unfortunately, insuperable obstacles to this simple proceeding are often encountered in the sensitiveness of the mucosa of the pharynx and larynx, and we are obliged to resort to other measures. If dyspnœa be either absent or slight, attempts may be made to diminish this irritability by frequent introduction of the probe, just as in the extirpation of neoplasms,* so that the foreign body may afterwards be removed. This proceeding requires several days even in the most favourable cases, and we should advise that the patient be, during this time, kept under constant observation, attended by a trained nurse, and, moreover, that everything be ready for the performance of tracheotomy. We should only recommend this method in cases where the foreign body is impacted, and in which there is no chance of its causing suffocation from change of position.

* Cocaine should, of course, be here tried (Translator).

In order to avoid this tedious proceeding, which is also not quite free from danger, and at the same time to obviate the necessity for operative interference, two methods have been proposed—(1) extraction during local anæsthesia; (2) total anæsthesia.

1. *Local anæsthesia*, for the extraction of foreign bodies, has been successfully practised by Schroetter in the same way as for the extirpation of tumours. We have already discussed the advantages and disadvantages of local anæsthesia, and will only add that it is not practicable in children, because its employment requires a certain amount of assistance from the patient, and in early life there is increased danger of morphia poisoning.*

2. *Chloroform inhalation.*—Stöerk recommends for restless children the production of "semi-narcosis," in which consciousness is retained, but every volitional impulse is in abeyance. For this purpose he only gives a few whiffs of chloroform, and then tries to remove the foreign body with forceps. Schroetter, on the other hand, produces complete anæsthesia; the head of the anæsthetised child, who is supported by a nurse, is flexed backwards by an assistant; the mouth is opened by means of a gag; the tongue is lightly pulled out with forceps, dried with a cloth, and then forcibly drawn forwards. Under guidance of the mirror the foreign body is then extracted.

Present experience is not sufficient to let a definite judgment be given on this method; at all events, chloroform is less objectionable as an aid to the extraction of foreign bodies, which causes no bleeding, than for the extirpation of tumours.

If dyspnœa be very marked from the beginning, tracheotomy should not be delayed; this has not only the effect of quieting the anxiety and restlessness of the patient, but also offers the possibility that the foreign body may be spontaneously expelled through the wound either immediately or after some days. On the other hand, there is in tracheotomy the danger that the foreign body may fall into the trachea. To obviate this, the operation should be performed with the head hanging down, or the tracheal tampon may be used; it is better to combine both. If the foreign body has not been spontaneously expelled, attempts should be made to remove it by the mouth; and if these be unsuccessful, thyrotomy (preferably the partial operation) must be resorted to.

Emetics have been recommended as a substitute for these manipulations; their action is inefficient because, with each act of vomiting, the larynx is compressed and the foreign body, if sharp, more firmly impacted. It has further been proposed to invert the patient and then to slap the back and chest so as to expel the foreign body; this method too is seldom successful, and is at best only suitable when the substance to be expelled is round and smooth.

* The first-named objection only partly applies to cocaine, while, of course, the latter does not (Translator).

CHAPTER IX.

NEUROSES OF THE LARYNX.

Under this designation are classified all disturbances of sensation or motion which cannot be ascribed to pathological changes in the organ itself, and to account for which we can either demonstrate or suppose a lesion of the nerves which supply the larynx—either at their origin, in their course or peripheral expansions; in other words, the term neurosis we use to designate all functional disturbances.

As we shall see later, primary disease of the muscles must be assumed in many cases of impaired mobility; but our knowledge does not enable us to separate myopathic paralysis from neuropathic, so that both must be treated together.

According as the sensory or motor nerves are affected we distinguish sensory and motor neuroses.

A. SENSORY NEUROSES.

Sensibility may be changed either in amount or quality. If the sensation of an impression be more marked than one would expect in health, the condition is one of hyperæsthesia; if, on the other hand, the reaction of a sensory nerve be impaired, we speak of hypæsthesia and anæsthesia, while qualitative changes are spoken of as paræsthesia.

(*a*) *Hyperæsthesia of the Larynx.*

Etiology.—The physiological irritability of the laryngeal mucous membrane is capable of such variations, and is so different at different points, that it is difficult to define the beginning of anomalies of sensation. Many persons are very tolerant in allowing the mucous membrane to be touched, and, as we have pointed out in the chapter on *Physiology*, only react by coughing when certain points are irritated; other healthy individuals are so sensitive that the slightest touch may produce paroxysms of cough and spasm. It is usually difficult or impossible to give a reason for these variations. Hyperæsthesia is said to accompany many physiological processes, such as dentition, menstruation, and pregnancy, so that it coincides in its occurrence with these conditions. Inflammatory affections of the laryngeal mucosa are

often associated with hyperæsthesia, but, again, the inflamed surface may be remarkably tolerant. Many persons with pulmonary phthisis suffer from marked hyperæsthesia of the larynx in the beginning of their disease without that organ being the seat of any pathological change.

Symptoms.—Hyperæsthesia of the larynx is characterised by increased reflex irritability, so that the slightest touch produces marked reaction; for example, a pellet of mucus from the trachea resting on the glottis may produce a paroxysm of cough and laryngeal spasm. Sometimes hyperæsthesia is associated with pain without the presence of organic changes in the larynx; conditions of this sort are spoken of as hyperalgesia.

Many authors class as hyperalgesia the pain which is sometimes present in inflammation and ulceration. We do not approve of this classification, as in these cases the pain is proportionate to the local disease, and therefore not a neurosis.

As a special form of hyperalgesia, we must consider neuralgia of the larynx. It is of very rare occurrence, and is manifested by paroxysmal pain either in the neck or under the sternum, corresponding to the course of the laryngeal nerves; sometimes the pain is unilateral, and radiates towards the ear.

In a case observed by the author, the pain always and only came on during phonation, so that there was real phonophobia. The patient was under observation for more than two years, and during that time no pathological change could be detected in the larynx.

The pain is sometimes relieved by pressure upon the larynx. In two cases of hyperæsthesia, E. Fraenkel succeeded in finding painful points; the latter did not correspond in position to those parts of the throat in which the patients experienced abnormal sensations, they maintained the same position during the whole course of the affection, and differed from the neuralgic points douloureux, described by Valleix, in being tender, not so much when touched as when the constant current was applied to them. The tenderness was greater during the application of the negative than the positive pole, although the latter was by no means painless. In proportion as the points douloureux became less sensitive to the electric current, the affection diminished.

Prognosis.—The prognosis is by no means very favourable, as the condition is very obstinate, and tends to recur.

Treatment.—The general health must be considered, especially in relation to hysteria, hypochondria, and neurasthenia. Hydropathy, sea-bathing, and change of air are to be recommended, and in anæmia preparations of iron are serviceable. Bromides of potassium and sodium may subdue the abnormal irritability of the laryngeal nerves, while in several cases of neuralgia Mackenzie saw good results from quinine. Locally, the application of chloroform and morphia recommended by Schnitzler is of value; we have seen good follow the use of even weak

astringent solutions (argent. nitrat. 2 per cent., or roughly gr. 10, ad ℥i), and have been able to dispense with those which are caustic in their action. As a very mild remedy, we may mention painting with a solution of bromide of potassium, or the prescription recommended by Jurasz, which is as follows :—

Chloral hydrate, 4 gr. 20.
Aq. dest., 100, or roughly ℥i.
Morph. muriat, ·1 gr. ½.

Tobold, and recently E. Fraenkel, advocate the use of the constant current, particularly in hyperalgesia. The latter applies the positive pole—according as the patients refer their pain to the mouth, pharynx, larynx, or trachea—to the submaxillary region, the larynx, or along the trachea. In cases where points douloureux can be found, the anode (positive pole) should be applied to the painful spot ; the cathode may be placed upon an indifferent part, or upon the cervical spine, while the duration of each sitting should be from four to five minutes. Sometimes heat and moisture in the form of hot-water cloths are useful ; these should be composed of a folded napkin which covers the front of the throat, and must be applied for half an hour or more several times a day. The water must be as hot as the patient can bear it, and the compresses well wrung out and changed every minute or two. Cold applications are badly tolerated in these cases.

(*b*) *Anæsthesia of the Laryngeal Mucous Membrane.*

Etiology.—A diminution of the normal sensibility of the laryngeal mucosa, or more accurately, extremely slight irritability (hypæsthesia), may exist, as we have seen, in persons otherwise healthy. All laryngologists know of cases in which the sensibility was so slightly developed, that on the first examination any endo-laryngeal manipulation could be undertaken ; but this state of matters cannot be considered morbid. Anæsthesia, on the other hand, or actual loss of sensibility, has been observed in hysteria, advanced bulbar paralysis, associated with paralysis of motion in gross cerebral lesions, in hemiplegia, together with motor paralysis of the pharynx, and affecting the distribution of both laryngeal nerves after diphtheria.* Anæsthesia is also said to be a constant symptom during epileptic fits, and sometimes to last for some time afterwards. According to Romberg, it is also a constant symptom in the last or asphyxic stage of Asiatic cholera. Artificial anæsthesia may be

* Hemi-anæsthesia of the larynx may also result from tumours of the base of the skull, as described by Fraenkel, Schech, and the Translator (Edin. Med. Journ., *July* 1885) (Translator).

produced, as we have seen, by the application of chloroform with morphia [and cocaine (Translator)]. We are very doubtful whether bromide of potassium taken internally, or applied locally, can produce anæsthesia, or even hypæsthesia, although it may perhaps alleviate hyperæsthesia. In deep anæsthesia there is also anæsthesia of the larynx, but otherwise the sensibility is only blunted.

As the normal sensibility varies so much, it is very difficult to determine in an individual case whether the anæsthesia or hypæsthesia be physiological or morbid. It is more than doubtful whether hysteria should be spoken of as a cause of hypæsthesia, for the small number of recorded cases are not conclusive.

In hemiplegia anæsthesia was once observed by Longhi. To this the author is enabled to add a second case. The patient was a man sixty years of age, who ten weeks after an attack of apoplexy was so anæsthetic as to his larynx that the author was able to remove a fibrous tumour from the anterior commissure of the cords at the first séance.

In order to establish the fact that there is a causal relation between apoplexy and laryngeal anæsthesia, more observations are required.

Schnitzler reported a case of anæsthesia associated with hyperalgesia, and designated this condition *anæsthesia dolorosa laryngis.*

Pathology.—Anæsthesia and hypæsthesia may be of central or peripheral origin. We must seek the cause in the sensory centre, when the affection is due to hysteria, bulbar paralysis, hemiplegia, and epilepsy. Diphtheritic anæsthesia, on the other hand, must be looked upon as a peripheral nervous affection, because, as Ziemssen has explained, (1) the disturbance of innervation in the larynx is always associated with motor paralysis of the palate and pharynx, which on account of the electrical reaction may probably be assumed to be due to peripheral changes in the nerves. (2) Associated with anæsthesia there is always absence of the laryngeal reflexes. (3) The sensory and motor pareses of the larynx are most marked on the side most affected by the diphtheritic process.

Symptoms.—In complete anæsthesia the mucous membrane of the epiglottis and laryngeal cavity down to the cords is quite devoid of sensibility when touched with the probe, and no reflex action is produced. As, owing to paralysis of the thyro- and ary-epiglottic muscles, which are supplied by the internal branch of the superior laryngeal nerve, the larynx is closed insufficiently or not at all during deglutition, food enters; the patient is thus threatened with suffocation and pneumonia, owing to diminished sensibility, and absent reflexes on the part of the deeper portions of the air passages. Severe paroxysms of cough, produced when the food touches the still sensitive mucous membrane of the trachea, make the patient's life miserable.

Laryngoscopic examination shows the epiglottis to be upright, and leaning against the base of the tongue, the mucous membrane is unchanged, or may be reddened owing to contact with particles of food. Touching the epiglottis, the arytenoids, the ventricular bands, the cords, and the interarytenoid fold with a sound, is not felt, and

produces no reflex action; pricking with a sharp instrument causes no pain, so that there is also analgesia.

The symptoms of diminished sensibility (hypæsthesia) are but slightly pronounced. Subjective symptoms are almost absent, and objectively there is great tolerance of the mucous membrane when touched with a sound. Sometimes there is hypæsthesia only on one side, sometimes one side is anæsthetic, and the other hypæsthetic, while not uncommonly there are also paralyses of motion, to which we shall again refer.

Duration, Results, and Prognosis.—Definite observations only exist as to complete anæsthesia. Diphtheritic anæsthesia usually disappears after five or six weeks, while the anæsthesia of bulbar paralysis depends upon the course of the primary disease. The chief danger of complete anæsthesia* lies in insufficient closure of the larynx, and in food getting into the air passages; the affection is therefore always serious.

Diagnosis.—This can only be made with certainty after examination with a sound introduced under guidance of the mirror. Ziemssen tests the sensibility by means of an electric current, which he localises by means of a delicate laryngeal electrode. When motor pareses are also present, the electro-muscular irritability may in this way be tested at the same time.

Treatment.—Hypæsthesia requires no special treatment, but complete anæsthesia demands special consideration. In order to prevent the danger from food getting into the air passages, nourishment must be administered either by the œsophageal tube or per rectum, in the form of meat-juice or pancreatised meat. The introduction of the œsophageal tube requires great care lest the instrument pass into the anæsthetic larynx instead of the œsophagus. The surgeon should be guided as much as possible by introducing the finger of the left hand, and should convince himself that the instrument is in proper position by making the patient sound a note.

In the curative treatment of anæsthesia the local application of electricity is the most important agent. Both varieties of current should be used alternately, and Ziemssen recommends that a double electrode should be introduced into both pyriform sinuses, and the branches pressed against the anterior wall by raising the handle. In this way the fold containing the superior laryngeal nerve which passes from the base of the arytenoid to the apex of the great cornu of the hyoid bone is directly acted upon.

Of internal remedies strychnine may be administered internally or subcutaneously. Ziemssen begins with small doses, and injects ·005 (of a gramme) in solution, and increases this in adults up to ·01 twice a

* This does not always apply to hemi-anæsthesia (compare paper by Translator above referred to) (Translator).

day. These doses may produce slight symptoms of poisoning, but can be used without danger, and sometimes with the best results.

(c) *Paræsthesia of the Laryngeal Mucous Membrane.*

Etiology.—The most important causes of paræsthesia are hysteria and hypochondria. In hysteria there is frequently a complaint of a foreign body in the throat, in addition to the globus. Hypochondriacs are often so taken up with the anomalous sensations they experience in the throat, that one is left in doubt whether the latter be the cause of their depression, or a local manifestation of nervous debility. Among hypochondriacs those who are unfortunate enough to suffer from syphiliphobia are particularly afflicted with paræsthesia of the larynx, which makes them fear that "the chancre has broken out anew in the throat;" the same thing occurs in onanists, who, indeed, may be called "phthisiphobics." We agree with Jurasz in considering paræsthesia of the larynx as a very frequent premonitory symptom of pulmonary phthisis. We have seen too many persons by whom we were consulted on account of anomalous sensations in the larynx, and in whom physical examination of the chest gave a negative result, attacked weeks or months afterwards by pulmonary phthisis. Such cases are too common to be accounted for on the theory of coincidence, and we have now learned to watch, with special care, cases of laryngeal paræsthesia occurring in persons of weakly build, although apparently healthy, in whom laryngoscopic examination shows the mucous membrane to be anæmic.

Paræsthesia is also common in anæmia and chlorosis, with or without general nervous irritability.

Anomalous sensations are also often observed for some time after the extraction of a foreign body.

Pathology.—Paræsthesia, when due to hypochondriasis and hysteria, is of central origin. In most instances it cannot be determined why the sensation is referred to the larynx, but sometimes a slight peripheral irritation is sufficient to establish its localisation. Thus swallowing a rather hard morsel may be sufficient in a hypochondriacal patient to produce the sensation of a foreign body; or a slight transient catarrh is enough to fill a syphiliphobic patient with the idea that he feels the disease in his throat. It is difficult to say whether the altered condition of the blood in anæmia and chlorosis stimulates the sensory centre, or the nerves in their peripheral distribution; in favour of the latter, there is the fact that purely localised anæmia of the mucous membrane is sufficient to cause paræsthesia of the larynx. The paræsthesia, which occurs in incipient phthisis, is to be looked upon as a peripheral neurosis; and we are inclined, with Jurasz, to ascribe it to reflex action, on the hypothesis that stimulation of the sensory nerves

of the lungs is radiated to the centripetal laryngeal nerves, *i.e.* to another branch of the same trunk. We must, however, remember that anæmia of the larynx is a constant concomitant of this form of paræsthesia.

Sensations produced in the larynx, by local disease, cannot be considered among neuroses; but, in so-called neurotic subjects, slight affections may cause symptoms which are quite out of proportion to existing irritation, and must therefore be looked upon as nervous.

Symptoms.—Paræsthesia manifests itself by the most various sensations, *e.g.* burning, tickling, itching, pressure, feeling of cold, of a foreign body, such as a hair, a skin (fear of diphtheria), or fish bone; a feeling of tickling is particularly apt to give rise to coughing or clearing the throat. Paræsthesia is often associated with hyperæsthesia, and still more commonly with hypæsthesia. Laryngoscopic examination gives a more or less negative result; the mucosa only appears to be markedly anæmic, and sometimes there is slight catarrh of the upper portion, which, however, is by no means in proportion to the sensations of the patient.

Course and Prognosis.—Paræsthesia of the larynx is devoid of danger, but usually very obstinate. In hysteria and hypochondriasis it often gives place to other neuroses, while in phthisis it diminishes as the pulmonary disease advances.

Treatment.—This must be directed to the primary cause, be it anæmia, chlorosis, or hypochondriasis. For the neurosis itself little can be done. Narcotics, nerve tonics, and bromide of potassium are not satisfactory in their results; in some cases in which there was no evidence of disease, we have had good results from the application of a 2 or 3 per cent. solution of nitrate of silver (gr. 10–15 ad ℥i).

B. DISTURBANCES OF MOBILITY.

Motor disturbance of the larynx may be of three forms.

(1) Excessive contraction or spasm of certain muscles or groups of muscles (hyperkinesis).

(2) Disturbance of co-ordination.

(3) Deficient or absent muscular action owing to diminished or interrupted nerve conduction (hypokinesis).

(*a*) *Hyperkinetic Disturbances.*

Spasm may occur in one of two forms. (1) Spasm of the muscles which close the glottis (laryngo-spasm). (2) Paroxysmal spasm of the glottis combined with the contraction of the expiratory muscles (nervous cough).

Theoretically, it cannot be denied that other muscles besides those which close the

glottis may be affected by spasm, but no cases have been observed which demonstrate this except, perhaps, one described by Fraentzel, which he designated

SPASM OF THE ABDUCTORS.

The patient was not only quite aphonic, but could not produce any laryngeal sound at all, even cough being aphonic. The cords, even on attempted phonation and during forced expiration, maintained the position seen in deep inspiration. Fraentzel explained the case as one of paralysis of the adductors and secondary spasm of the abductors.

I. SPASM OF THE GLOTTIS.

(Syn.—Laryngismus stridulus, Asthma Millari, Asthma thymicum, Asthma Koppii.)

To these numerous designations Jurasz has recently added another, viz. "respiratory spasm," in contradistinction to spasm on phonation, which we shall again refer to in discussing disturbance of co-ordination. We do not consider this nomenclature appropriate because, during the attack, not only respiration but phonation is prevented just as in the other variety.

The expressions "asthma thymicum" and "asthma Koppii" are only of historical interest, because at present no one supports Kopp's view that the disease is due to enlargement of the thymus gland.

By the term spasm we understand sudden paroxysmal closure of the glottis, which may be due to direct or reflex stimulation of the recurrent, or of the vagus above its junction with the recurrent nerve. As the condition is different in children and adults, we shall discuss the former first.

(*a*) *Laryngeal Spasm in Children.*

Etiology.—Even slight general and local conditions may give rise to laryngeal spasm in childhood, on account of the following physiological conditions: (1) The increased irritability and tendency to reflex action of the nervous system, which predisposes to spasm; (2) the sensibility of the larynx in childhood; (3) the small orifice of the glottis in early life. Laryngeal spasm is most common between the ages of four months and two years, but has been observed soon after birth. Should the affection become developed after the age of two, it is, according to Steffen, of less severity. Boys are more prone to be attacked than girls, but in this the general law that the larynx is more liable to disease in males than in females is followed. Season is not without influence on the development of the disease. Spasm of the glottis is most common during the cold months, from October to the end of March; the last-named seems to be most favourable for the appearance of the affection. Among general causes nutrition is the most important. Hand-fed children, and those who, after weaning, have been improperly nourished, show a special predisposition to laryngismus. Unhealthy, small, badly ventilated, damp dwellings, and want of fresh air (especially in winter) favour its occurrence.

All observers are agreed that rachitic children are particularly prone to be attacked; according to Flesch, three quarters of all cases occur in those so afflicted. The nature of this relationship we shall discuss under the head of "Pathology."

Heredity is a doubtful cause. Gerhardt and Reid noticed several deaths due to laryngismus in the same families; this, however, is not conclusive proof, because it is quite as easy to assume other common causes—especially bad nutrition—to account for these cases.

A common cause of spasm is enlargement and caseation of the bronchial glands, which, by pressing upon and irritating the recurrent, give rise to the affection.

Among general diseases of the nervous system, chronic hydrocephalus and microcephalus sometimes give rise to glottic spasm. In hydrocephalus the spasm is, however, only a part symptom of general convulsions, which either begin or end with laryngismus, and usually follow an acute exacerbation of the cerebral lesion.

The view that swelling of the thymus gland may be a cause of glottic spasm has been proved erroneous by numerous dissections.

In a certain number of cases no cause can be demonstrated, and we are compelled to assume either a functional change in the brain or medulla or simple reflex action.

As accidental causes, may be mentioned catarrh of the larynx, trachea, or bronchi, which may produce paroxysms in children who are subject to laryngismus, also over distension of the stomach, dyspepsia, intestinal catarrh, flatulence, and emotion (fright, pleasure, crying).

Pathology and Pathogenesis.—Laryngismus is a pure neurosis, and no change can be found either in the nerves, muscles, or mucous membrane of the larynx. What is found post-mortem is either a remote cause or a secondary condition affecting various organs.

In the majority of cases rachitic changes are found in the skeleton, especially in the bones of the head (in the form of cranio-tabes or periostial thickening), in the thorax (either simple thickening of the epiphyses of the ribs, or marked lateral flattening producing pigeon breast).

Various views exist as to the etiological connection between rickets and laryngismus. Elsässer assumed that in rickety softening of the occiput the pressure upon the brain, produced by the child lying down, caused laryngismus. Against this view it may be stated that (1) laryngismus occurs in rickety children without softening of the skull (craniotabes), and inversely softening may exist without laryngismus; (2) that the attacks may occur in the upright posture; (3) that it would be strange if pressure on the brain were to cause stimulation of the vagus only without affecting other nerves.

Steffen finds the principal predisposition to disease in general, and to

laryngismus in particular, in the morbid irritability of the nervous system, a result of deep-seated disturbance of nutrition, and a characteristic symptom of rickets when it is associated with changes in the skeleton. Owing to the marked deformity of the thorax, respiration is shallow and rapid; if, then, the rhythm of respiration be disturbed by coughing, screaming, fright, or by being suddenly wakened from sleep, the heart's action becomes more rapid, owing to increased want of air, and thus hyperæmia of the brain and medulla are produced, and the conditions necessary for the production of laryngismus result.

Monti agrees with this view, but he believes that spasm of the glottis is not developed at all stages of rickets, but only when the disease is progressing acutely; then, owing to marked changes in nutrition, be it anæmia or disturbed nutrition of the nerve centres, increased irritability of the nervous system is produced, and is manifested by sleeplessness, irritability, and uncertain temper. In this condition the action of various disturbing causes and peripheral irritants may give rise to the development of laryngismus.

Besides evidence of rickets, there may be found in the bodies of children, who have succumbed to laryngeal spasm, enlargement of the solitary glands, of Peyer's patches, and the mesenteric glands; less commonly, enlargement of the tracheal and bronchial glands, with partial or complete caseation; in a few cases the recurrent nerve is embedded in these glands. Enlargement of the thymus gland, to which formerly considerable importance was attached (Kopp), is only found exceptionally. In the cranial cavity there is found, especially in cases in which death occurs during a convulsion, more or less hyperæmia of the brain and its membranes, sometimes cerebral œdema and exudation. The lungs are slightly emphysematous, especially at their anterior borders, in consequence of the spasmodic closure of the glottis; œdema is not uncommonly present, and sometimes there is chronic pneumonia, with or without tuberculosis. In the larynx itself there are no changes, or, at most, slight catarrh.

Symptoms.—Although, as we have seen, laryngismus rarely attacks healthy children, but rather those who are badly nourished and weakly, still the disease occurs without premonitory symptoms, as regards the larynx or respiratory tract. A typical case is somewhat as follows: suddenly, after one or two short whistling inspirations, respiration ceases, owing to closure of the glottis. The anxious countenance, the staring eyes with contracted pupils, the pale skin, blue lips, dilated nostrils, the head bent backwards, while the neck is extended, and the brow covered with cold perspiration, show how sharp has been the struggle for breath. After a short time, lasting from a few seconds to two minutes, which, however, seems an eternity to the onlookers, if death, by suffocation, does not occur during the paroxysm, the painful scene is

ended by several deep crowing inspirations. The respiration, at first rapid and deep, soon resumes its regular rhythm, and gradually the child returns to its normal condition.

The attack is not always the same in severity and character; when slight it consists only of a momentary stoppage of respiration, which is relieved by a single, long, noisy inspiration. In severe cases the spasm also affects the regions of distribution of other nerves; the fingers are contracted, the hands closed, or the thumb points inwards, while the other fingers are spasmodically extended, and remain stiff. Owing to spasm of the flexors of the forearm, the wrists are bent inwards; the lower extremities are also affected, the toes are firmly drawn together, the foot turned inwards, and, finally, general tonic convulsions of the body occur. In slight cases consciousness is retained, but in severe attacks it is more or less lost. The heart's action is at first irregular and strong, soon becoming weaker, and the pulse is small.

The number of attacks during the day varies. Often several follow one another at short intervals, to be succeeded by a comparatively long interval of health, after which they are renewed. This change may occur several times within twenty-four hours. The shorter the interval, the slighter, as a rule, are the attacks. Sometimes after a number of mild attacks a severe one occurs, which may even end in death. The attacks may occur during the day as well as at night, and may be produced by any of the accidental causes mentioned under Etiology; a direct exciting cause may, however, not be demonstrable.

Duration, Result, and Prognosis.—Laryngismus may last for weeks and months, or, in other words, so long as disturbed nutrition and increased irritability of the nervous system exist, the attacks are always liable to recur. When nutrition is improved, complete cure takes place. Death, which is not common, may be due to asphyxia or general convulsions. Sometimes the disease is complicated by exudation between the membranes of the brain and into the ventricles, and the little patients die, sooner or later, with symptoms pointing to pressure. Other diseases, which occur during liability to laryngeal spasm, *e.g.* gastro-intestinal catarrh, pulmonary catarrh, and pneumonia, must be looked upon as the results of the rachitic state. The prognosis, as a rule, is not unfavourable, but depends upon the general condition of the child, and upon the possibility of placing it under favourable hygienic conditions. Complication of the attacks, with general convulsions and marked cerebral changes affecting the brain substance, the membranes, or the medulla, makes the prognosis less favourable.

The prognosis is also said to be more favourable in girls than in boys.

Diagnosis.—The sudden advent of an attack, the characteristic picture of severe but transient apnœa, the intervals of free respiration,

the absence of fever, cough, and vocal disturbance prevent confusion with croup, laryngeal œdema, or any other organic disease. The differentiation of spasm from bilateral paralysis of the abductors of the cords is easy, because in the latter there is constant, but generally not very marked, difficulty in breathing, which, on slight exertion, increases to apnœa.

Treatment.—The treatment of the attack must be independent of that of the primary disease. The paroxysm is frequently so short that there is hardly time for the application of remedies, and it is so sudden that whatever is requisite must be left to the relatives; the great majority of cases certainly recover without anything being done. It has, moreover, been doubted whether we can in any way influence the duration and result of any given attack. Flesch, indeed, believes that the means hitherto recommended are not only valueless, but tend to lengthen the paroxysm by increasing the "series of checks to respiration, of which each attack is composed." This notwithstanding, the anxious relatives demand help, in the face of the painful scene produced by a case of marked laryngeal spasm, and even in cases of medium severity it is better not to assume a purely expectant attitude. The window should be opened to supply fresh air, all tight clothing removed, friction exercised upon various parts of the surface with spirits of mustard and cold water applied to the face and thorax, in order to restore respiration, while ether and ammonia are given internally, and action of the bowels produced by a purgative enema. If the paroxysm be severe, cyanosis marked, and asphyxia threatened, the cold douche should be employed while the patient is immersed in warm water (26°–28° R. or 78°–82° F.). If the surgeon be present, time should not be lost by mild remedies, but recourse be had to catheterisation of the larynx. If, in spite of this, no breathing occurs, artificial respiration must be combined with the above, air being blown into the catheter, and expiration produced by pressure on the sides of the chest. Attempts may also be made to stimulate respiratory movements by the action of the induced (applied to the phrenic) or constant currents (one pole to the thorax and the other to the spine). Tracheotomy is, in the first place, usually impossible, because the scene terminates too quickly; and, in the second place, useless, because when catheterisation and electricity do not stimulate respiration, tracheotomy is also unsuccessful.* The inhalation of chloroform may cut short an attack, but can only be carried out in older children; and the same applies to subcutaneous injections of morphia.

From the use of internal remedies, *e.g.* musk, assafœtida, etc., not much is to be expected; in mild cases they are unnecessary, and during

* It must be remembered, however,—a point apparently not considered in the foregoing—that the surgeon is more likely to have the means at hand for opening the wind-pipe than laryngeal catheters and various batteries (Translator).

severe paroxysms swallowing is impossible. Enemata of assafœtida and tobacco have been recommended in various quarters, but they are, at all events, not more useful than purgatives administered in like manner.

It is of great importance to employ treatment during the free intervals, and, so long as the cause exists, to diminish the frequency of the attacks by prophylactic measures. Accidental causes, which are apt to be followed by laryngismus, should be discovered and obviated; excitement should be avoided, crying and screaming prevented, which, considering the irritable condition of the child, is no easy matter. The apartment should be well ventilated, and, if the weather be warm, the patient may be permitted to go out occasionally, but the effects of sudden changes of temperature should be guarded against. Above all, nutrition should be regulated; it is well known that over distention of the stomach may produce convulsions by stimulation of the peripheral ends of the vagus, and, for this reason, small quantities of food should be given at frequent intervals, or, in older children, fluids and broths. If dyspepsia be present, it should be treated by suitable remedies, *e.g.* alkalies, acids, and rhubarb. For the affection itself, or rather for the increased irritability of the nervous system, a large number of remedies have been advocated, *e.g.* nervines (musk, assafœtida, preparations of zinc and copper, gold, nitrate of silver) and narcotics (morphia, belladonna, cannabis indica, chloral). The value of these drugs is doubtful, but we have seen distinct benefit from bromide of potassium. We are in the habit of ordering, for older children, half a gramme (about 7 grains) three or four times daily, and for infants, ·1–·2 (of a gramme, or approximately $1\frac{1}{2}$–3 grains) every three hours until the attacks diminish in frequency.

As primary causes, rickets, struma, and glandular enlargements deserve special consideration. We cannot enter into the details of their treatment, but must rest content with stating that, in addition to regulation of diet (principally consisting of milk and meat to the exclusion of starchy matters) and attention to hygiene (well-ventilated apartments and fresh air), the administration of cod-liver oil and iodide of iron is necessary.

Monti, for children under one year, prescribes cod-liver oil with valerian, as follows:—

* Ol. jecor. Asell. flav. 10 (℥v.)
Pulv. gum. arab.
Aq. font. $\overline{aa}$ q. s. ut. fiat.
Mixtur. colaturae 100 $\overline{aa}$ (℥vi.)
Adde Tinct. Valerian. 2.0 (℥i.)
Three or four tablespoonfuls daily.

* The adjoined drachms and ounces, here and elsewhere, will be found to give the approximate proportions (although not actual quantities (Translator).

If there be much anæmia, the valerian should be replaced by tinct. fer. pomat., and if the bronchial glands be enlarged, by the syrup of the iodide of iron (10, or in a six ounce mixture ℥v.). To older children cod-liver oil should be given undiluted, or, if it be not well borne, the following powders:—

Ferri iodid. sachar. 1·0 (gr. 15½).
Sachar. alb. 2·0 (gr. 31).

Divide in partes decem æquel. Three or four powders daily.

or

Syrup. ferri iodid. 5 (℥i and min. 40).
Syrup. simpl. 50 (℥ii).
Aether. acet. ·5 (min. 10).

Half a teaspoonful thrice a day.

In chronic hydrocephalus iodide of potassium may be administered.

Potas. iodid. 1–2 (gr. 30–℥i).
Aq. font. 90 } ℥vi.
Syrup. simpl. 10 }

A tablespoonful every two hours.

(*b*) *Laryngeal Spasm in Adults.**

Etiology.—If we exclude spasm due to the presence of foreign bodies, or associated with certain forms of laryngeal tumour (which cannot be looked upon as neurotic), the affection is rare in adults. Hysteria is the most common cause, and the symptom either replaces or is associated with other forms of spasm. Next in frequency to hysteria, as a cause, is stimulation of the recurrent or vagus by tumours, or aneurisms. In these cases the pressure is never so great as to produce paralysis; it is also not constant, but is influenced by external circumstances, particularly position.

Thus, the author observed a case of goitre in which the left lobe of the gland was much hypertrophied, owing to which the patient was seized with laryngeal spasm whenever he lay on his left side. An attack also occurred when a large, hard morsel was swallowed, and this was not due to choking, but to real spasm.

Glottic spasm is sometimes due to epilepsy, tetanus, hydrophobia, and chorea; it is rarely a symptom of pathological changes in the brain and spine.†

* See also article by translator, on Laryngeal Vertigo in Appendix.

† This last statement is open to criticism, because for years past the laryngeal crises of locomotor ataxia have been recognised as not uncommon.

The author has under observation a case of locomotor ataxia in a woman, who suffers from severe attacks of laryngeal spasm. These occur every day, and end with the expectoration of a small pellet of mucus, which he believes to be the exciting cause of the attack. The attacks often cease for weeks, and then recur for a time.

Cases of laryngeal spasm, without any definite cause, must be ascribed to morbid irritability of the nervous system. It is well known that many persons are seized with violent spasm when the interior of the larynx is touched with a probe, while usually this only produces cough.

The author observed an interesting case of glottic spasm in an otherwise healthy man. The attack occurred at every forced expiration, and the patient stated at his first visit that, for some time back, every act of coughing had been followed by spasm, and that some days before, when made to laugh at a circus by the antics of the clowns, such a severe attack occurred that he was in danger of suffocation. The author examined the patient with the laryngoscope, and made him sound a note. It was then discovered that the patient did not inspire, and that the cords remained in the position of adduction, for which reason the mirror was withdrawn, and an attack of laryngeal spasm occurred which was of such severity, and lasted so long, that the author hardly expected recovery.

Symptoms.—Laryngeal spasm in the adult is characterised, in most cases, by a series of deep, whistling inspirations, and short, noisy expirations. Complete closure of the glottis occurs more rarely than in children, but the anxiety of the patient and his difficulty in breathing are often as great. General convulsions probably only occur in hysterical persons, and are more due to the general ailment than to the laryngeal spasm.

An opportunity of making a laryngoscopic examination during a paroxysm is rarely afforded, both because it is difficult of execution, and because it depends upon the chance of seeing the patient during an attack. In the case observed by us we found the cartilaginous portion of the glottis firmly closed, the points of the vocal processes somewhat prominent, and the ligamentous portion of the glottis closed, with the exception of a narrow cleft; contact of the ventricular bands did not take place. During the intervals the mucous membrane of the larynx may be completely normal, and there is no cause visible.

Duration, Result, and Prognosis.—Laryngeal spasm in the adult may last for weeks and months, the attacks being of varying frequency. In hysterical patients the affection may give place to other convulsive conditions for a time, and then recur. The paroxysms usually end favourably, but a few authors have reported fatal results, and occasionally patients are said to die from exhaustion when the affection lasts for a long time.

Diagnosis.—Paralysis of the abductors of the cords alone can be confounded with this condition; laryngoscopic examination, however, shows that in the former the cords remain in the position of adduction, even

when there is no paroxysm, while in glottic spasm muscular action is normal during the intervals.

Treatment.—The paroxysm itself rarely requires treatment; if it lasts long and assumes a threatening character, inhalation of chloroform may be employed, in addition to the application of counter irritants to the surface (mustard poultices to the chest and calves, and cold water to the face). Tracheotomy is probably never called for.

For the rest, the primary cause must be found out and treated, thus hysteria must be met by dietetic and medicinal agents, glandular swellings and goitres by preparations of iodine. In women the condition of the sexual organs must be inquired into, and any existing morbid condition treated. If no organic disease can be found as a cause, we should recommend that the bromides of potassium and sodium be given to diminish reflex irritability of the nervous system. We have also found these remedies useful in cases in which the spasm was due to a goitre pressing upon the recurrent. Tobold recommends the use of the constant current, "when every attempt to find out the exciting cause of glottic spasm has failed, and when only so-called irritability of the nervous system is present."

II. NERVOUS COUGH.

We understand by the designation nervous cough, a cough caused by no demonstrable pathological change in the respiratory tract, but due only to increased irritability or other affection of the central nervous system. We consider as nervous a cough produced by stimulation of such sensory fibres as do not when irritated produce this symptom under physiological conditions, and, further, that which, though not produced by reflex action, is due to an affection of the central nervous system.

The term nervous cough has been employed in various ways. Some authors characterise it from the manner of its onset, others by its peculiar sound. Eulenburg considers it to be a respiratory inhibitory neurosis, and ascribes it to irritation of the centripetal fibres of the vagus, thus excluding cases due to irritation reflected from other nerves, as also those due to central causes. Tobold separates nervous from hysterical cough, with which, according to his view, it has nothing in common, and describes it as a cough occurring in paroxysms of unusual severity, with intervals of complete freedom. Schroetter describes that cough which occurs against the wish of the patient, and which always attracts attention from its peculiar sound, as "spasmodic."

The author classes under this term all forms of cough of purely neurotic origin, in whatever way they occur.

The terms spasmodic cough, etc., we have especially avoided, because they are only based upon a symptom which also belongs to diseases of the respiratory tract.

Etiology and Pathogenesis.—Among the causes of nervous cough, as of laryngeal neurosis generally, hysteria takes the first place; then follow all diseases which are associated with increased irritability of the

sensory or central nervous system, *e.g.* diseases of the sexual apparatus in women, altered quality of the blood, as in chlorosis and advanced anæmia, and also "general nervousness." In these cases cough may occur in one of two ways—(1) reflexly, by irritation of those sensory fibres which, when stimulated, do not normally produce cough; (2) without any external cause, when it is due to purely central irritation. As an example of reflex cough, Ebstein reports the case of an hysterical young lady in whom cough was produced not only by stimulation of sensory nerves, but also of those of special sense; "the slightest touch, every noise, such as the sound of knives and forks in eating, the footsteps of her father on returning from a walk, were sufficient to produce paroxysms of cough the like of which for duration and intensity I have rarely heard." Leyden reports the case of a young man, who was so sensitive that on attempting to examine his chest, the physician was unable to touch him without producing a most fearful fit of coughing. As caused by central irritation, we must consider those cases in which cough occurs spontaneously, or owing to psychic influences (fear, excitement, etc.), or on touching the region between the second and fourth cervical vertebræ; the peculiar cough sometimes observed in chorea is also dependent upon disease of the central nervous system.

Rühle brings forward observations showing that paroxysmal cough, with perfectly free intervals, may occur in children suffering from tubercular disease of the bronchial glands, and considers himself justified in assuming functional disturbance of the vagus produced by the adjacent glandular swelling.

Females are more liable to be attacked than males. The affection is particularly liable to attack girls about the age of puberty, but also boys up to their sixteenth year.

Temperature, season, etc. have no influence either on the development or the occurrence of the disease.

Symptoms.—Nervous cough is characterised by the manner of its appearance and its characteristic sound.

As to the manner of its occurrence, we may differentiate two forms, according as the cough occurs (1) in paroxysms of varied duration, or (2) is almost continuous, short, and rhythmic.

(*a*) Paroxysmal cough is characterised by its great severity; cough follows cough, the patient being unable to stop even for a moment until the attack spontaneously and almost suddenly ceases, to return again after several hours. These paroxysms are repeated several times a day, and often at definite times. Rühle describes a case in which it occurred in a manner resembling tertian ague and lasted several hours. Generally the attacks are produced spontaneously, without any apparent cause; sometimes they are due to excitement, fright, or stimulation of a sensory nerve. During sleep the condition ceases completely, there is rarely

any expectoration, although occasionally the attack may end by the expectoration of fluid secretion.

(*b*) Continuous rhythmic cough is not so severe as the paroxysmal variety; it consists in uninterrupted, regular coughs varying in loudness. The patient can only interrupt it so as to allow of eating and speaking, which in the other variety is impossible during a paroxysm, and the same applies to laryngoscopic examination. During sleep the cough ceases entirely, but Ziemssen relates the case of an hysterical lady in whom nervous cough of this kind lasted for weeks without half an hour's intermission by day or night, so that the larynx and the whole system were tired out. In many patients intermissions of several minutes occur, and, according to Schroetter, the condition becomes worse when the sufferers know that they are being watched. According to the same author, some patients can partially check the affection by an effort of will, while others, on the contrary, become worse when called upon to exercise volition. In conjunction with this rhythmic cough there may be also observed twitching of other muscles, especially those of the face. In a case observed by us, cough and facial twitching alternated so that the cough lasted for weeks, and then twitching set in as soon as it ceased, and *vice versa*.

Schroetter, whose description of this form of nervous cough for the most part tallies with that here given, speaks of the condition as chorea laryngis, and defines it as a cough which occurs without apparent cause, without concomitant disease, and against the will of the patient, is characterised by certain acoustic peculiarities, and ceases during sleep, to begin again on waking at intervals of from five to ten minutes.

We consider this definition as unsatisfactory, and are disinclined to accept the term "chorea laryngis." Almost every cough occurs against the will of the patient when it is not voluntarily produced for some reason, and this especially applies to every cough produced reflexly by disease of the respiratory tract. As to the "musical properties," it is certainly true that nervous cough is often characterised by acoustic peculiarities, but we cannot, even in this, find anything pathognomonic; the sound of the cough may differ but slightly or not at all from the normal. As we have already stated, we consider its characteristic feature to be the continuous rhythmic expiratory efforts.

The designation, chorea laryngis, which we adopted to describe this affection for some time, we consider is unsuitable for various reasons, although we must agree with Schroetter, that the cough may be associated with choreic twitchings of the face and extremities, protrusion of the tongue, etc., and that the condition is most commonly found in young persons (from eight to fourteen years of age). In eighteen cases observed by us, facial twitching was twice present, associated with the cough, once the two conditions alternated, once the cough was associated with general chorea, and at the same time the patient's brother had chorea without cough, twice brothers or sisters had chorea, and, finally, two members of the same family had rhythmic cough at the same time (aged respectively nine and six). In the remaining cases there was no association with chorea, but, in two of them, there was hysteria.

We cannot consider the cough as due to choreic twitching, because the characteristic feature of chorea is found in anomalous movements, as a result of attempted voluntary co-ordination, and nervous cough disappears at the moment of phonation.

Besides, various authors designate different conditions as chorea laryngis; Mackenzie describes under this name "tremulous action of the laryngeal muscles in weak and extremely nervous persons;" Schech, "insufficient force and duration in the tension of the

cords;" Voltolini, "a peculiar contraction of the glottis closers or inclination to cough." We, therefore, think it better to drop the term chorea laryngis entirely.

The sound of nervous cough, especially in the second variety, is often characteristic; sometimes it is croupy or remarkably deep, shrill, metallic, howling, or crowing; occasionally, however, there is no such peculiarity.

Laryngoscopic examination shows nothing abnormal, or at most a slight catarrh which bears no proportion to the severity of the cough; the mucous membrane of the larynx is often anæmic, and this condition is frequently associated with general anæmia. Physical examination of the chest shows the respiratory tract to be normal.

Course, Duration, and Prognosis.—Both forms of nervous cough set in suddenly, and run their course without fever or constitutional disturbance. The affection is remarkably obstinate, and may last for months or even years.

A short time ago, Professor Berger sent a young lady of twenty-four to the author for laryngoscopic examination, with the diagnosis of hysteria and nervous cough. The lady stated that twelve years before, she had consulted the author for the same affection which, during this long interval, had remained unchanged; it was a noteworthy fact that during a visit to Madrid, she became much worse. The patient was, on the whole, well nourished. The cough thus lasted without intermission for twelve years, and had changed from a purely "nervous" into an "hysterical" cough. Its character corresponded to that of the second variety above described, viz. rhythmic cough.

The cough often disappears after some weeks only to relapse once or oftener, and sometimes to give place to other nervous symptoms. Nevertheless, the prognosis is not unfavourable, for, in spite of the long duration and severity of the symptom, the system suffers little and cure always finally results.

Diagnosis.—The absence of all anatomical changes in the respiratory tract and the peculiar mode of recurrence of the cough (either in paroxysms, with intervals of complete freedom, or as continuous rhythmic cough) makes the diagnosis certain. We must, however, bear in mind that occasionally, though rarely, a cough lasting for hours, and repeated several times a day, which may have the acoustic peculiarities of nervous cough, occurs in the early stage of phthisis at a time when physical examination of the chest gives no certain indications of pulmonary disease; careful examination, however, shows that the intervals in these cases are not quite free from cough.

Treatment.—Rühle says "as a characteristic of this kind of cough, we must consider the fact that it is but rarely relieved by medicines." We should confine this remark to narcotics, which are usually without influence upon the affection. On the other hand, we have, in cases complicated with choreic twitchings, seen decided benefit from the use of arsenic. Schroetter recommends a cold douche two or three times a day, applied while the patient is seated in tepid water, quinine in

large doses, and the constant current. Sometimes the cough ceases after change of air and surroundings.* In anæmia and chlorosis, preparations of iron and attention to nutrition are required. Leyden specially advocates moral treatment, *i.e.* removal from the family circle and firmness.

(*b*) *Disturbances of Co-ordination within the Larynx.*

Etiology and Pathogenesis.—In nervous, hysterical persons, one sometimes sees, during laryngoscopic examination, that the cords, instead of becoming separate, approach one another and close the glottis, so that a transitory, inspiratory dyspnœa arises which compels the patient to open the glottis for a moment; this, however, is again followed by spasm of the cords, and thus further laryngoscopic examination is made impossible. This perverted action of the cords cannot be considered pathological, because it only occurs during laryngoscopic examination and gives place to normal action when the patient gains confidence; it may, however, be taken as the type of serious motor disturbances, which, it is true, differ in their causes and symptoms, but have this much in common that the volitional impulse is followed not by the intended movement but by one which is unpremeditated and opposite, or the voluntary and involuntary become combined.

The pathogenesis of this peculiar form of motor disturbance is involved in obscurity, because the number of well-observed cases is very small; sometimes the condition is due to hysteria. It remains uncertain whether there is a central ataxia, that is to say, a disturbance of co-ordination in the various laryngeal muscles due to central changes or a so-called sensory ataxia (in other words, a disturbance in the centripetal fibres between the periphery and the centre). We do not yet know anything concerning the sensibility of the mucous membrane or muscular sense in these lesions of co-ordination, so that we are unable thus to gain knowledge towards deciding this question.

Commonly the affection occurs associated with paresis or paralysis of individual muscles or groups of muscles, and Semon therefore designates it as "a mixture of spasm and paralysis occurring in a chronic form."

As the prototype of this condition, we may look upon the so-called paralytic contractions, to which we shall again refer when discussing paralysis. These contractions depend upon the fact that in paralysis of a muscle or a group of muscles the antagonists act at the same time, or even alone, when the patient attempts to bring the paralysed muscles into action (central radiation of the volitionary impulse,

* Mackenzie specially advocates a sea voyage when practicable (Translator).

according to Nothnagel). This deficient innervation is most marked in paralysis of the abductors, in which it often produces marked inspiratory dyspnœa by further contracting the narrow opening of the glottis. In the same way, paresis of individual muscles sometimes gives rise to perverse action of the cords.

We must refer to the same causes, the disturbance of co-ordination sometimes seen in persons who use their voice in the exercise of their profession (clergymen, costermongers, etc.), which have been rightly compared with other neuroses due to occupation (writer's cramp, piano player's cramp).

Symptoms.—Disturbances of co-ordination, affecting the laryngeal muscles, give rise to such varied symptoms that it is difficult to give a general description of these. In the first place, we may differentiate two principal forms, viz. (1) functional spasm of the glottis on phonation, (2) functional spasm on inspiration. Both forms have this in common—in contradistinction to laryngeal spasm—that they only occur when certain muscles are called upon to act; they differ, however, from each other, in that in the first form spasm only occurs on phonation, and in the second on inspiration.

We have adopted a different classification from that employed by other authors, but believe that our description is fully justified.

In proportion as the cases of these affections, so far observed, are few, the designations employed have been numerous; phonic glottic spasm, aphonia and disphonia spastica, spasm of co-ordination, perverted action of the vocal cords, chorea laryngis, vocal asynergia, functional spasm of the laryngeal muscles, spasm of the tensors are in part synonyms, and in part designations applied to the various symptoms met with. To us the term "functional spasm of the glottis" seems most applicable, but we prefer "disturbance of co-ordination," as being more general, for under this heading we are enabled to group both spasm and paralytic contraction.

(1) Functional spasm on phonation is characterised by the fact that at each attempt to speak, the muscles which close the glottis are attacked with spasm, so that the cleft, which exists under physiological conditions, and which is necessary for phonation, is closed. The immediate result is a more or less marked interference with speech. In highly developed cases, there is complete inability to speak or even to produce a sound; a word, as it were, remains in the larynx, because, owing to its closure, the expiratory current cannot pass. It is therefore wrong to speak of aphonia spastica, and it would be more justifiable to term the condition aphthongia laryngia spastica. Nothnagel gives a vivid description of this condition in a case observed by himself; "the patient attempts to speak, but at each effort her lips only move. It is noticeable that she is exerting herself considerably, the abdominal muscles are felt and seen to contract as during expiration, the face becomes cyanotic, but no sound is produced." Even speaking in a whisper is impossible, for the reason above specified.

The resemblance between this condition and that described by Fleury as aphthongia or reflex asphasia at once becomes evident. In this affection every attempt to speak is followed by hypo-glossal spasm, which makes speech impossible and fixes the tongue immovably against the hard palate. This completely justifies the term aphthongia, and, in order to show that the affection under consideration is not due to hypo glossal spasm, as in Fleury's aphthongia, but to spasm of the vocal cords, we add to it "laryngea spastica." We may further remark that in dyslalia laryngea, as described by Kussmaul, the larynx only loses the ability to pronounce accurately such consonants as require its assistance.

The vocal disability is not always so marked; the patients may be able to sound certain notes or even pronounce short sentences, although the voice is subdued; articulation then stops, and the more the patient tries the less able is he to produce a note. Sometimes the vowels of a word are sounded double (Jurasz), or the diphthongs are divided into their component letters (Schech).

So long as attempts at phonation last, respiration is impeded, and in severe cases even dyspnœa with cyanosis may occur; when the attempt to articulate is given up, respiration becomes normal. If the patient does not attempt to speak, he may be able to tax his pulmonary organs to any extent without respiration being disturbed. Usually the attack only occurs when an attempt is made to speak in a loud, clear voice; in one case observed by Schech, spasm occurred, though to a slight degree, during whispering; in Nothnagel's case, it occurred at every voluntary innervation of the muscles which close the glottis, *e.g.* when an attempt was made to blow out a candle; in one instance noted by Voltolini, it was produced by irritation and inclination to cough, and Jouquière noted its occurrence in one instance associated with coughing and laughing as well as speaking.

We may here note a resemblance to some attacks of laryngeal spasm, which, for example, in a case observed by us, occurred on forced expiration—laughing and coughing. It will require further observations to establish the relation between laryngeal spasm and phonation or other voluntarily produced expiratory acts, *e.g.* artificial laughter and voluntary cough.

During the attack the patients complained of pain in the larynx and thorax. The sensation in the larynx is sometimes described as tightness, and sometimes as actually pain. The pain in the thorax is referred to various points, such as the attachment of the abdominal muscles or beneath the sternum.

Almost always there are present during the attack other neurotic symptoms of a spasmodic nature, *e.g.* general tremors (Nothnagel), slight twitching of the muscles of the face and neck (Schech).

The general condition is only slightly affected, while the lungs and heart are normal. As the affection is prone to attack nervous persons, the patient sometimes complains of neuralgia, headache, cardialgia, sleeplessness, or great irritability; it also occasionally causes melancholy and depression.

Laryngoscopic examination shows no anatomical changes, nor is there any disturbance of mobility so long as the patient breathes. On phonation the cords are approximated so violently that no opening is left for respiration; they remain in this position until the attempt is given up. Vibration of the cords is not noticeable, and sometimes the ventricular bands approach one another. When the affection is slight, a linear cleft is seen, and the cords move slightly in a spasmodic manner.

The severity of the attack and the laryngoscopic appearances evidently depend upon whether the adductors are all affected, or only individual muscles. Probably in all cases the lateral crico-arytenoid—the adductor proper—is affected, but not always the transverse muscle. If the last-named be normal, or, as in a case observed by Hack, paralysed, the cartilaginous portion of the glottis remains open in the form of a triangle. The most complete closure of the glottis and the most severe symptoms are produced by spasm of the internal thyro-arytenoid muscle.

As a special form of disturbed co-ordination on phonation, we may regard habitual too powerful contraction of the tensors of the cords—the crico-thyroids—in consequence of which the voice becomes too high-pitched and acquires a shrill and piping character. This high falsetto note occurs in those who, after the change of voice (breaking), have not acquired complete control over their vocal organs.

Mackenzie partially describes, under the appellation spasm of the tensors of the cords, the symptoms which we have above detailed. Why he only assumes spasm of the tensors and not of the adductors, is not evident.*

(2) *Functional Inspiratory Spasm.*—While in phonic spasm, as we have seen, an intended movement is carried out without proper adjustment of innervation in relation to the various muscles (adductors and tensors), in inspiratory spasm, on the other hand, movements are accomplished which are exactly opposite to those intended. Instead of the glottis becoming wider on inspiration by the action of the abductors, it is contracted by the adductors; and there results inspiratory dyspnœa, with various degrees of stridor. Phonation, however, is normal, and is carried on without difficulty, and during sleep both dyspnœa and stridor disappear. To a slight degree it is present, associated with paresis of the abductors, in many cases of laryngeal catarrh; the dyspnœa then occurs only after exertion or excitement. The general health is not disturbed.

Laryngoscopic examination shows the interior of the larynx to be unchanged in colour and form; as to the opening of the glottis, however, its configuration varies in different cases, although all agree in so far that on inspiration the cords are approximated instead of separated. This approximation of the cords does not always occur in a similar manner. Sometimes the glottis is entirely closed with coincident dyspnœa, sometimes the cords are only so far approximated as to assume

* It must be observed that Mackenzie regards the internal thyro-arytenoid muscles as the chief tensors of the cords (Vol. I., p. 208) (Translator).

the position of phonation, or again, their position may be half-way between this and the cadaveric. Even in the same patient the amount of closure may vary in successive inspirations; one inspiration may occur with a moderate aperture, and be followed by a second with the cords in contact, or the succeeding few respirations may be normal, and then the spasm ensue. The condition of the glottic opening during expiration is not always the same; usually it is narrower than in health. Sometimes, at the close of expiration or the beginning of inspiration, there is tremulous movement of the cords.

The cords acted in a very peculiar manner, in a case observed by Riegel. At the beginning of inspiration the glottis opened as in health; but this did not last long. Almost immediately the cords became rapidly approximated, up to a point half-way between the position of phonation and the cadaveric; and thus they remained until expiration began. This second condition, called by Riegel "the inspiratory pause," always lasted longer than the first. At the next expiration, which, as in the case of the inspiratory widening of the glottis, was accompanied by a loud sound, separation again occurred. Sometimes this expiratory widening was preceded by rapid approximation until the cords were almost in contact; this was then immediately followed by separation. Afterwards, however, the widening of the glottis lasted but a short time before it was again followed, as in the case of the inspiratory separation, by sudden, almost complete closure. In this position — expiratory pause — the cords remained until the next inspiration.

Riegel explained the symptoms by assuming a secondary glottic spasm caused by easily induced fatigue, or paresis, on the part of the abductors.

Duration, Course, and Prognosis.—The number of recorded cases, both of phonic and inspiratory spasm, is too small to enable us to give definite views on the course and prognosis. In spite of the marked dyspnœa which is especially apt to be associated with the phonic variety, no fatal case has been recorded. As a rule, too, this form seems more obstinate than the inspiratory. Mackenzie has never attained permanent cure in the latter, while Fritsche and Jurasz state that the prognosis—particularly in recent cases—is more favourable.

Diagnosis.—It is possible to confound these affections with simple laryngismus. The latter, however, occurs spontaneously and in paroxysms, while the functional variety only results on phonation and inspiration. Paralysis of the abductors produces similar symptoms to those seen in inspiratory spasm, but here the glottis becomes wider during expiration, while in the former a constant, though incomplete, closure exists. It must, however, be remembered that inspiratory spasm may be associated with paresis of the abductors.

Treatment.—Antispasmodics and so-called nervine tonics are useless. So far as we know at present, galvanisation of the spine is most effectual (Schnitzler). Nothnagel made his patient practise movements of the lips and tongue, and breathe slowly according to directions. She was forbidden to speak or even to attempt it for days. By these means the power of speech was restored slowly at first but afterwards rapidly, so

that the patient was dismissed cured. Hack effected a cure by a similar method in a case of inspiratory spasm, viz. by making the patient inspire and expire deeply, and at the end of expiration hold the breath as long as possible, the directions being given by himself during laryngoscopic examination. The demand for air so produced led to normal inspiration. A general tonic line of treatment, including cold-water cure, cold douching, etc., is to be recommended in conjunction with the above.*

(c) *Hypokinetic Disturbances of Mobility or Paralysis.*

Etiology and Pathogenesis.—Paralysis of the larynx may be due to the following causes: (1) Interrupted conduction in the nerves which

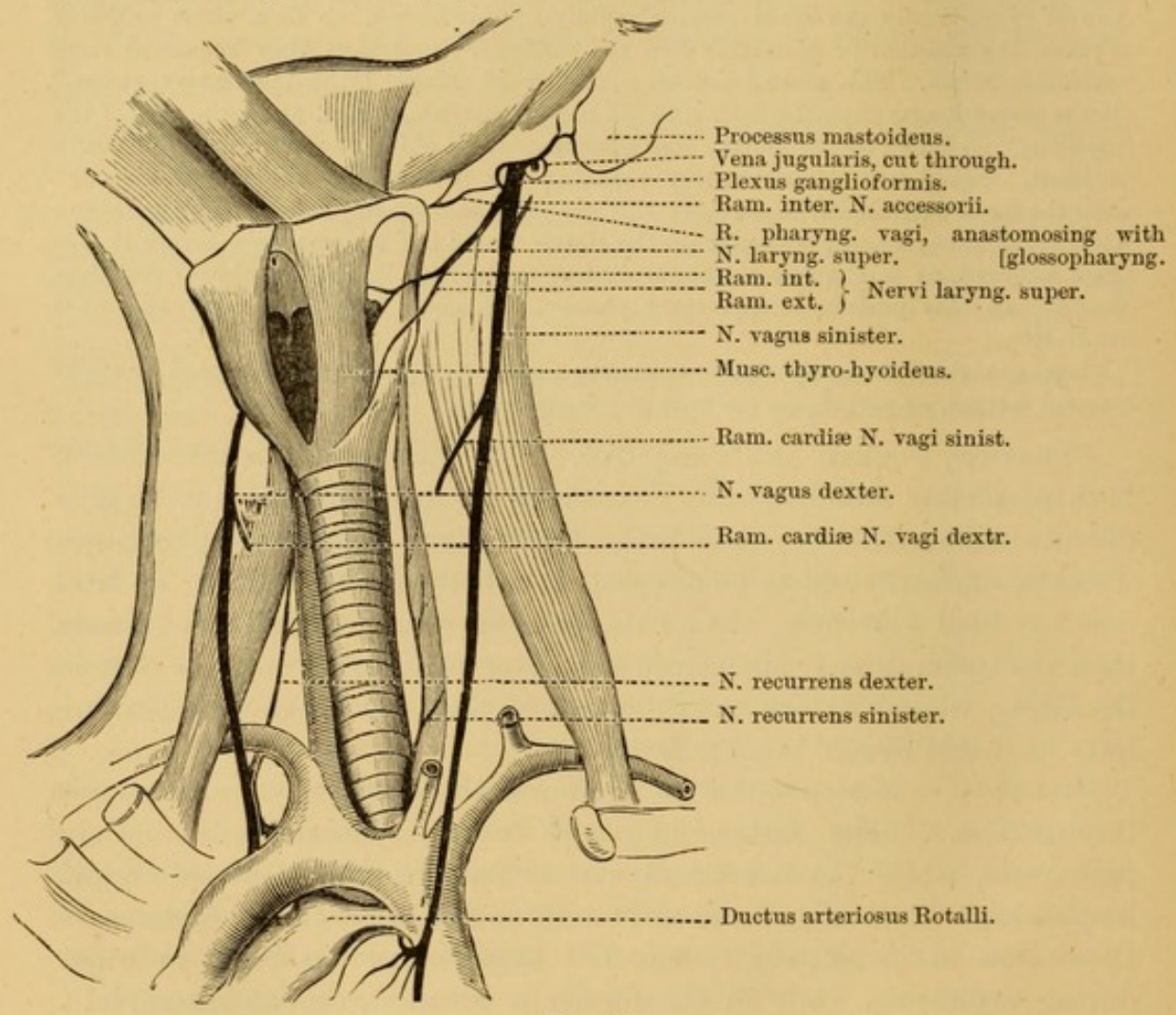


Fig. 29.

The Laryngeal Branches of the Vagus in the Infant. (According to Henle.)

supply the larynx, viz. the recurrent and superior laryngeal, the trunk of the vagus, or the spinal accessory of Willis (peripheral paralysis); (2) lesions within the skull affecting the roots of the vagus and spinal accessory (central paralysis); (3) diseases of the muscles (myopathic paralysis). Concerning the causation of the last named, so little is

* Schech has recently had satisfactory results in cases of phonic spasm treated by cold sprays and douches applied to the throat and neck (Monatssch. für Ohrenheilkunde, etc., Jan. 1885) (Translator).

known and the symptoms differ so little from those of peripheral paralysis, that we must treat both conditions together.

The long course of the vagus from its exit from the skull to the point where within the thorax the inferior laryngeal nerve is given off, and further, the exposed position of the latter—situated as it is in close proximity to large vessels (the sub-clavian on the right and the aorta on

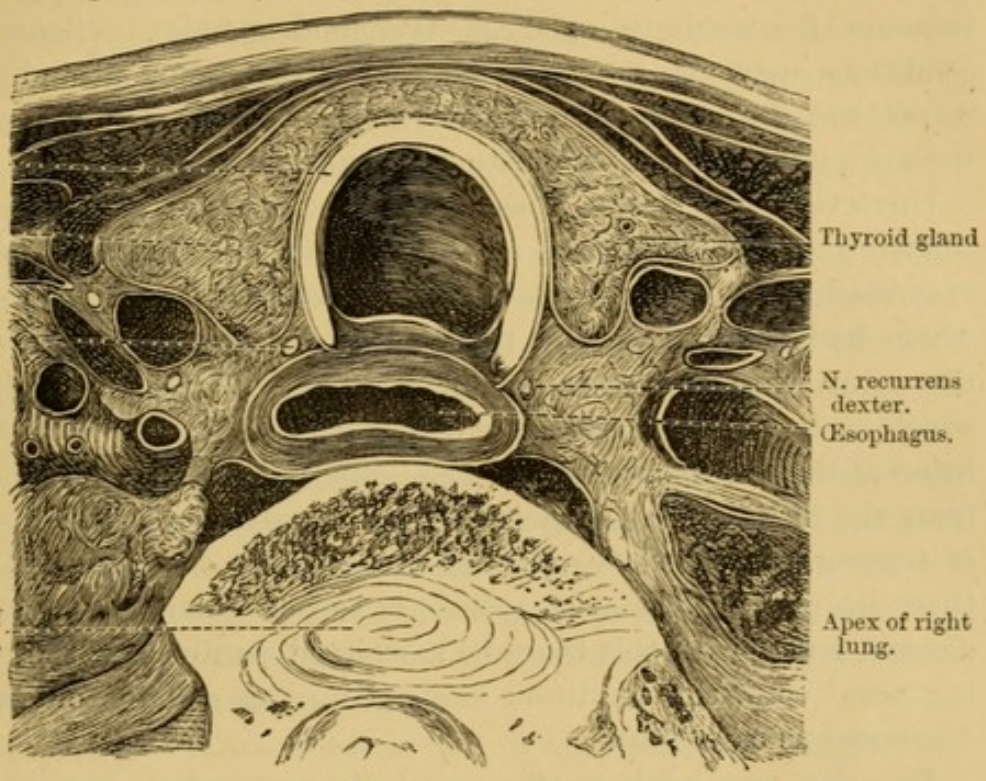


FIG. 30.

SECTION THROUGH THE NECK OF A MAN AGED 25 AT THE LEVEL OF THE FIRST DORSAL VERTEBRA. After BRAUNE (Atlas, Plate VIII.).

the left), between the œsophagus and the trachea, in the immediate neighbourhood of the thyroid gland and large lymphatics—make it evident why the innervation of the larynx may suffer in a great variety of diseases. (Compare Figures 29 and 30, which will illustrate these conditions.*)

A lesion of the ganglion of the vagus has not so far been observed, but it would produce complete paralysis of the laryngeal muscles with anæsthesia of the mucous membrane.

After the pharyngeal and superior laryngeal nerves have been given off, the trunk of the vagus may be injured by wounds and operative measures (cutting or tying, especially during the removal of large cervical tumours or tying the carotid). Mackenzie observed a case of compression of the vagus by a carotid aneurism, and Heller noticed the same result due to a cancerous tumour. It may also be due to cervical or intra-thoracic tumours, enlarged cervical or bronchial glands, goitre, œsophageal tumours, phlegmonous inflammation of the neck,

* Cases have been recorded by Schech, Fraenkel, and the Translator (Edin. Med. Journ., July 1885), in which the vagus and other cranial nerves were compressed above the point of junction with the superior laryngeal nerve with resulting hemi-anæsthesia and hemiplegia of the corresponding half of the larynx (Translator).

aneurism of the sub-clavian (on the right side) and of the aorta (on the left).

The same causes may, in part, also interfere with conduction through the recurrent—especially goitre (the substernal variety in particular), aneurism of the innominate and sub-clavian (on the right), and aorta (on the left), cancer of the œsophagus situated high up, mediastinal tumours (particularly enlarged bronchial glands). Some of these conditions may act simultaneously upon the recurrent and the vagus. Sometimes the right recurrent nerve is compressed in its course near the apex of the lung by pleuritic thickening due to phthisis.

Unverricht observed a case of paralysis of the left recurrent due to effusion into the left pleura, a result of cancerous disease; post-mortem examination showed the pleura to be infiltrated with nodules, one of which had compressed, and produced atrophy of, the left recurrent at the point where it winds round the aorta. This is just the place at which it leaves the vagus and runs beneath the pleura. Unverricht believes that, although on the left side the recurrent is farther away from the pleura than on the right, that it may yet be involved in cases of tumour. He believes the following statement to be accurate: "If there be pleural exudation, which is suspected to be due to malignant disease, and if with this there be associated paralysis of the corresponding vocal cord, the condition may, with a fair amount of certainty, be diagnosed as cancerous."

Bäumler met with a case in which pericardial effusion produced bilateral paralysis of the recurrent nerves.

Finally, as possible causes of peripheral palsy, we must take into account rheumatic tendencies.

Usually peripheral palsy of the recurrent, especially when due to pressure, is unilateral, but, excluding rare cases of bilateral aneurism, the condition may be produced on both sides by cancer of the œsophagus, goitre, and enlarged bronchial glands. In such cases there is often complete paralysis of one and partial paresis of the other.

Peripheral palsy of the superior laryngeal nerve is very rare except as a result of diphtheria; Mackenzie, however, records an instance of this affection due to inflammation affecting the glands and cellular tissue below the angle of the jaw.

All the fibrils of the recurrent are by no means necessarily affected, so that all the muscles of the larynx need not be involved; incomplete paralysis of the larynx may, however, develop into the complete form.*

* Although the point will be again referred to, it is necessary here to remark that Semon has conclusively shown that in the early stage of recurrent paralysis it is the abductor muscles alone which are usually affected. This gives rise to immobility of the affected cord, in the middle line, and may give rise to slight or even no symptoms—the condition being sometimes only discovered accidentally on laryngoscopic examination (Translator).

Cases of paralysis, due to the pressure of malignant growths upon the spinal accessory within the skull, have been observed by Türck (cancer affecting the base of the skull), Schech (sarcoma in the same region), Gerhard (cancer), and Dufour noticed a similar result due to an echinococcus cyst. In Schech's case the glosso-pharyngeal and the hypo-glossal nerves were at the same time involved. Among peripheral paralyses we must class those forms of which it is doubtful whether they are due to nervous or muscular changes. They generally affect only individual muscles, and result from excessive exertion of the voice (speaking loud and continuously, crying, or singing) and from pre-existing catarrh of the larynx.

The most common cause of central paralysis of the larynx is hysteria. This condition gives rise to both unilateral and bilateral paresis and paralysis; it usually affects the muscles which close the glottis—attacking one of these, several, or even all—and the tensors of the cords.

Paralysis of the cords may also be seen in bulbar paralysis, multiple cerebro-spinal sclerosis, progressive muscular atrophy, and locomotor ataxia when the medulla oblongata is affected. In these cases there is degeneration of the roots of the pneumo-gastric and spinal accessory, in the floor of the fourth ventricle. These pareses are usually incomplete, but may finally become complete.

Unilateral paralysis of the cords is rare in apoplectic hemiplegia.

Many acute diseases may be followed by unilateral or bilateral laryngeal palsy; of these the most important is diphtheria, but we must also include typhoid, cholera (a case observed by the author), and acute rheumatism.

The author observed a very interesting case of paralysis of the abductor (post. crico-arytenoid), in a man aged eighteen, who, during convalescence from scarletina, was suddenly attacked with the following symptoms, viz. dysphagia, oblique position of the tongue on extension, and aphonia; diphtheria could be excluded. Objective examination gave the following results: paralysis of the left side of the palate, tongue protruded towards the left, left cord immovable near the middle line; the voice could not be called aphonic, but was monotonous. Professor Berger, who had the kindness to examine the case, found, besides paralysis, rapid atrophy of the left half of the tongue with marked "reaction of degeneration," and considered the condition as due to an acute process in the floor of the fourth ventricle on the left side (acute unilateral bulbar paralysis).

Berger observed the same condition in a boy of fourteen, after catching cold, in whom the right vocal cord was in the cadaveric position owing to complete paralysis of the recurrent nerve; there was paralysis of the hypo-glossal on the right side, rapid pulse (120 per minute during rest as a result of palsy of the cardiac inhibitory branch of the vagus), and marked atrophy of the sterno-mastoid, due, doubtless, to palsy of the external branch of the spinal accessory.

According to Ziemssen, as we have already stated, in discussing "Anæsthesia," the sensory and motor pharyngeal and laryngeal paralyses, which follow diphtheria, are most marked on the side most affected by the disease; he believes that diphtheritic paralysis is due to a peripheral nerve lesion.

It is doubtful whether toxic paralyses of the cords, such as is sometimes seen after poisoning with lead, arsenic, and atropia, are to be looked upon as due to central causes.

Paralysis due to syphilis seems to be generally the result of specific disease of the brain, although sometimes a gummatous tumour interferes with the recurrent, or the muscles are rendered inactive by specific infiltration.

Pathology.—The pathological changes in the muscles and nerves depend upon the nature, duration, and extent of the affection. The nerves may show all stages of atrophy from simple flattening and thinning (various degrees of fatty and amyloid degeneration) to complete disappearance, when only a sheath of neurilemma is left. In cases due to peripheral interference with conduction, in which, during life, only single muscles were found to be paralysed, Ziemssen states that partial degeneration, limited to the distribution of single bundles of nerve-fibrils, could be demonstrated after death. In recent cases the muscles are found to be unchanged, but in long-standing paralysis they are seen to be pale or yellowish brown, and the fibrils show evidence of interstitial cell proliferation, atrophy, and fatty degeneration.

Symptoms.—These vary according to the function of the paralysed muscles, and according as one or both sides are involved.

On practical grounds, and for convenience of description, we may divide laryngeal paralyses according to the functional disturbance produced in each variety.

(1) Paralysis of the tensors of the cords.
(2) Paralysis of the muscles which close the glottis.
(3) Paralysis of the muscles which open the glottis or abductors.
(4) Paralysis of all the muscles supplied by the recurrent.

I. PARALYSIS OF THE TENSORS.

As we have seen in the anatomical part of this work, the crico-thyroid muscle is the chief tensor of the cords. This muscle is supplied by the superior laryngeal nerve, which contains besides only sensory fibres and perhaps sends motor twigs to the depressors of the epiglottis (thyro- and ary-epiglottic muscles).

Isolated paralysis of the crico-thyroid has not yet been demonstrated; but, if it occurred, the result would be a rough, deep voice and inability to modulate it in the production of high notes. On the other hand, several observations exist to show, as Ziemssen puts it, "that complete anæsthesia, complete paralysis of the epiglottis, and paralysis of the crico-thyroid together form a group of symptoms quite apart from those observed in recurrent paralysis and which can only be accounted for by assuming a pathological condition in the superior laryngeal nerve."

The symptoms consist of (1) complete anæsthesia of the mucous membrane covering the upper and middle divisions of the larynx; (2) deficient closure of the glottis during deglutition; (3) changes of voice.

Laryngoscopic examination shows the epiglottis to be immovable, and leaning against the base of the tongue, and, according to Mackenzie, there is a wavy outline of the glottis. If only one muscle be paralysed, the corresponding cord is higher than the other. Paralysis of the crico-thyroid seems only to occur after diphtheria, and is then commonly associated with paresis of other muscles.*

II. PARALYSIS OF THE MUSCLES WHICH CLOSE THE GLOTTIS.

As closers of the glottis we may consider the following muscles: (1) The lateral crico-arytenoids (or adductors); (2) the interarytenoid (or transverse muscle); and (3) the external and internal thyro-arytenoids, all of which are innervated by the recurrent nerve.

All these muscles may be affected or they may be attacked singly or in groups.

(*a*) *Paralysis of all the Closers of the Glottis.*

This occurs most commonly in hysteria, and is marked by complete aphonia, which is sudden in its occurrence and disappearance.

Laryngoscopic examination shows that on attempted phonation the cords remain in the position of inspiration. The condition is usually bilateral, but not always complete; sometimes one side is paralysed and the other only impaired in its action, or, again, the muscles of both sides may be only paretic, so that the cords approach one another but always leave a considerable triangular aperture.

It is characteristic of this affection that the aphonia is only present on attempted articulation, but that reflex acts, such as coughing and sneezing, are accompanied by a vocal sound.

In a case lately seen by the author a hysterical girl of seventeen, who had suffered from intermittent aphonia for two years (the cords, on attempted phonation, remained in the inspiratory position), also had attacks of hiccup in addition to other hysterical symptoms; the inspirations during spasm of the diaphragm were accompanied by loud, bellowing sounds, while the voice was completely aphonic.

Besides motor disturbance there is also sometimes anæmia of the mucous membrane and sometimes anæsthesia of the pharynx and larynx.

(*b*) *Paralysis confined to the lateral Crico-arytenoids.*

Isolated paresis of this muscle, *i.e.* without coincident affection of the thyro-arytenoid and transverse muscles, is rare and difficult to

* Mackenzie has met with a case due to inflammation about the angle of the jaw, and this muscle must (according to present views) have been paralysed in the cases referred to on p. 183. In the Translator's case, however, no evidence of such paralysis could be made out, although the question was carefully considered. Possibly recent observations on the innervation furnish an explanation (Translator).

diagnose. As the activity of these muscles (the thyro-arytenoid and transversus) admits of inward movement and tension of the cords, the disturbance of voice is slight.

Laryngoscopic examination shows the cleft of the glottis to be abnormally wide in the region of the vocal processes on phonation.

Mackenzie describes as unilateral paralysis of this muscle an affection in which the cord remains near the laryngeal wall on attempted phonation, so that it is scarcely visible, while the healthy cord assumes the normal position; according to him, this condition causes a hoarse, shrill voice.

We consider the phenomena just described to be due to unilateral paralysis of all the adductors; at least we do not understand how it can be differentiated from the latter, by either symptoms or objective appearances.

(*c*) *Paralysis of the Transverse Arytenoid Muscle* (interarytenoid).

Paralysis of this muscle produces deficient approximation of the arytenoid cartilages. It is usually seen as a result of acute catarrh, and is often associated with paralysis of the internal thyro-arytenoid. The principal symptom is hoarseness, or even aphonia.

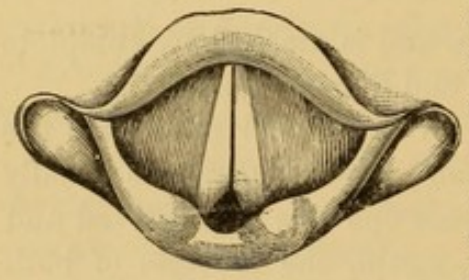


FIG. 31.

PARALYSIS OF THE TRANSVERSE ARYTENOID MUSCLE.

Laryngoscopic examination shows that, on phonation, there is normal closure of the ligamentous portion of the glottis, but the cartilaginous part gapes, leaving an isosceles triangle with a comparatively broad base formed by the posterior wall of the larynx (Fig. 31).

(*d*) *Paralysis of the Internal Thyro-arytenoid Muscle.*

The function of the muscle of the cord, as we have seen, is to bring the vocal cords in contact, after they have been approximated by the action of the lateral crico-arytenoids and the interarytenoid, and, further, to give their free edges the firmness and elasticity necessary for phonation. When the function of these muscles is destroyed, the cords are unable to vibrate, and the result is aphonia; in unilateral paralysis or in paresis, dysphonia only is produced. The condition is a very common one and may be unilateral or bilateral, isolated or associated with paralysis and paresis of the other adductors. Hysteria is the common cause, but it is not unfrequently due to laryngeal catarrh or over exertion of the voice.

With the laryngoscope, in isolated paralysis, the glottis shows a considerable opening, specially in its centre during phonation; the cords seem narrow, the free margins appear excavated, their sharpness

of outline is lost, and they do not vibrate. The glottis assumes the shape of a narrow oval, which extends from the anterior commissure to the cartilaginous portion; the latter is only closed in its posterior part (Fig. 32).

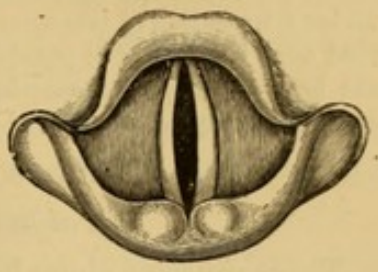


Fig. 32.
Paralysis of Internal Thyro-arytenoid Muscles.

The statement, that the cords seem narrower than usual in this affection, is only found in Stoerk's work; the narrowing is, however, always present. The observer can best convince himself of this in a case of unilateral paralysis, in which the healthy cord will be seen to appear broader than the other. This appearance is, however, most marked, as we shall see, when the transverse muscle is also paralysed.

Stoerk believes that the cords appear narrower, because they are higher than in their normal state of tension; we consider it more probable that they lose their width because the intrinsic muscle is unable to give them their normal shape and tension.

In unilateral paralysis the laryngoscopic image is, of course, correspondingly altered; the normal cord approaches the middle line, and only that on the paralysed side shows the above-described changes.

Very frequently paralysis of the internal thyro-arytenoid is associated with a similar condition of the transverse muscle; gaping of the cords and of the cartilaginous portion of the glottis are then present with complete aphonia.

Sometimes in this affection every attempted phonation is followed by approximation of the ventricular bands, until their anterior edges are in contact. The laryngoscopic image may then easily lead the observer to believe that the vocal disturbance is due to swelling of the ventricular bands, which mechanically prevents closure of the glottis.

We have repeatedly observed diagnostic errors of this kind, and may give the following as an example.

Mrs E. from Warsaw, after violent excitement, was seized with obstinate vomiting, palpitation, and other symptoms which Professor Berger, who was consulted, believed to be due to a vagus neurosis for reasons into which we need not further enter. As the patient was also aphonic, she was sent to us for laryngoscopic examination. On quiet respiration there was no abnormality, on phonation the cords approached one another so that the cleft of the glottis always remained unusually wide; the cartilaginous portion in particular gaped, while, on the other hand, the ventricular bands approached one another until they met anteriorly, but immediately afterwards separated. Paralysis of the internal thyro-arytenoids and transversus was diagnosed and electrical treatment recommended, which produced a cure in three weeks. The patient had previously been treated for swelling of the ventricular bands by inhalations, brushing, cauterisation, and finally the waters of Ischl.

In another case, a girl of twelve, in whom we had used electricity for a long time without any result, came under the hands of another surgeon who was equally unsuccess-

ful, but who attempted to diminish the size of the ventricular bands, because, contrary to our view, he believed that their contact on phonation was due to swelling. Afterwards, under a tonic line of treatment, the voice returned as suddenly as it was lost, a sure sign that our view as to the paralytic nature of the affection was correct. Errors in diagnosis are best avoided by inspecting the ventricular bands during quiet respiration, when, in cases of paralysis, they will be seen to be of normal size.

III. PARALYSIS OF THE ABDUCTORS (GLOTTIS-OPENERS).

Paralysis of the Posterior Crico-arytenoids.

These muscles alone have the important function of opening the glottis, so that a passage is afforded for the entrance of the respired air; it will easily be seen then what a risk is run if this function be in abeyance.

As the symptoms vary according as both or only one muscle are involved, we shall consider the conditions separately.

(*a*) *Bilateral Paralysis of the Abductors.*

This condition is not so rare as has been hitherto assumed; at least, the number of recorded cases has lately increased to a marked extent. The etiology of this affection is doubtful, but in some cases its appearance was preceded by laryngeal catarrh; the condition may certainly be due either to paralysis or muscular changes. Ott observed a case in which a piece of meat remained impacted in the upper portion of the œsophagus for twenty-four hours, in such a way that it pressed upon and paralysed the abductors. In some instances, excessive use of the voice, following injury or inflammation, seems to have led to degeneration and paralysis (Mackenzie). In like manner Rehn explains a case which resulted from typhoid fever. In a few cases syphilis seems to have been the cause, and in them Mackenzie assumes gummatous infiltration of the muscles in question; on the other hand, Sommerbrodt, in a syphilitic child who died of unilateral paralysis of an abductor, found only atrophy of the muscle. It has yet to be determined by laryngoscopic examination whether the paroxysmal inspiratory dyspnœa, which occurs in hysteria, is due to transient paralysis of the abductors.*

Paralysis of the abductors produces the gradual development of purely inspiratory dyspnœa with stridor, associated with a normal or nearly normal voice. At first dyspnœa only occurs during acts which demand increased activity of respiration, *e.g.* going up-stairs, continued speaking, etc.; later it becomes permanent and reaches such an extent that tracheotomy becomes almost always necessary. The voice, however, is only altered when catarrh or inflammation is also present. Laryngoscopic examination shows the cords to be more or less approximated, so that the opening of the glottis is represented by a narrow cleft, which, on each inspiration, is still further narrowed. On phonation the normal condition of parts is seen.

* From recent observations it would seem that locomotor ataxia is by no means an uncommon cause of bilateral paralysis of the abductors (Semon, Krishaber, Jacob, the Translator, and others). Pressure on both recurrents, too, may produce a similar condition—although the cords are then often unequally affected (Translator).

The above-described laryngoscopic appearances fully explain the symptoms. The inspiratory dyspnœa is caused by the narrowed glottis, which on inspiration becomes further constricted; expiration is free, because during this act the cords again separate slightly and allow the air to pass; the inspiratory stridor is caused by the current of air making the approximated cords vibrate. The voice is normal because the closers and tensors of the cords act as in health.

The explanation of the laryngoscopic image is as follows: The cords remain in the position of adduction, because the antagonistic muscles remain active, as is observed in other parts (paralytic contraction). It is, however, not so certain why the glottis should further contract on inspiration. Ziemssen, Burow, and others believe that the excess of pressure, on the part of the external air over that contained in the trachea, causes the approximation of the cords; Rosenbach, on the other hand, thinks it is due to conduction of the nerve current in one direction only, *i.e.* to the non-paralysed muscles, in other words, a perverted rhythmic innervation.

(*b*) *Unilateral Paralysis.*

This is developed from the same causes as the other, and the symptoms produced are not marked. Respiraton is free, because the opening of the glottis is still sufficient; there is only stridor on forced inspiration, and slight dyspnœa on exertion. Sommerbrodt, however, describes the case of a child, æt. one year, affected with congenital syphilis, which showed the most marked symptoms of inspiratory dyspnœa and stridor, and in which, on dissection, only advanced atrophy of the left posterior crico-arytenoid muscle was found.

The voice is somewhat wanting in clearness, on account of the two cords not vibrating together. Laryngoscopic examination shows the affected cord stationary in the middle line, while the healthy one moves freely on inspiration and phonation.*

IV. PARALYSIS OF ALL THE MUSCLES SUPPLIED BY THE RECURRENT NERVE OR RECURRENT PARALYSIS.

When both the abductors and adductors are paralysed, the cords must remain immovable both during inspiration and attempted phona-

* The description here given of paralysis of the abductors—more particularly of the affection when unilateral—must be now modified, owing chiefly to the writings of Semon. This author has shown that both in central and peripheral paralysis of the larynx (due to organic changes), it is the abductor fibres of the recurrent nerve which suffer first or alone. The immense importance of this fact cannot be over estimated. The slight symptoms of paralysis of abduction, when unilateral, might be easily overlooked, or indeed all symptoms may be absent, so that Semon rightly insists that a laryngoscopic examination should always be made in cases where there is any possibility of pressure on the recurrent nerve. It will be manifest from what has been said, that all the causes afterwards described as liable to produce recurrent paralysis, may cause, and usually do cause paralysis of abduction only. For further information we refer the reader to Dr Semon's most important papers on this subject, in the "Archives of Laryngology," No. 3, 1881, and Berlin Klin. Wochenschrift, 1883, No. 46, *et seq.* (Translator).

tion, and their position is that which is seen in the dead body. This, aptly designated by Ziemssen as the cadaveric position, does not quite correspond to that assumed by the cords when at rest, and when both abductors and adductors equally receive nerve impulse, and thus are balanced as in normal respiration. In the cadaveric position, as it occurs in recurrent paralysis, the cleft of the glottis is somewhat narrower than when at rest, the cords themselves are narrower, their free margins less sharply defined and excavated, and there are no vibrations on attempted phonation.

(*a*) *Bilateral Recurrent Paralysis.*

This condition is very rare; it has been observed when both recurrents were pressed upon by cancer of the œsophagus, tumours of the thyroid, simultaneous occurrence of aneurism of the aorta and innominate, and, as in Bäumler's case, by extensive pericardial effusion.

Johnson, Bäumler, and others also observed bilateral recurrent paralysis due to pressure on the vagus of one side. Johnson explains these cases as reflex paralysis, assuming that the compressed sensory fibres of the vagus conduct the irritation to the nucleus of the spinal accessory, and, as the fibres of the latter cross, paralysis of the muscles of the opposite side is thus caused. It is, however, more probable that continued irritation of one pneumogastric eventually produces central structural changes, and thus both spinal accessory nerves become affected.

Unilateral compression of the recurrent can never produce bilateral paralysis, because this nerve has no centripetal fibres.

The symptoms produced by bilateral recurrent paralysis are absolute aphonia and inability to cough vigorously and expectorate, on account of the wideness of the glottis. On every attempt at forced expiration a strong current of air escapes from the mouth of the patient, dyspnœa is not present, but forced inspiration is stridulous because the current of air causes the soft parts of the laryngeal aperture to vibrate (the arytenoids, cartilages of Santorini, ary-epiglottic ligaments, and the relaxed vocal cords).

The conduction of the recurrent on both sides is not always equally interfered with, and the paralysis is then incomplete.

Incomplete bilateral recurrent paralysis may be produced by tumours of the œsophagus and thyroid gland. The completely paralysed cord will then assume the cadaveric position, while the other is either paretic and slow in its action, the motion being insufficient for the fulfilment of its function, or what is much more common, remains in the position of adduction.

To account for this latter condition, we must here refer to a most important and interesting fact.

All authors are agreed that (1) in recurrent paralysis, whether central

or peripheral, all the muscles supplied by the nerve are not always affected from the beginning, and (2) that the abductors are first involved and the adductors only at a later stage.*

We cannot here enter into the various hypotheses which have been advanced to explain this condition, but shall only refer to the fact (Rosenbach) that an analogy may be found in affections of other nerves and of the central nervous system; thus, for example, the flexors are much later affected than the extensors, and the sensory later than the motor nerves.

An explanation seems to have been recently found by Grützner (Bresl. ärztl. Zeitschrift, 1883, Nr. 18), who shows that muscles which differ in function also vary anatomically (shape) and physiologically (peculiarities of irritability).

In incomplete bilateral recurrent paralysis, the patient is not aphonic, but can with great effort produce monotonous tones which are wanting in clearness, while the sound produced by coughing is most peculiar and almost like a howl.

(*b*) *Unilateral Recurrent Paralysis.*

As the healthy cord during phonation not only approaches the middle line but often crosses it, aphonia is not produced, but the voice is weak and deficient in timbre, and in loud, continuous speaking merges into falsetto on account of unequal vibration of the cords.

Laryngoscopic examination shows the paralysed cord and corresponding arytenoid in the cadaveric position (Fig. 33); on phonation, the healthy cord and arytenoid cross the middle line, so that the arytenoids are crossed and the glottis assumes an oblique position. The paralysed cord also shows an excavated edge.

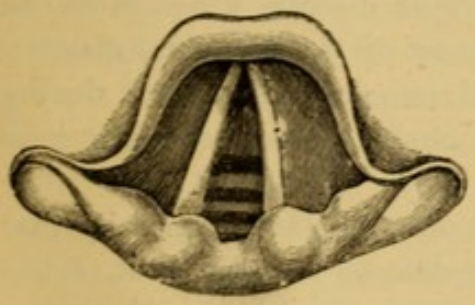


FIG. 33.

PARALYSIS OF THE LEFT RECURRENT (INSPIRATION).

The healthy cord crosses the middle line on account of compensatory action of the adductors and tensor, especially the lateral crico-arytenoid, which rotates its cartilage, so that the processus vocalis crosses; at the same time the arytenoid of the opposite side is pressed outwards, being no longer fixed, owing to paralysis of the muscles which act upon it.

When this condition has lasted for a long time, the cord becomes atrophic and narrowed.†

* Although this fact had been observed before, it was Semon who first drew attention to the general rule, and there is no doubt that to him most of the credit is due (Translator).

† We have already seen that the paralysed cord most frequently lies in the middle line—paralysed abduction (Translator).

Course, Result, and Prognosis.—Paralysis of the cords may occur suddenly, and disappear with equal rapidity. Hysterical patients may repeatedly become aphonic within twenty-four hours, owing to laryngeal paralysis, and during the intervals speak with a clear voice; or they may be aphonic for weeks or months, and then suddenly regain their vocal power, which may again be lost for a time. Paralysis of the cords in acute laryngitis may rapidly disappear after stimulation, whether by the insufflation of powder, the application of a medicated solution with sponge or brush, contact with a probe, or the passage of a weak electric current; the voice afterwards becomes loud, although it may remain hoarse and be deficient in clearness owing to organic changes in the mucous membrane.

Sometimes paralysis may disappear permanently or for a time during the first laryngoscopic examination, owing to the increased innervation of the muscles required for the intonation of "eh;" or the patients may emit a vocal sound during examination, but their speech remains aphonic. If, then, they be made to produce a vocal sound several times during the introduction of the mirror, voice and speech become restored.

On the other hand, many forms of paralysis, and even those in which there are no grounds to suspect degeneration of the nerve fibres, especially when they occur in hysterical subjects, defy all treatment until, after lasting for months, they disappear as suddenly as they came.

The prognosis as to restoration of function should be guarded not only because in many cases a severe incurable disease, which is at the root of the evil (aortic aneurism, enlargement of the bronchial glands), may run its course without symptoms, and remain undiscovered during life, but also because in curable cases it cannot be foreseen how long the condition will resist treatment.

As to the various forms of paralyses, it may be stated generally that *ceteris paribus*, and so far as no incurable disease is at the root of the condition, paralysis of the adductors is more readily cured than a corresponding condition of the abductors.*

Paralysis of the adductors is not associated with danger to life, as is the case when the abductors are affected (especially when this condition is bilateral); death, then, often results from suffocation, if tracheotomy be delayed.

Bilateral paralysis of the superior laryngeal nerve may produce death in one of three ways, viz. (1) by inanition, because food passes the wrong way owing to the coincident anæsthesia of the larynx, and nutrition is thus impaired; (2) suffocation; (3) pneumonia, due to the entrance of food into the trachea.

* This is due to the fact, before pointed out, that organic disease usually causes paralysis of the abductors, while paralysis of the adductors is commonly functional or catarrhal (Translator.)

Diagnosis.—When one or both cords are seen to be immovable, three points have to be considered before arriving at a diagnosis.

1. The proof that impeded motion is not due to mechanical causes, but to functional disturbance.

2. To decide what muscle or what group of muscles are unable to fulfil their function.

3. To discover what cause produces the paralysis in each.

Both the first points are principally dependent upon laryngoscopic examination.

It may be generally stated that in paralysis the mucous membrane of the larynx has a normal appearance, while when mechanical obstacles to movement exist, organic changes can be demonstrated; exceptions, however, occur to both rules. In many cases of catarrh, it may remain doubtful whether the insufficient closure of the glottis is due to paresis of the adductors or mechanical swelling of the mucous membrane; careful laryngoscopic examination of the posterior laryngeal wall is then essential to determine whether folds of mucous membrane are impacted between the cords during phonation.

Submucous and perichondrial inflammation sometimes produce, especially when the crico-arytenoid joint is attacked, unilateral or bilateral immobility of the cords and cartilages (complete or incomplete anchylosis); in such cases the condition may be taken for paralysis of the adductors, the recurrent, or abductors, according as the cartilage is fixed in the inspiratory, cadaveric, or phonic position, more especially if all inflammatory action has disappeared.

In order to distinguish these conditions, the history of the case often suffices. Paralysis is generally developed suddenly without preceding illness, while mechanical immobility follows inflammatory processes, which usually result from syphilis, typhoid, etc. Laryngoscopic examination in anchylosis commonly demonstrates an irregularity in the shape of the arytenoids, and signs of previous ulceration (cicatrices and swelling at the base of the immovable cartilage).

Other difficulties in diagnosis may be due to the position of the ventricular bands. We have already explained that sometimes in paralysis of the adductors, the false cords act vicariously, and approach each other during phonation; on the other hand, in inflammatory swelling of the latter they may approach one another in phonation, and hinder the proper closure of the cords. In order to avoid mistakes, it is sufficient in such cases to inspect the larynx during quiet respiration, and thus discover whether the ventricular bands are normal in size and appearance, or if they then also appear so swollen as to cover the cords.

In order to determine in any given case what muscles are paralysed, it is only necessary to consider their functions, and we may further refer to the previous description of symptoms. For convenience,

we shall here recapitulate the principal characteristics of each variety.

Paralysis of the crico-thyroid (superior laryngeal nerve) is characterised by anæsthesia of the laryngeal mucous membrane, food passing the wrong way, rough and monotonous voice, and inability to produce high notes; the laryngoscope shows the epiglottis immovable, and lying against the base of the tongue, mobility of the cords normal, and wavy line of the glottis on phonation; the condition is almost always a sequel of diphtheria.

Paralysis of the adductors produces, whether one or several muscles be implicated, dysphonia or aphonia. Respiration is normal; the mirror always shows deficient closure of the glottis, varying in character and extent, *e.g.*

In paralysis of all the adductors, the cords, even on attempted phonation, remain in the inspiratory position.

In paralysis of the lateral crico-arytenoids, the glottis gapes in the region of the extremities of the vocal processes.

In paralysis of the transverse arytenoid (interarytenoid), the cartilaginous part of the glottis leaves a triangular opening, while the ligamentous portion is closed.

In paralysis of the internal thyro-arytenoids, the cords appear narrower, the free margin is excavated, and the glottic opening resembles a narrow ellipse. In paralysis of both the interarytenoid and internal thyro-arytenoids, there is gaping of the glottis both in the cartilaginous and ligamentous portion.

If in these respective forms one side only be paralysed, the laryngoscopic image is asymmetrical, and the healthy cord moves normally while the other is stationary or paretic.

Paralysis of the abductors is characterised by marked inspiratory dyspnœa, increased on exertion; there is loud stridor, while the voice and expiration are unaffected; laryngoscopic examination shows the opening of the glottis to be very narrow, and to diminish further on inspiration.

In unilateral paralysis of an abductor, respiratory troubles are slight and usually only occur on exertion; the voice is wanting in clearness, the glottis is diminished by a half, as the paralysed cord remains stationary in the middle line.*

Paralysis of all the muscles of the cords (complete recurrent paralysis) produces absolute aphonia, and the cadaveric position of both cords.

Complete unilateral recurrent paralysis gives rise to cadaveric position of the paralysed cord, crossing of the arytenoids, and obliquity of the glottis, owing to vicarious action of the healthy cord, which crosses the middle line.

* This is the most common form of laryngeal paralysis, due to organic lesion of nerves or the centres, as pointed out by Semon (Translator).

Much more difficult of solution, however, is the third diagnostic problem, viz. the determination of the cause of paralysis.

It will be evident, from a consideration of the numerous possible causes already mentioned, how necessary is a careful examination of various organs towards the elucidation of this question. It is necessary to consider the general health, the nerves and nerve-centres, the results of inspection and palpation of the neck, the condition of the œsophagus and thorax, and the history of the case.

For the sake of illustrating to what extent the condition of remote organs may afford aid in diagnosis, we shall here detail an interesting observation, for which we are indebted to Dr Wolf.

K. W., a cook, aged sixty-three, stated that, three weeks ago, she was attacked by abdominal pain, together with obstinate constipation; after ten days there was hoarseness, occasional aphonia, and difficult deglutition. During the first few days after admission into hospital, the last-named symptoms predominated. Laryngoscopic examination showed the cause to be recurrent paralysis on the right side (cadaveric position of the right cord, with crossing of the arytenoids on phonation). After a day or two, epigastric pain reappeared, accompanied by dyspnœa, frequent vomiting and eructation, loss of appetite and wasting. There was no jaundice, neither could any tumour be felt. Three days later there was increase of size of the liver and resistance to pressure in its neighbourhood; this was probably observed now for the first time, because the tension of the abdominal muscles was diminished. Two days before death, which occurred with symptoms of pneumogastric paralysis, bilateral hydro-thorax and ascites were discovered.

Dr Wolf diagnosed for reasons which we need not here further enter upon, and which he will publish elsewhere, primary cancer of the liver or gall bladder with secondary infiltration of the bronchial glands to which the paralysis of the recurrent was due. Post-mortem examination showed that, in addition to cancer of the gall bladder with secondary affection of the liver, the right recurrent nerve was imbedded in a mass of bronchial glands, which also pressed upon the trunk of the vagus. Microscopic examination showed cancerous infiltration of these glands.

In this case the cause of the recurrent paralysis could not at first be detected; later, however, when disease of the liver was manifested, it remained doubtful whether there was a causal relation between this and the paralysis of the recurrent. The knowledge, however, that infiltration of the bronchial glands is sometimes, though rarely, associated with hepatic cancer, and that this condition frequently gives rise to recurrent paralysis, justified the diagnosis of recurrent paralysis in consequence of secondary cancer of the bronchial glands.

Cases are by no means rare in which the cause of the paralysis remains obscure for a long time, until finally, after years of observation, marked evidence is afforded of the presence of cancer of the œsophagus or aortic aneurism, or in which a fatal termination, due to perforation, throws light upon the cause of the paralysis.

It is always better to be careful in diagnosing rheumatic paralysis of the cord, and only to arrive at such a conclusion after every other possible cause has been excluded.

Treatment.—The first object in treatment is to remove the cause, but,

unfortunately, this is not always possible. Paralyses due to cancer of the œsophagus, aortic aneurism, enlargement of the bronchial glands, and, probably, almost all those cases which depend upon organic disease of the central nervous system (locomotor ataxia, bulbar paralysis, etc.) are incurable. Goitre, strumous swelling of lymphatics in the neck and mediastinum, should be reduced by the internal and external use of preparations of iodine. Anomalous conditions of the blood (anæmia and chlorosis) should be relieved by the administration of iron, and general tonic treatment. In obstinate cases of hysterical paralysis, we have repeatedly seen benefit from change of air. The treatment of paresis and paralysis due to acute and chronic laryngeal catarrh is very satisfactory, as these often disappear after the application of astringents, before the tissue changes are removed; the stimulus supplied by the insufflation of some indifferent powder is often sufficient to cure the aphonia. The same almost magical effect is produced by insufflations, in cases where paresis or paralysis is due to excessive use of the voice.

A girl, aged fourteen, went for a drive with some of her companions, accompanied by her schoolmistress. The vehicle employed was a heavy omnibus. As the party were driving over the pavement of the village which was their destination, the girl wished to carry on a conversation with a companion some distance from her, and, in order to make herself understood during the noise produced by the heavy vehicle, she was obliged to raise her voice. When she got out she was completely aphonic. The treatment adopted by the medical attendant remained unsuccessful. When the aphonic patient came to us, we found the mucous membrane quite normal, but the glottis open on attempted phonation. A single insufflation of powder at once permanently restored the girl's normal voice, to the astonishment of her uncle who accompanied her.

It is certain that the action ascribed by Tobold to astringent and tonic local treatment in cases of paresis due to excessive use of the voice, depends only upon the local stimulation produced by the remedy.

In obstinate cases—particularly of unilateral paralysis—the electric current must be resorted to. It is best to apply both forms in succession for two or three minutes, either percutaneously or with one pole inside of the larynx. In percutaneous application, the two electrodes, in cases of bilateral paralysis, are laid upon the lateral plates of the thyroid cartilage; in unilateral paralysis one is placed on the corresponding thyroid plate, and the other on an indifferent part of the body, preferably the cervical vertebræ. In the endo-laryngeal application of electricity, the curved laryngeal electrode (covered up to its point, and here furnished with a small sponge) is introduced under guidance of the mirror while the other is applied to the neck, or the double electrodes of Ziemssen or Oertel are employed.

Sometimes the action is very rapid, especially in hysterical paralysis; frequently, however, electricity must be employed for weeks and months. In unilateral abductor paralysis we have seen, like Tobold, improvement in the voice without restoration of mobility to the cord; probably, as

Tobold believes, the tensor of the cord in these cases improved as to innervation and contractile power.

Not uncommonly the voice returns during the passage of the current, and is lost when it ceases. Such cases yield a favourable prognosis, as, after a short time, the voice is permanently restored. The electrical treatment should then be aided by practice in the use of the voice; the patient is made to count aloud so long as the current acts, and the latter is interrupted for a second or two from time to time.

Laryngeal gymnastics may be of use in cases where the voice is restored during laryngoscopic examination; while the mirror is *in situ* the patient should be made to sound loud notes. Ollivier recommends pressure on the lateral portions of the thyroid cartilage during phonation; but we have not seen any good results from this method.

Strychnine, best employed subcutaneously, and in not too small quantities, is said by Ziemssen to hasten the restoration of conduction in sensory and motor nerves, and the return of muscular contractility in many diphtheritic cases.

In bilateral paralysis of the abductors, the dyspnœa is sometimes so marked that prophylactic tracheotomy cannot be delayed; this should not be put off too long, even if the patient feels himself that he is somewhat better.

PART III.

SECONDARY DISEASES.

CHAPTER I.

LARYNGEAL DISEASE IN TUBERCULOSIS.

The larynx may become involved in one of two ways in the course of tuberculosis; it may be attacked by such affections as may also occur primarily or in the course of other diseases, or it may be involved in a specific manner characteristic of phthisis (laryngeal tubercle, phthisis laryngea).

We have departed from the method adopted by other authors, who, with the exception of Türck, only treat under this head ulcers due to miliary tuberculosis or tubercular infiltration, the result of pulmonary phthisis.

We believe that no complete description of laryngeal disease, liable to arise in the course of phthisis, can be given if only morbid conditions, which depend upon tubercular changes, are considered, and non-specific inflammations are discussed separately. We do not consider the latter to be only accidental, but believe them to be intimately associated as regards their etiology with tubercle, and that this connection is more than is explained by assuming them to be a predisposing cause.

Etiology.—Pulmonary phthisis is one of the most common causes of laryngeal disease; we do not consider that we are going too far in saying that a phthisical patient rarely has a normal larynx, although the morbid condition may be slight and produce no functional disturbance.

Willigk, in dissecting 1317 cases of tuberculosis, only found laryngeal disease in 237 (13·8 per cent.), and Heinze in 276 out of 1226 (30·6 per cent.). It must, however, be remembered that both authors refer only to destructive processes (phthisis laryngea), and that many abnormal conditions, *e.g.* paresis, paralysis, anæmia, etc. cannot be detected on dissection. Schäffer, who examined with the laryngoscope all patients whose lungs required examination, found the larynx normal in only 8 out of 310 persons afflicted with pulmonary disease, in other words, the larynx was affected in 97·4 per cent. Out of a hundred cases of pulmonary phthisis in the second and third stage, observed at the London Hospital, Mackenzie found changes in the larynx in seventy-one; he appears, however, only to have paid attention to organic changes, for no mention is made of motor disturbances, and, further, it is not stated whether, as in the cases recorded by Schäffer, the patients

were observed for any length of time; the first stage of phthisis, too, in which anæmia and paresis are so often present, is not included.

With regard to the proportion between specific tubercular laryngeal disease (infiltration, ulcers) and non-specific conditions (catarrh, paresis), Schäffer found that out of 100 cases of pulmonary disease 64·6 belonged to the first, and 32·8 to the second variety, while in 2·6 the larynx was not implicated.

Among predisposing causes sex and age are of considerable importance. Men are far more frequently attacked than women [in the proportion of 33·6 to 21·6 (Heinze), 32·2 to 17·7 (Schäffer)], while the relative proportion of severe laryngeal phthisis in males and females seems to be as 69·2 to 60·7. We thus see that the former are not only more frequently attacked, but that they are also more apt to be afflicted with the more severe forms, a fact which is all the more noteworthy since tuberculosis is known to be almost equally distributed between the sexes.

Between twenty and forty is the age at which the disease is most frequently developed, and Heinze only found nine examples in children under nine (2·3 per cent.).

Before entering further upon the pathogenesis of the laryngeal disease, we must consider whether there is such a thing as primary tuberculosis of the larynx. Although all authors are agreed that laryngeal phthisis is always found complicated with pulmonary tuberculosis, and, although it is not denied that in the majority of cases the laryngeal disease arises during the advanced stage of the pulmonary affection, views differ as to the general order of events. Trousseau, Belloc, Ter Malen, Rühle, Waldenburg, Schech, and others state that the larynx may be attacked by tubercle before the lungs, but Louis, Türck, Ziemssen, Heinze, Tobold, Klebs, and Mackenzie deny this.*

There is no doubt that the larynx may become affected at a time when the pulmonary lesion is slight, or even before physical examination gives any clue to its existence. On the other hand, however, there remains the fact that cheesy or consolidated nodules, when situated deep in the substance of a lung, may long escape diagnosis; we must, therefore, confess that the question as to the occurrence of primary laryngeal tuberculosis cannot be decided on clinical evidence. Pathological evidence that the laryngeal may precede the pulmonary condition has not yet been obtained, and, as no one dies of laryngeal phthisis alone, cannot be obtained unless it accidentally happens that a body is examined which shows the presence of laryngeal without pulmonary

* In the Centralblatt für Laryngologie, etc., Jan. 1885, p. 213, there is an abstract of a case reported by Demme, which seems to prove the possibility of tubercular infiltration of the larynx without infiltration of the lungs (Translator).

phthisis.* Until this has happened the question must remain an open one, although a number of laryngoscopic examinations seem to point to the primary occurrence of laryngeal tuberculosis; on theoretical grounds the possibility cannot be denied, and the view of a primary infection of the larynx derives some support from recent researches on the parasitic nature of tuberculosis.

When considering the relation of pulmonary to laryngeal disease, we must separate tubercular from non-specific conditions of the larynx.

Louis was the first to express the opinion that the decomposing contents of pulmonary cavities favour or cause laryngeal phthisis, and this theory has, since the discovery of the tubercle-bacillus, received new support, more especially from Klebs. The latter believes that the secretion from cavities, which is rich in bacilli, produces deep-seated anatomical changes either in those parts which, from their anatomical position, are most exposed, or in the whole mucous membrane, according to the amount and intensity of the infecting material. In this process he considers that the ventricles of Morgagni play an important part; owing to their retaining the infective matter they favour the occurrence of tubercular ulcers on the vocal processes, and then "the approximation of the latter plays the same part as valvular closure in parasitic (mykotisch) endocarditis." In the same way the ventricles aid in the formation of the not uncommon longitudinal ulcers which run parallel to the free margins of the cords on their upper surface.

As opposed to this view, as held by Louis and Klebs, it must be mentioned that (1) many cases in which extensive pulmonary cavities exist run their course without laryngeal disease being caused, and (2) tubercular ulceration of the larynx may frequently be observed in the early stages of pulmonary phthisis, when infectious secretion can hardly be thought of. Heinze, moreover, states, as another argument in the same direction, that the anatomical changes in laryngeal tuberculosis begin not on the surface of the mucosa, but in the subepithelial layer—a fact which can hardly be brought into accordance with the view that the corroding secretion acts by contact.

We believe, however, that this last argument cannot now hold, because the view at present held concerning the penetration of the tissues by the tubercle-bacillus enables us to explain the above-described anatomical changes. If the mucous membrane be slightly eroded, the bacilli may, as we think, penetrate the tissue, become developed there, and produce anatomical changes without the epithelial covering being at once involved. In favour of this view is the observation that tubercular nodules are most numerous in the upper part of the mucosa, just underneath the epithelium, and diminish in quantity as the deeper

* This has now occurred, as we have seen above, the patient, a child, dying of tubercular meningitis (Translator).

layers are reached. We may draw as a general conclusion, from the foregoing, that Klebs' view as to the infective properties of secretion from cavities cannot be rejected, but tubercular infection of the larynx may also take place in other and unknown ways.

With regard to non-tubercular diseases of the larynx occurring in phthisis, our knowledge as to their etiology and connection with the pulmonary lesion is, if possible, still more obscure. Probably the so frequently observed anæmia and the anomalies of sensation (paræsthesiæ), which are often associated with them, are due to disturbed nutrition, although it is noteworthy that anæmia occurs in the early stages of phthisis, at a period when, in many cases, general nutrition has suffered but slightly, or not at all. The obstinate laryngeal catarrhs, from which phthisical patients so often suffer in the beginning of their ailment, may possibly be due to diminished power of resistance on the part of this organ. Heinze in one case of very marked catarrh of the mucous membrane of the larynx and trachea, which, however, showed no trace of ulceration, made sections through the ventricular bands, and in this position found in a commencing tubercular infiltration only, a small tubercular nodule with two giant cells. There can be no doubt (Heinze is of the same opinion) that in this case the tubercle was not the cause of the catarrh, but that, perhaps, on the other hand, the catarrh was a predisposing cause for the localisation of the tubercular process. That these catarrhs are simple and not tubercular is shown by the fact that they may entirely disappear, and that those who have suffered from them may be free from laryngeal phthisis during their whole illness.

The author observed a very marked example of this in a member of his own family who died of phthisis. The patient, so long as the pulmonary symptoms were slight, suffered from repeated attacks of obstinate laryngeal catarrh with aphonia. Though the pulmonary disease advanced, the larynx afterwards remained unaffected up to the time of death, while a tubercular otitis and tubercular ulceration of the septum of the nose, which resulted in perforation, became developed.

Why, in one case only, a simple catarrh, and in another tubercular infiltration occurs, we cannot tell any more than we can explain why sometimes one and sometimes another organ is attacked.

Paresis and paralysis of the laryngeal muscles, especially the adductors, are, as we shall see, rather common in the first and second stages of phthisis. Schäffer found that the paresis in the larynx occurred, almost without exception, on the same side as the pulmonary disease, and he attempts to explain this on anatomical grounds, assuming that the infiltrated pulmonary tissue presses upon the recurrent. He rests this theory on a statement by Luschka, that the right recurrent passes between the concavity of the arch of the sub-clavian and the apex of the lung, and that it is thus exposed to compression in pulmonary disease.

We do not think that Schäffer's explanation is satisfactory for all cases, as is proved by the bilateral paresis which may occur in a unilateral pulmonary affection; we are rather inclined to think that many pareses and paralyses are due to disturbed innervation resulting from anæmia, while others are caused by the accompanying catarrh, or by the anatomical changes in the muscles demonstrated by E. Fraenkel (see below).

Pathological Anatomy.—Almost all pathological examinations of the laryngeal changes in consumption, so far recorded, refer only to laryngeal phthisis proper, and do not take the non-specific changes into account. The reason for this is partly that many of these conditions, such as anæmia and paresis, cannot be recognised in a dead body, while others, such as catarrh, are transient, being either cured or giving rise to the development of ulceration. For this reason we are thus thrown back upon the results of laryngoscopic examination. We have already given our views upon anæmia, and content ourselves with remarking here that the pallor of the laryngeal mucous membrane may remain stationary during the whole course of phthisis, without resulting in any severe laryngeal disease. The catarrh presents no features by which it can be distinguished from the ordinary form, it attacks every part of the larynx, and thus, as we shall see, differs from tubercular infiltration; the cords are always most affected, and sometimes paresis or paralysis is also present. Catarrh alone never leads to ulceration of the larynx (laryngeal phthisis), and in favour of this view we may adduce laryngoscopic observations and pathological examinations. Laryngoscopic examination teaches that simple catarrh may heal spontaneously, or by the aid of remedies, or may remain unchanged until death; but that, in cases which end in ulceration, circumscribed thickenings are found in various parts of the larynx, concerning the nature of which the mirror gives no information; pathological examination shows that laryngeal phthisis always results from tubercular infiltration, and never from simple catarrh. Just as ordinary laryngeal catarrh may lead to erosions, so also in simple catarrh, when occurring in the course of tuberculosis, superficial loss of epithelium may be observed, but the latter never leads to deep ulceration. Sometimes small ulcers are observed, due probably to a suppurating follicle, but these are exceptional, and never increase to any size; we have seen this principally on the upper margin of the epiglottis.

On the other hand, all inflammatory hyperplasias and destructive ulcerations, which are comprised under the term phthisis laryngea, must be ascribed to tubercular infiltration.

In this sentence we signify our adherence to the recently expressed views of Heinze, Eppinger, Schech, and others, as opposed to the opinions of the older school (Louis, Cruveilhier, Trousseau), which have found favour with Rühle and Rindfleisch, as to the

non-tubercular nature of laryngeal phthisis. We cannot here enter further into the disputed point, but content ourselves with observing that Rindfleisch looks upon phthisical ulcerations in the larynx as due to a suppurative follicular catarrh.

Rindfleisch, indeed, believes that in the larynx miliary nodules may become developed, and bases this statement partly on the authority of Virchow, who has observed ulcers of an undoubtedly tubercular nature in the larynx, and partly on his own experience, which he sums up in the following words: "In the laryngeal ulcers, usually at some distance from the surface, in the middle of healthy tissue, there are found circular masses of cells," which, by their characteristics and the results of carmine staining, remind one of miliary tubercle. At the same time he ascribes to these nodules only the action of irritants, and considers the most important and marked destructive changes in the larynx and trachea to be due to catarrhal and follicular ulceration. Rindfleisch assumes that the ulcerative process starts from the orifice of a mucous duct, and thus there results "a circular, conical ulcer, with a narrow yellow rim, which sharply defines it from the surrounding mucous membrane. In the centre of the ulcer the distended duct, or the gland itself, which may also have become distended, forms a circular excavation, by which means the depth of the ulcer is rapidly produced; thus, the catarrhal ulceration of gland ducts has characteristics enough to distinguish it from other similar processes. It is only when the ulcer has extended in surface and depth that these original distinguishing points are lost. Owing to confluence of adjacent ulcers there occur, for example, the 'grape-like' contours, which are supposed to be pathognomonic of tubercular ulcers. The extension in depth is favoured by ulceration of the bodies of the mucous glands. Suppuration of the surrounding and interstitial connective tissue leads to destruction of the acini. The whole gland falls to pieces, and if we further mention that the mucous glands of the air passages lie not in the mucosa but in the submucosa, we can readily understand that such ulcers are particularly apt to cause deep-seated destruction."

As we shall see, Heinze proves that the glandular affection is never the primary or most important condition in laryngeal phthisis; it occurs together with tuberculosis as a complication, but never by itself gives rise to the marked destruction of tissue, which we call laryngeal phthisis.

We shall show further, when discussing the symptoms, that the results of laryngoscopic examinations also agree better with the views of Heinze than of Rindfleisch, in as far as it is possible to draw pathological evidence from them.

As the first stage of laryngeal phthisis, and as the origin of all further changes, we must consider tubercular infiltration. It is found, according to Heinze, in a half of all cases in which an autopsy is made, but with the laryngoscope it is observed much oftener. Usually the infiltration begins at one point, rarely does it occur at several parts at once; it is most common in the ventricular bands and aryepiglottic folds, next in frequency are affected the mucosa covering the arytenoids, the cords, and least commonly the epiglottis (and here indeed it may be said that it does not occur at all, without other parts also being involved).

The naked eye pathological appearances of the infiltrated parts are as follows:—an uneven swelling with a tense feeling when touched, of a dull grey or greyish-yellow colour, covered with a deposit which has a cheesy appearance, and is either grouped in patches or presents a smoothly granular surface. Microscopically the swelling consists of quantities of cells, imbedded in a reticular intercellular substance, situated in the subepithelial or submucous tissue; in the latter a

varying number of circumscribed round or oval patches are found, of which some are entirely composed of nuclei, while others contain in the centre, at the periphery, or in both situations granular detritus and giant cells (tubercular nodules). These nodules, which vary much in size, usually occur in the greatest quantities in the superficial part of the mucosa just beneath the epithelium, forming a belt parallel to it, but more rarely they are scattered uniformly through the whole depth of the mucosa. "Here and there," says Heinze, from whom this description is chiefly derived, "we also find examples in which a well-defined free space can be observed between the lower edge of the epithelial and the upper edge of the tubercular layer; this space certainly contains a few round cells, and is rich in capillaries, but there are no tubercles or reticular tissue. This gives further proof that tubercular infiltration of the mucous membrane does not take place from without through the epithelium, but that the mucosa and submucosa are the parts in which the deposit first takes place, and that thus the tubercular ulcer is formed by perforation from within outwards." The deposition of tubercle always occurs superficial to the glandular layer, and, together with the round cell-infiltration, diminishes as the depth from the surface increases. Bacilli are present in the nodules in small numbers. The glands are rarely quite normal, and they may be affected in one of two ways—(1) secondarily by extension of the tubercular process into their tissue; (2) by primary inflammation.

"If the tubercular process attacks the glands, the connective tissue capsule of the glandular acinus is destroyed, and the further destruction of its contents is rapid, in proportion as previous inflammation of the intracapsular substance has paved the way. An uncontrolled diffuse tubercular infiltration now extends between the acini, separating or compressing them, and finally sweeping them away; soon only fragments of acini remain to show traces of their previous existence. Thus the tubercular infiltration soon extends to a considerable depth, and eventually reaches the cartilage" (Heinze).

The primary disease of the glands is characterised either by small celled infiltration between the acini, which destroys them by pressure (interacinous infiltration), or by the glands becoming changed into a granular mass (interacinous destruction); both processes occur together and assist each other. According to Heinze, the large ducts offer most resistance to the destructive process.

As to the blood vessels, there is an accumulation of round cells seen around their transverse sections, which are situated partly outside of the adventitia, and partly imbedded between its fibres. In cases of advanced tubercular infiltration, sections of vessels are often seen in the centre or periphery of fully developed tubercles; the adventitia is always completely destroyed, but the muscular and internal coats are

retained. This power of resistance on the part of the muscular coat is only observed in the arteries; the corresponding portion of the veins is much sooner destroyed. In the capillary vessels the endothelial cells are usually unchanged, and the walls are of the usual thickness.

Tubercle is rarely found in the muscles of the larynx; in one case only, did Heinze observe, not only between the fibres, but also between the fibrillæ a large accumulation of round cells, which at some points were so marked that the continuity of the muscle was completely interrupted. In the centre of this infiltration, and at a considerable distance from the ulcerated margin of the cord (in which old tubercular deposits existed), were found some fresh tubercles. E. Fraenkel found in the muscles of the larynx, when affected with tubercular disease, changes which involved the contractile substance; it was loosened from its sarcolemma, and replaced by a granular mass, which, when absorbed, led to collapse of the investing membrane. Proliferation of cells, which appeared to proceed from the muscular corpuscles, was also present.

The cartilages are only involved in the disease when the tubercular infiltration has reached the perichondrium. Numerous pus cells are found between the fibres of the perichondrium, so that finally the cartilage is imbedded in a zone of purulent infiltration.

The cartilage itself becomes diseased owing to cells from the infiltrated perichondrium penetrating the intercellular substance, and thus producing softening, fatty degeneration, and destruction. The cartilage cells lose their cohesion, and finally are destroyed by fatty degeneration. It is only rarely that cells penetrate the capsule of the cartilage and destroy it (Eppinger).

The disease of the perichondrium and cartilage does not, according to Heinze, extend in proportion to the intensity of the tubercular process. We cannot be positive that the perichondrium is involved even when there is present "the enormous swelling of the epiglottis and the arytenoids, which characterise true tuberculosis of the mucous membrane, and give rise to marked changes in those parts."

The condition of the epithelium is of importance; it may be retained even when there is a large accumulation of tubercle immediately beneath it—a fact which may perhaps militate against the possibility of secondary tubercular infiltration, by absorption through the mucous membrane,and its passage through the epithelium. So soon, however, as the tubercular infiltration has reached the deepest portion of the epithelial layer, the latter becomes sodden, raised from its limiting membrane, torn in its most superficial parts by the pressure of newly developed tubercles, loosened and cleft in its deep layers. Perforation of the epithelium then results, and this soon leads to a crater-like opening, and finally an ulcer is formed by the throwing off of the softened tubercle.

The tubercular ulcer is characterised as such by the presence of tubercles at its margins or base, while giant cells, free or imbedded in infiltrated and reticular tissue, may also be found. Many ulcers may no longer in themselves retain these principal characteristics, but they then "show in their immediate vicinity on section deposits of an undoubtedly tubercular nature, and also those changes which imply the preliminary or first stage in the development of ulcers."

When ulceration results from tubercular infiltration, particularly when the destructive process has extended to the glandular layer, deep crater-like ulcers with raised margins are formed. The edges show marked proliferation of their epithelium, which "sends cancroid prolongations in the form of hypertrophied papillæ, into the sub-epithelial connective tissue" (Wahlberg).

If, on the other hand, single miliary nodules only are present, the mucous membrane, as Schech puts it, becomes riddled owing to the formation of small ulcers, which remain superficial, and are therefore not accompanied by deep destruction—the "aphthous," "corrosive," or "infective ulcers" of some authors.

Much controversy has taken place as to the nature and etiology of these little ulcers. On the one hand they have been spoken of as non-specific, and described as "catarrhal." They only occur, however, in consumptive persons, and, as Trousseau points out, their appearance and shape are so characteristic of phthisis, that from this fact alone their tubercular origin seems probable. On the other hand, Louis assumed these ulcers to be caused by the retention in the larynx of the secretions from pulmonary cavities, and spoke of them as "corrosive or infective ulcers."

We have already expressed the opinion that, according to the views now held as to tuberculosis, laryngeal infection, by means of pulmonary secretion, is possible under favourable conditions, but that the first result of such infection would be not ulceration but tubercular infiltration; we do not, therefore, consider the terms "corrosive or infective ulcers" as justified.

These shallow ulcers usually occur in situations where the mucosa is loosely attached and capable of being distended, *e.g.* the ventricular bands, and more particularly on the lower wall which forms the roof of the ventricle.

Symptoms.—The symptoms produced by laryngeal phthisis vary with the pathological condition of the organ, and with the stage of the disease which has been reached. They are marked when tubercular infiltration has occurred, and slight when only a non-specific condition is present.

At first, patients complain of peculiar sensations in the throat and larynx (such as have been described under Paræsthesia), the voice being easily fatigued, and there is a tendency to hoarseness. Laryngoscopic

examination then shows either no changes or marked anæmia of the mucous membrane. These symptoms, so far as the larynx is concerned, may be the only ones which affect the patient during the whole course of his malady. In other cases the laryngeal affection begins with hoarseness and aphonia, without any tubercular infiltration having yet taken place; the disturbance of voice then depends either upon catarrhal inflammation, which differs in no respect from the simple form, or upon paresis or paralysis of the adductors. This catarrh is certainly obstinate, but finally yields to care and proper treatment; it is, however, very apt to relapse, and may become permanent, and finally result in deep tissue change. On the other hand, temporary or permanent catarrh may be the sole symptom of implication of the larynx in phthisis during the whole course of the disease.

Functional dysphonia and aphonia occur in like manner; they may be present in the early stages, and eventually disappear or become masked by deeper changes. Laryngoscopic examination shows either insufficient approximation or tension of the cords, or rarely unilateral paralysis of the recurrent; we have almost always found, in addition to these motor disturbances, marked anæmia of the laryngeal mucous membrane.

The symptoms become more constant and characteristic, whenever the larynx is the seat of tubercular changes, that is, when phthisis laryngea proper begins.

Disturbance of voice is then rarely absent; out of 500 cases of laryngeal phthisis examined by Mackenzie during life, this symptom was present in 460 (92 per cent.), and of these 123 (24·6 per cent.) suffered from aphonia, and 337 (67·4 per cent.) from dysphonia. The same author in 100 cases of phthisis in which there was no tubercular infiltration of the larynx, found permanent or occasional hoarseness in 37.

The disturbances of voice, which vary from slight hoarseness to complete aphonia, depend upon the amount and situation of the disease. This symptom may be due to the catarrh which accompanies the tubercular process, or to thickening and ulceration of the cords. Infiltration of the interarytenoid fold may mechanically prevent approximation of the cords, or swelling of the ventricular band may interfere with the vibrations of the corresponding vocal ligament. In ulceration and secondary œdema of one or both arytenoids, the crico-arytenoid articulation may become completely immovable. When partial or complete destruction of the cords has taken place, the ventricular bands may act instead of them in phonation, and the voice then acquires a peculiar rough sound. Disturbance of mobility due to paresis or paralysis is rare in this stage; occasionally paralysis of the recurrent, due to its compression by the consolidated apex of the lung or enlarged bronchial glands, may develop at this stage.

Dysphagia occurs in about 30 per cent. of cases (151 out of 500,

according to Mackenzie); it may be so marked that swallowing is almost impossible and great agony results. When moderate in amount and due to ulceration of the upper part of the larynx (the ventricular bands, aryepiglottic folds, and interarytenoid commissure), each act of swallowing produces pain which often shoots towards the ear of the affected side. If the epiglottis and arytenoids be much swollen, either owing to infiltration or secondary œdema, swallowing is not only painful, but very difficult. Solid food never reaches the œsophagus, while fluids are swallowed with difficulty, being apt to get into the larynx and cause cough and suffocation. Many patients cannot swallow either solids or fluids, but only food of semifluid consistence.

Spontaneous pain is rare, but patients often complain of a feeling of rawness or uncomfortable dryness, especially after waking in the morning. We have already discussed the paræsthesia, which occurs in the early stage of phthisis.

Cough is a more or less constant symptom of laryngeal phthisis, and is commonly due to the pulmonary affection, but in the early stage of consumption there may be, in addition to the anæmia of the mucous membrane and paræsthesia, a short dry cough which we may look upon as laryngeal.

Expectoration becomes very difficult in the advanced stages of laryngeal phthisis, partly on account of deficient energy in the respiratory muscles and insufficient closure of the glottis, partly on account of the mechanical obstruction of the swollen portions of the larynx. As a result, masses of tough mucus collect within the narrowed glottis, and thus the patient is obliged to swallow and cough, which still further add to his discomfort.

Shortness of breath is due to the pulmonary lesion, but is increased when hyperplastic changes narrow the glottis. Severe dyspnœa, which may even require tracheotomy for its relief, may be due to œdema of the aryepiglottic ligaments and epiglottis, subglottic laryngitis (compare a case observed by the author), the presence of exuberant granulations around ulcers, and to perichondritis with its results.

The general nutrition may remain comparatively good, even in cases in which the larynx has become infiltrated and ulcerated, when the tubercular process in the lungs is not very extensive, and has not yet led to marked structural changes. The case is, however, different when nutrition is interfered with by dysphagia, for then the laryngeal affection hastens the wasting process. It appears, however, that the tubercular disease of the larynx in itself interferes less with general nutrition than pulmonary consumption. We have often observed that the well-nourished appearance of the victims of laryngeal phthisis has led to mistakes as to the nature of the disease, because the changes in the lungs were but slight.

The laryngoscopic images, presented by laryngeal phthisis, vary according to the stage of the disease, and the parts that are principally affected.

The first evidences consist in isolated flat swellings (tubercular infiltration) which may occur at one or several points. Although these may have different shapes according to their position, still they have this in common that their surface passes imperceptibly into the surrounding mucous membrane, and is of a dull grey colour. The remaining mucous membrane is either normal, anæmic, or shows the appearances of simple catarrh.

According to observations made on the living subject, these infiltrations seem to occur first and most frequently in the interarytenoid fold, then on the ventricular bands and arytenoids, and more rarely on the cords and aryepiglottic folds, while the epiglottis is least frequently attacked.

Infiltration of the interarytenoid fold may occur very early, and often at a time when no evidence of disease can be found in the lung; according to Schech, it may sometimes occur years before the outbreak of the pulmonary affection.

With the laryngoscope this condition is seen as an elevation of varying size and height; it is either situated so that the middle line passes through its centre or more to one or other side. On phonation the swelling is pressed between the cartilaginous portions of the glottis, and thus approximation of the cords is prevented, and more or less marked vocal disturbance results.

Tubercular infiltration of the ventricular band rarely affects it only in part; as a rule the whole is changed into a tumour, which gradually shades off into the lateral wall of the vestibule of the larynx; below the enlargement takes place at the expense of the ventricle, so that its opening is narrowed, or the latter may even quite disappear as a result of the pressure of the enlarged band upon the cord. The free edge of the ventricular band runs from behind forwards, in the same perpendicular plane as the margin of the cord, or even projects over and covers it; sometimes the cord may then be seen as a narrow stripe on phonation, or it may be completely concealed. If both ventricular bands are infiltrated in a marked degree, they touch one another on attempted phonation, and the voice is either rough or aphonic; in unilateral infiltration the voice may be retained.

Tubercular infiltration of the arytenoids may occur on one or both sides. The cartilages appear as two large, pale, pyriform tumours, the broad ends of which point upwards and outwards. The cartilages of Santorini and of Wrisberg are lost, and the interarytenoid notch is no longer visible. If one arytenoid only be infiltrated, the change in shape and size becomes all the more evident, the movement of the cartilage

is impaired by the swelling, the approximation of the cords is incomplete, and a considerable change in the voice results.

Infiltration of the aryepiglottic ligament is usually unilateral, and often associated with a similar condition of the epiglottis. The ligament loses its sharp margin and forms a sausage-like tumour; in severe cases the contour is no longer sharply defined; it loses itself in the aryepiglottic fold and epiglottis, and the margin of the latter seems to rise up perpendicularly from the interarytenoid notch.

Tubercular infiltration of the cords is at first almost always unilateral. The cord appears thickened, its edge and surface rounded and uneven; the thickening rarely reaches the same extent as in other parts. The normal, white, glistening, tendon-like appearance is lost, and the cord seems glazed or pink. It sometimes appears as if the upper and lower surfaces were separated at the free margin, *i.e.* cleft longitudinally, and the margin then becomes excavated without the existence of any ulceration; it looks, indeed, as if there were two cords, one upon the top of the other. From the lower surface of the cord the infiltration may extend to the whole subcordal space, and may give rise either to partial or complete subglottic laryngitis with the dangerous symptoms of marked stenosis which we have elsewhere described.

When the cords are infiltrated there is always marked alteration in voice.

Tubercular infiltration of the epiglottis is less commonly seen than œdematous swelling due to ulceration. It occurs in circumscribed patches, or involves the whole or a great part of the epiglottis. When circumscribed it gives rise to flat elevations of various sizes, situated either on one or other surface or at the margins. If the whole or great part of the epiglottis be infiltrated, its shape is much changed. The upper and lateral margins are much thickened, become rounded or turned inwards, so that the part assumes the shape of a turban, a perpendicular or horizontal tray, or a horse shoe. At the same time its mobility is lost, and it becomes rigid lying over the laryngeal inlet, and remaining stationary even during the production of high tones.

We have in our description assumed that infiltration is the first stage of tubercular affection of the larynx; this is, however, only meant to imply that from it result all the other destructive lesions comprised under the term—laryngeal phthisis. Tubercular infiltration may occur at any stage of the disease, so that not only may thickenings of various extent occur together at different parts, but ulcers may also be present at the same time. Whenever opportunity is afforded of watching the formation of ulcers, these are seen to arise from the breaking down of circumscribed infiltrations, and pathology teaches us that these infiltrations are tubercular. For this reason the parts upon which ulcers occur usually retain the shape due to such infiltration, while the ulcers show variations which we shall now discuss.

Ulcers in the interarytenoid region have a characteristic appearance; they are either furrow- or crater-like, the margins are raised and covered with conical excrescences, which resemble papillary neoplasms both to the naked eye and under the microscope. These raised margins so surround the ulcer that it is often impossible to see its surface. Only with the head bent well back during deep inspiration, and with the mirror held to one side, it is sometimes possible to see a part of its floor, which then appears uneven and is seen to be covered with a dirty grey coating (Fig. 34).

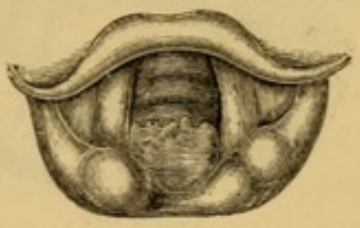


FIG. 34.
PHTHISICAL ULCER IN THE INTERARYTENOID REGION.

On the ventricular bands shallow "aphthous" ulcers are particularly apt to occur. The mucous membrane looks as if riddled, or there may be seen round patches, varying in size from a millet to a lentil, denuded of epithelium, and having a pale whitish floor; these ulcers bear a great resemblance to diphtheritic exudation, or to the spots produced on mucous membrane by the application of lunar caustic. These patches may become confluent, and give rise to a shallow ulcer covering the whole or great part of the ventricular band.

Ulcers of the aryepiglottic ligament are usually superficial, and their long axis corresponds with that of the ligament.

Ulcers of the cords vary according as they are situated on the free margin or surface. In the former situation there occur either small single ulcers separated by papillary granulations, or the cord is eaten out along its whole margin. These destructive changes are most common in the neighbourhood of the vocal processes; the points of the latter are thickened, prominent, and show laterally a hollow with a yellow floor—the ulcer proper. Ulceration, when it extends along the free margin, may produce considerable destruction so that the outlines of the cord are lost, and it is replaced by a narrow, dirty, yellow ridge. When ulceration begins on the upper surface of the cord, it encounters considerable resistance from the elastic fibres, and only shallow longitudinal clefts corresponding to the course of the latter are formed; these much more rarely lead to deep destruction than when the process begins at the margin.

Ulceration of the epiglottis only occurs on the laryngeal surface; but as the part is also thickened owing to infiltration or œdema, it is often impossible to see ulcers situated at its base or centre. These have either the characteristics of the "aphthous" ulcers which we have described as occurring in the ventricular bands, or they are deep and due to tubercular infiltration; in the latter case they are irregular in shape, with flat, irregular, or undermined edges (Fig. 35).

Some authors (Ter Malen, Türck, and recently Schnitzler and B.

Fraenkel) state that they have been able to detect with the laryngoscope miliary and submiliary nodules on the edges of ulcers, either with the naked eye or with a lens (Fraenkel). Heinze rightly observes "that even on careful microscopic examination of perfectly fresh tubercular ulcers on the dead body, one is unable to state with certainty whether the ulcer be tubercular or not, for tubercles can never be detected with the naked eye in recent laryngeal ulcers. What then remains doubtful on naked eye examination, when we are enabled to handle the specimen, must, most assuredly, be indistinguishable by means of the laryngoscope.

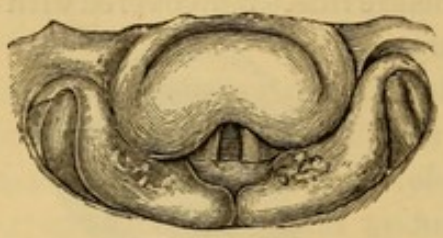


FIG. 35.

ULCERATION OF THE SIDES OF THE INFILTRATED EPIGLOTTIS AND ITS FOLDS. ULCERS OF THE INTERARYTENOID REGION.

Schnitzler certainly observed in one case, in the living subject in addition to white and grey nodules, varying in size from a poppy to a millet seed, and situated on both pillars of the fauces, small separate greyish white elevations of the mucous membrane (from the size of a pin point to a pin head), on the right œdematous arytenoid cartilage, the free edge of the epiglottis, and aryepiglottic folds; microscopic examination of a piece of the mucous membrane of the right faucial pillar, removed by means of scissors, showed the nodules to be tubercular and to contain giant cells. He further observed by means of the laryngoscope that the elevations within the larynx broke down, and produced small shallow ulcers. It must, however, be remembered, as Schnitzler himself admits, that such cases (*i.e.* when miliary tubercle can be diagnosed with any probability, by means of the laryngoscope) are very rare, and that small granulations or papillary growths may occur in the larynx, which might easily be confounded with tubercular nodules. We may arrive at the conclusion that the presence of such small nodulated masses cannot be taken into account in forming a diagnosis.

COURSE, RESULT, AND PROGNOSIS.—The course of laryngeal phthisis may vary much as to its duration, which depends upon the pulmonary disease, the situation of the laryngeal affection, and the general condition. We have already mentioned that the tubercular process in the larynx, even when severe, runs a much slower course, and has much less influence upon the general health when the pulmonary changes are slight. Not only the simple non-specific conditions, *e.g.* anæmia and chronic catarrh, but also tubercular infiltration and ulceration may then last for months and years without influencing the nutrition and appearance of the patient to any great extent. An increase of the pulmonary disease may then suddenly produce an unfavourable influence upon the general health and the local affection of the larynx. When the disease is situated at the upper part of the larynx, and if the epiglottis and

aryepiglottic ligaments be infiltrated and ulcerated, consumption advances more rapidly, owing to the accompanying dysphagia, than when the ventricular bands and cords only are affected. In like manner the condition progresses more speedily in those who have an hereditary tendency and in the anæmic. Laryngeal phthisis *per se* only causes death by suffocation in one of the following ways—(1) extensive infiltration; (2) the production of subglottic laryngitis; (3) the exfoliation and impaction of necrosed cartilage.

Is laryngeal tuberculosis curable? This question has recently been much discussed, but we do not consider the form in which it has been put as quite correct. The question as to the curability of the laryngeal condition seems to be intimately connected with that relating to the cure of pulmonary phthisis. So long as the latter has not been completely and permanently cured, we cannot be positive that every tubercular deposit has disappeared, and that no new relapse will take place. The other question, which, however, is quite different, is, "can tubercular ulcers heal?" In accord with almost all laryngologists, we answer in the affirmative. Heinze certainly remarks "one cannot see by means of the laryngoscope whether an ulcer be tubercular or simple." We think, however, that this author carries his scepticism too far. Although, indeed, we cannot, from the appearance of an ulcer, judge whether it be tubercular or not, the deduction may be drawn with tolerable certainty from its course and mode of development. An ulcer occurring in a phthisical patient and resulting from the breaking down of an infiltration, which spreads in depth and extent, must be looked upon as tubercular; and that an ulcer of this kind may heal (although rarely), many observations have proved. Rühle records two instances of post-mortem examination of healed ulcers; in one case there was a loss of substance which showed every appearance of having healed (a smooth floor of firmly attached connective tissue, with stellate edges); there was also another old ulcer on the arytenoid cartilage, and a recent one on the margin of the epiglottis; in the second case, there were on the lower surface of the epiglottis irregular cicatrices which produced curving of the parts, while in the region of the arytenoids there were recent ulcers of a manifestly tubercular character. Erosive or so-called catarrhal ulcers heal without leaving scars. A large number of laryngoscopic observations go to show that tubercular laryngeal ulcers may heal, so that, indeed, the question is beyond doubt. Another point now arises, viz. under what conditions healing takes place, and whether, when it does occur, the laryngeal tuberculosis is cured.

Many authors think that under favourable conditions a cure may be attained by local applications and antiseptic treatment. From our own observations, we have come to the conclusion that healing of the ulcers only takes place when temporary or permanent cessation of the pulmon-

ary disease or marked improvement in the general health occurs. At all events, exceptions to this rule are very rare, and there is always a suspicion that the ulcers were not really tubercular.

The author had quite recently an opportunity of observing an example of healing, in an ulcer which was undoubtedly tubercular. E., wife of a shoemaker, æt. thirty-four, applied for advice in April 1883, on account of hoarseness and very painful dysphagia. She had suffered for two years—since an attack of "pulmonary inflammation"—from cough, had lost weight, and had complained for eight weeks of pain in the throat, which was almost unbearable during deglutition. Solid food could not be swallowed at all, and of fluids only small quantities of milk could be taken with pain and difficulty. She had consulted a doctor, but he told her that her throat affection was associated with that of the lungs, and advised several litres of milk to be taken per diem. Laryngoscopic examination gave the following result:—right ventricular band much thickened (so that the cord only appears on phonation as a narrow stripe), and covered with shallow ulcers, some of which are separate, while others had become confluent; the ulcers extended on the right side to the upper part of the laryngeal cavity. In the thorax there was dulness on both sides down to the third rib and marked crepitations. There could be no doubt as to the nature of the disease; the infiltration, the characteristic ulcers, and the pulmonary signs could admit of no diagnosis other than tuberculosis. During three months applications of carbolic glycerine, creasote, and iodoform were made with short intervals of rest. Under this treatment the pain diminished, but the ulcers remained unchanged. In the beginning of July the patient went to Scheibau, a small village situated in a mountainous region (at the foot of the "Heuscheuer"). When she returned after four weeks, she was completely free from pain, the ulcers had disappeared, the ventricular band was still thickened, but its surface was smooth. The appearance of the patient had improved, the dulness and bronchial breathing remained, but as accompaniments there were only dry rhonchi at the end of deep inspiration. We should have examined for bacilli, but there was no expectoration.

The patient, it is true, believed that the result of local treatment had only become apparent later, and in thanking us she said—"Doctor, you cannot imagine what agony I have endured."

We do not certainly entertain the belief that our local treatment exercised any curative effect, but rather think that when the patient exchanged her poor unhealthy surroundings, damp dwelling, etc., for good mountain air, she was placed under such favourable conditions that the tubercular process came to a standstill, and at the same time the laryngeal ulcers healed.

In the present state of our knowledge we cannot explain why in one case laryngeal ulcers heal, while in others (and this is the more common condition) they do not. It is possible that in cases in which the tubercular infiltration is only superficial, healing of the ulcers may result from the softened tubercle being thrown off, and that thus for a time or permanently, relapses are prevented. Pathology teaches us on this point that, especially in single tubercular infiltrations, the destructive process is ended for a time after the diseased tissue has been thrown off (Heinze).

With the healing of the tubercular ulcer, however, laryngeal phthisis is by no means cured, for after a longer or shorter interval relapses almost invariably occur, either at the previously diseased or other parts of the larynx, and the patients die of tuberculosis.

In 1882, while staying in Görbersdorf at Brehmer's establishment, we had an opportunity of observing a case of what may be termed cured laryngeal phthisis. A young man, a druggist by trade, was examined in 1876 by Nothnagel who diagnosed pulmonary and laryngeal phthisis; there were extensive ulcerations in the larynx. After several years of residence in Görbersdorf the tubercular process ceased; the young man was a picture of health, and in the upper parts of the lungs percussion showed moderated dulness; there was bronchial breathing without any accompaniments, and in the larynx the ventricular bands and cords were thickened and uneven; the thickening, however, was not inflammatory but cicatricial. Syphilis could be excluded, and the cure had already lasted for two years.

Unfortunately cases of this kind are very rare, and it is better in laryngeal phthisis always to give a doubtful prognosis, and even when ulcers heal to remember the possibility and even probability of a relapse. The prognosis is most unfavourable in general tubercular infiltration of the larynx or when dysphagia is present, owing to ulceration of the epiglottis or arytenoids; *ceteris paribus*, the fatal termination is then much more rapid than when the affection is situated in the interior of the larynx.

Diagnosis.—When the pulmonary condition is marked, and the changes in the larynx are advanced, the diagnosis is not difficult. The case is different, however, when physical examination of the chest gives a negative or uncertain result, and when the tubercular affection is beginning. Laryngoscopic examination may then be able to determine with certainty, or at least with more or less probability, the nature of the disease, when other methods of examination give no result.

We have already discussed the diagnostic importance of localised anæmia of the laryngeal mucous membrane in the beginning of phthisis, and we can only repeat that marked anæmia, with paræsthesia of the larynx, paresis of the cords, and a short, dry cough, form a group of symptoms which should excite suspicion of commencing consumption. Obstinate diffuse laryngeal catarrhs, which occur in delicate persons, show a marked tendency to relapse, run a slow course, and do not yield to suitable treatment, including rest of the vocal organ, may likewise often be the forerunners of tubercular disease.

Of much more importance and of great diagnostic value are certain changes in the larynx, which are characteristic of tuberculosis. The first of these is infiltration of the posterior laryngeal wall or inter-arytenoid fold. Circumscribed prominent thickening in this situation, whether with or without the addition of conical excrescences, must be looked upon as a sure sign of tuberculosis, even when all other evidences of phthisis in the lungs and larynx are absent. To illustrate this point, we shall describe the following, which is one of a series of cases.

On the 4th Feb. 1883, Dr G. sent us a young girl of seventeen years of age to be examined and treated for hoarseness. Dr G. found swelling of the right vocal cord posteriorly.

The girl appeared well nourished, and had no discomfort except that she was aphonic. We found a prominent swelling of the posterior laryngeal wall covered with small papillary excrescences, which were especially marked at the posterior attachment of the right cord; there were also present at the anterior commissure small red granulations which extended below the cords. Although this last-named condition might justify the view that we had to do with neoplasms, the author expressed the opinion that he considered the changes in the posterior wall of the larynx as pathognomonic of tuberculosis, in spite of the absence of cough and other pulmonary symptoms. We attempted in consultation with Dr G. to remove the granulations by means of solid nitrate of silver and the galvanic cautery. They really became smaller, and the voice was rather better. On the 31st March, Dr G. informed us that examination of the lungs showed the presence of apex catarrh, and that the patient was beginning to get thinner, and to perspire at night. After this the disease progressed rapidly, but the laryngeal infiltration did not break down, at least up to the 22nd of June, when the last laryngoscopic examination was made. Notwithstanding careful treatment, good nourishment, country air, etc., death took place in the beginning of August.

Every laryngologist has met with a number of such cases, but the course is not always so rapid as with our patient. Months often pass before fresh characteristic evidences of tuberculosis admit of no further doubt as to the nature of the disease.

Not only infiltration of the posterior laryngeal wall, but also a similar condition of other portions of the larynx, may be of diagnostic value when the pulmonary symptoms are latent or uncertain. We would like to insist upon the following axiom:—in all cases in which an isolated thickening, whose surface passes imperceptibly into the surrounding mucous membrane, and which but slightly changes the configuration of the affected parts, is found within the larynx, especially on the ventricular bands, the aryepiglottic folds and cords, the condition can only be due to tuberculosis or syphilis. The following characteristics will aid in distinguishing tubercular from syphilitic thickening:—tubercular infiltrations show a dull uniform surface of a pale or livid colour; in syphilis they are irregular, of bright or dark red colour, and surrounded by a zone of inflammation; syphilitic infiltration breaks down much more rapidly, and usually runs an acute course. Mackenzie states that syphilitic ulcers are commonly unilateral, but, according to our experience, this also frequently applies to the tubercular variety, at least in its early stages. We consider unilateral corditis as always suspicious of tuberculosis.

The diagnosis is, of course, more difficult when the history and an examination of the lungs leave us in doubt. Erosions can hardly be confounded with tubercular ulcers; the former are shallow, and have thin edges, while the surrounding tissue shows evidence of catarrh but never of infiltration. Several points have been adduced for the differentiation of tubercular from syphilitic ulcers. B. Fraenkel says of the tubercular variety that they extend more transversely than in depth, that their edges are rounded, that they are surrounded by an inflammatory zone, and that in many cases, even during life, by the aid of a lens,

submiliary and miliary tubercles may be recognised, while the floor is cheesy and covered with detritus. As to the laryngoscopic diagnosis of tubercle, we have already expressed ourselves, and as to the other characteristics insisted on by Fraenkel, we may remark that they do not always hold. Even experienced laryngoscopists, when judging only from the appearance of the ulcers, can in many cases only diagnose with probability—rarely with certainty—their tubercular nature. The locality of the ulcers is of more importance with regard to diagnosis. Tubercular ulcers are situated especially on the laryngeal surface of the epiglottis, the arytenoids, the ventricular bands, and the posterior wall of the larynx, while the syphilitic variety affect principally the edge and upper surface of the epiglottis, and more rarely other parts, except the cords, where the tubercular and syphilitic are found with equal frequency; the former, however, never produce such rapid and deep destruction as the latter, and, as is always the case in phthisis, they develop but slowly. The pallor of the mucosa is also characteristic of tubercle, and in addition to the ulcers infiltrations are often present which render the diagnosis certain.

When all are taken together—the mode of development, the locality and appearance of the ulcers, the condition of the parts in the immediate vicinity, and in the remainder of the larynx—one can usually arrive at a positive diagnosis, even when the general features of the case admit of doubt.

In spite of this, however, cases occur in which the diagnosis must remain doubtful, either because a phthisical patient has laryngeal syphilis, or a syphilitic patient becomes attacked by phthisis. There then remains no course but to form an opinion *ex juvantibus et nocentibus* after careful antisyphilitic treatment, which cannot materially injure the condition of a consumptive individual.

The following observation by the author goes to show how difficult the diagnosis between laryngeal syphilis and phthisis may be rendered by a combination of circumstances.

G. was sent to us with a history of infection which had occurred some years before. Six months ago he became affected with hoarseness, dysphagia, and cough, which worried him night and day; he had twice tried a course of inunction and iodide of potassium without effect, and the cough and pain were not alleviated by narcotics. Laryngoscopic examination showed, on the right side of the posterior laryngeal wall, an ulcer extending on one side to the posterior portion of the ventricular band, and on the other through the furrow formed between the posterior and lateral wall of the larynx, as far as the inter-arytenoid notch. There were no further symptoms of syphilis and no pulmonary signs. We reported that no deduction could be drawn from the appearance of the ulcer; but, as the patient had used antisyphilitic treatment without result, and considering the teasing dry cough and the recent loss of weight, we believed a suspicion of tuberculosis justified—at all events, we considered that further antisyphilitic treatment was not called for. A residence of several weeks in Reinerz improved the general condition, but had no effect upon the local symptoms (dysphagia, pain, and hoarseness). The patient went to Vienna, consulted Sigmund, and on his recommendation again underwent a course by

inunction at the clinic; after this all the symptoms disappeared, and complete recovery resulted.

We believe that our error, or rather our doubt, as to the nature of the ulcer was excusable. It is, indeed, not a rare observation that inunction in a hospital under careful medical superintendence is more efficient than when carried out at home.

It is always advisable in such doubtful cases to be cautious in prognosis and diagnosis.

Recently B. Fraenkel has proposed to utilise the presence of tubercle bacilli in the secretion of laryngeal ulcers, for purposes of diagnosis; but we do not consider that at present this method is sufficiently certain. The positive result of the experiment must leave it doubtful whether the secretion is from the larynx and not from the lungs, and a negative result would justify the question, whether even although tubercle bacilli are present in tubercular ulcers, they always exist in the secretion. We would, therefore, not attach much importance to the demonstration of bacilli, until further observations have been made.

Treatment.—The treatment of laryngeal phthisis is intimately connected with that of pulmonary consumption, but it is also important to combat the tubercular process in the larynx, or at least to limit it by local means.

It is not our intention to discuss the general treatment of tuberculosis, and we shall confine ourselves to a consideration of the general rules of treatment, and the modifications required when the larynx is also attacked.

We do not yet know the conditions under which tubercle bacilli carry on their unhealthy action, but must rest satisfied with Koch's dictum, that the disease occurs where they find a suitable locality. Experience further teaches that the power of resistance to parasitic development on the part of the organism is diminished by delicacy of constitution, and disturbance in the mechanism of respiration. The greatest care is, therefore, necessary as regards nutrition and a sufficient supply of pure air.

The food should be mixed. M. Schmidt writes to the point when he says, "with meat and eggs alone a phthisical patient is fed to death." For phthisical patients vegetables are just as important as meat, and the physician should not be too careful as to diet. The taste of the patient and his accustomed mode of living, so far as it be not irrational, should be as much as possible considered, for a less nourishing diet is better than one which is deficient in quantity. Regularity as to meals and change of food is of advantage; but the laryngeal disease requires special consideration. All food and drink, calculated to irritate the larynx by temperature, form, consistence, or chemical composition, should be

avoided. In this respect patients usually know what is best borne. Ices are usually pleasant, and there is no reason why they should not be from time to time taken, but hot drink and food are injurious. In ulceration of the upper part of the larynx, such food as can most easily be swallowed, and causes least pain, should be given; usually semi-solid or gelatinous food suits best (milk, thickened with flour or rice well boiled, and puddings).

Among the most valuable means of nourishment may be reckoned milk, and milk cures have long been advocated in phthisis; it is, however, only of benefit when it is given in sufficient quantity (two litres or more a day)* and when it is not taken at the expense of other food. During, and shortly after each meal one or two glasses should be taken. Alcoholic beverages cannot be dispensed with in phthisis; in laryngeal ulceration wine and beer often cause severe pain, and therefore the former should be diluted, and the latter slightly warmed.

Nutrition is aided by the use of malt extract, and cod-liver oil in winter if it be well borne.

Of not less importance than nutrition is pure air; a roomy, well-ventilated bedroom, especially if the patient be confined to it, should be insisted upon. When at all possible, however, the patient should go out every day. Many persons afflicted with laryngeal phthisis are attacked by cough whenever they go into the open air; respirators must then be worn, but this is very much a matter of habit. When the patient has been induced to take a daily walk, even in unfavourable weather, his sensitiveness to changes of temperature is diminished. In the early stages of phthisis, great attention should be paid to the skin. It is not sufficient to recommend cold sponging, but this should be carried out by an experienced person, and modified according to the condition and powers of the patient. In anæmic individuals sponging with water at a temperature of 20° R. (77° F.) should be first used, and the temperature gradually diminished.

We must now consider the question whether consumptives should be treated at home, or whether they should be sent to another climate, and if the latter be decided upon, whether treatment should be carried out in a special institution or not. It is somewhat difficult to give general directions on these points; phthisical patients in whom the disease is advanced, and who rarely leave their rooms, or have to remain in bed, should stay at home, for even in the best situated and regulated of establishments they feel ill and are not improved by change of air. On the other hand, it is often astonishing how much the general health, local disease, and nutrition are improved by change of air. If it be not intended only to produce a very transient improvement, it is not sufficient to spend four or six weeks at a bath, and then return home to

* A litre equals from 35 to 36 ounces (Translator).

business and former regimen, because the patient now feels "much better and stronger." We believe that in consumptives life may be prolonged or even a cure effected, and that the disease is always alleviated if they be early and regularly—that is, for a period of years—sent to suitable climatic resorts. Good results may be obtained both at institutions* and by means of independent treatment, but we prefer the former. We are not blind to the evils of even the best conducted establishments, as we have learnt them from a residence of several weeks in such a resort; but ideal conditions cannot anywhere be found, and the advantages exceed the disadvantages. M. Schmidt is right: "The patient must understand why he is obliged to live by rule, and must gain strength of mind sufficient to enable him to carry this out for years or even always." In an institution not only medical supervision and instruction, but also the example of fellow patients are of value; the patient is taught to adapt himself to rules, and it is wonderful what improvement in nutrition may thus result. We should advise young people in whom the necessary self-control cannot be guaranteed, to be accompanied, at least for a time, by some energetic relative, for the eye of the physician cannot be everywhere. The regimen of public health resorts is always but that of an hotel with all its drawbacks, even without considering all the temptations to which the patients are exposed; in saying this, we speak from personal experience at Montreux. All points, however, must be considered in each case before a decision is arrived at. Among health resorts we must choose, for cases of laryngeal phthisis, those which have pure and moist air, free from dust, such as Pisa and Venice. In the Riviera, Mentone and San Remo are the best, and lately sea voyages, or trips up the Nile have been much recommended. High altitudes, *e.g.* Davos, etc., are usually badly borne by the victims of laryngeal phthisis, but in Görbersdorf we have seen those affected with this malady thrive well, and M. Schmidt says the same of Falkenstein.

Unfortunately the number of those whose means admit of expensive journeys and prolonged stay at health resorts, is limited. We would advise even those who are obliged to stint themselves when abroad, and who are not able to spend months and years in search of health, to remain at home. In such cases the physician must pay great attention to hygienic conditions, *e.g.* bed-rooms, regimen, and nutrition, to which we have already referred. It is, however, always desirable, when possible, for the patient to leave home for some time during the summer months; it is often enough to send the sufferer to a sheltered wooded place where the air is free from dust, and the accommodation not too primitive. Many resorts, such as Reichenhall, Gleichenberg, Badenweiler, Soden, etc., and the seaside, when the patient is not too weak, are often of service.

* *i.e.* Special establishments conducted on the lines of our hospitals (Translator).

Rest of the vocal organ is of great importance in all cases of laryngeal phthisis, and when there is ulceration, speaking above a whisper should be forbidden; this should be particularly enforced when the patient is in the open air. Pulmonary gymnastics are also sometimes beneficial. The sufferer should be directed when in the open air or in a forest to perform from ten to sixty deep inspirations and expirations, thrice daily. Ascending stairs requires too much effort, but wandering over soft gradual ascents is capital exercise. In this respect the wooded grounds of Brehmer's establishment at Görbersdorf are exemplary.

It need hardly be added that smoking and sitting in a smoky atmosphere should be forbidden.

Local treatment must never be energetic, and it should vary according to the stage of the disease and the pathological conditions. In simple laryngeal catarrh without infiltration and ulceration, such as occurs in the beginning of the disease, we have no objections to astringents, especially nitrate of silver used as previously recommended; these applications are also useful in relieving the short dry cough which together with paræsthesia afflict patients during the first stage. When at any point infiltration has occurred we consider astringents useless, and even directly injurious. We cannot cause disappearance of tubercular infiltration by means of any astringent, but we may favour the breaking down of the cheesy mass with resulting ulceration; at this stage it is best to abstain from all local treatment.

M. Schmidt recommends deep incision into the thickened tissue, in infiltration of the epiglottis and aryepiglottic folds, whether there be ulcers or not. He uses for this purpose a scissor-like instrument, the branches of which work something like a tonsillotome. The instrument for the left arytenoid fold has near its extremity a slight bend towards the right, so that the fold may be cut through at right angles. The points of the cutting portion are blunt, so that the apparatus can be introduced between the posterior laryngeal and pharyngeal walls, and into the lumen of the larynx without causing injury. The scissors are introduced closed until they are behind the epiglottis, they are then opened and the branches gently pressed downwards, so that one lies within the larynx and the other at the beginning of the œsophagus; the infiltrated portion of the posterior laryngeal wall lying between them is then quickly cut through, from which proceeding but slight pain and hæmorrhage result. On the following day swelling is seen to be less, and sometimes there is rapid disappearance of the infiltration.

Scarification of the epiglottis is carried out by means of a knife which is rounded in front, and has a cutting edge of only about three millimetres in length at its lower part, which is turned towards the operator.

The incisions should, above all, be large, and the treatment be applied early, especially if dysphagia be marked.

We had an opportunity of examining, in Dr Schmidt's clinic, a patient who two years before had ulceration of the posterior laryngeal wall; there was, however, not a trace of this to be seen, and not even thickening of the part. The pulmonary symptoms, on the other hand, had recurred.

So far, this method, however, has not been much used by others.

As to the local treatment of ulcers, it has been attempted to promote cicatrisation by means of astringents; this method, however, has now been abandoned by all physicians, not only as useless but as injurious. To give temporary relief from pain Schnitzler recommends insufflation either of acetate of lead or nitrate of silver (·6–1·25 to 4 parts of sugar of milk), or cauterising the ulcers with lunar caustic. These applications we also consider as unnecessary, or rather other remedies about to be considered may be substituted. Antiseptics, on the other hand, used in various ways, have of late found general favour.

M. Schmidt, who has been a warm advocate of their use, started from the hypothesis that he could thus disinfect the ulcerated surfaces and promote healing, and that, as a secondary result of such disinfection, the inspiration of injurious matter into the lungs could be prevented.

We, for our part, do not believe that this result is obtained; ulcers which are continually exposed to contamination both by the respired air and pulmonary secretion, and which, moreover, always receive fresh infective material from their base, composed as it is of infiltrated tissue, cannot possibly be kept aseptic. We must, however, admit that some antiseptics are of undoubted value in the treatment of laryngeal phthisis, and of these the most important is carbolic acid.

Carbolic acid may be used either in the form of inhalation, or may be applied as carbolic glycerine by means of the brush.

Schmidt uses in sluggish pale mucous membranes, camomile tea as a vehicle for the antiseptic, and this is kept boiling over a spirit lamp. To half a litre of the infusion he adds a tablespoonful of a 2 per cent. solution of carbolic acid. The steam so produced he orders to be inspired through a paper tube, one third of a metre in length, the lower part of which covers the vessel, and, becoming gradually narrower, tapers to the other extremity which corresponds to the size of the open mouth. These inhalations are repeated three or four times a day, and each lasts for five minutes. If, instead of this simple cheap apparatus, a spray be desired, the boiler of the latter may be filled with camomile tea, and to the glass intended for the active agent there may be added from thirty to fifty drops of a 6 per cent. carbolic lotion, filled up with camomile infusion. When the mucous membrane is much reddened, plain water should be used instead of camomile tea.

When the carbolic acid is to be applied by means of a brush a 1–3 per cent. solution in glycerine is used.

When the treatment has to be carried out by the patient, we must resort to inhalations, but it is better for the physician to apply the carbolic glycerine, or both methods may be combined.

Carbolic acid acts as an anodyne, and we can thoroughly recommend its employment.

Creasote acts in the same way, and should be thus prescribed :—

Creasote ·5		Minims 5.
Spirit. Vin. Rect. 20	or approx.	℥iii.
Glycerin. 30		ad ℥i.

This may be applied by means of a brush each day, after the larynx has been cleansed by the inhalation of a 1 per cent. solution of common salt.

Balsam of Peru is also used by Schmidt in the form of inhalations, as in carbolic acid. From 10–20 drops of a mixture containing two parts of balsam to one of rectified spirit are added to half a litre of camomile infusion and inhaled.

The use of boracic acid is much lauded by Schech and Schäffer. After the ulcers have been cleansed by means of a 1 per cent. solution of salt, or a 4 per cent. solution of chlorate of potassium, from ·2–·5 [of a gramme, which equals 15·43 grains] is insufflated.

Iodoform has not fulfilled the expectations which it raised. Schadewaldt half fills a retort with water and adds a teaspoonful of iodoform. The retort has a perforated cork, through which passes a glass tube bent at right angles. The iodoform, as soon as the water boils, is mingled with the steam, and thus inhaled ; the dose can be regulated by the size of the flame, the quantity of iodoform, and the duration of inhalation. Küssner recommends its inhalation as a spray in the following manner : Of a 10 per cent. alcoholic solution, 10 cubic centimetres are poured into the glass connected with the inhaler (spray producer), which has a capacity of about 30 cubic centimetres ; this is then filled up with water, and the resulting mixture inhaled.

It is, however, simpler to insufflate iodoform pure (·2–·3 of a gramme), or triturated with ether (·5–·6 of a gramme).

Iodoform—quite putting aside the fact that it deprives some patients of appetite—has nothing to recommend it before other antiseptics.

Corrosive sublimate in the proportion of 1 to 1000 of water is without any action.

Carbolic acid and creasote may also be inhaled, as described on page 36.

In cases in which painful deglutition is very marked, and not relieved by the use of carbolic acid, recourse must be had to narcotics. Morphia may be used subcutaneously in the cervical region, or it is insufflated in doses of from $\frac{1}{9}$ to $\frac{1}{4}$ of a grain (or more) mixed with starch. The following mixture may be employed :—

Iodoform or boracic acid 8
Powdered gum or starch 2
Muriate of Morphia ·5

and of this ·2 [or about 3 grains] may be insufflated.

Schäffer advocates the destruction of tubercular granulations of the interarytenoid region, true and false cords, by means of the galvanic cautery; we would, however, only recommend this when they cause stricture.

When stenosis is very marked, tracheotomy must be performed if relief be not obtained by incising œdematous parts or opening perichondrial abscesses.

We cannot close this chapter without expressing regret that the local treatment of laryngeal phthisis has not obtained the attention it deserves from physicians generally, at least, so far as our experience goes. In spite of our doubt as to being able to accomplish healing of tubercular ulcers by local measures, yet we consider "Nihilism" to be absolutely unjustifiable and inexcusable. A rational, careful, local treatment, for which certainly training in the use of the laryngeal mirror is necessary, may not only often alleviate, temporarily or permanently, the painful symptoms of the consumptive patient, but has also a moral effect by making the poor sufferer hope. Unfortunately, however, laryngeal phthisis is regarded by many as a "*noli me tangere*," and the internal administration of narcotics is considered to be the utmost that can be done.

CHAPTER II.

LARYNGEAL DISEASE IN SYPHILIS.

Etiology.—Syphilitic disease of the larynx is always a part symptom of general syphilis, and almost always combined with an affection of the pharynx.* In the order of frequency with which organs are attacked in syphilis, the larynx comes after the skin and pharynx. According to Lewin, whose statistics are based on the largest number of cases, about 575 (equal to 2·9 per cent.) out of 20,000 syphilitic persons who were taken into the Berlin Charité had the larynx affected; of those who were so attacked, about 500 (87 per cent.) showed slight laryngeal disease, and in about 75 (13 per cent.) the larynx was severely involved. The statistics of other authors, however, differ considerably from those of Lewin, and this may be due to various circumstances. Laryngologists must arrive at different results from syphilolographers, because the former are principally consulted in severe cases of laryngeal syphilis; the result must also vary according, as in one hospital all secondary cases are examined, while in another only those who complain of throat symptoms, for the symptoms of laryngeal syphilis may be so slight that the condition gives rise to no discomfort. Views as to syphilitic congestion and catarrh, as Chiari and Dworak rightly remark, vary so much that in this way different results may be accounted for. At all events, Lewin's statistics seem to come nearest the truth, because they are drawn from a large material, and because all the syphilitic cases in the institution within a given time were examined with the laryngoscope. According to these, the proportion of secondary or slight to tertiary or severe cases was 7 : 1. As to the relative frequency of syphilitic laryngeal disease compared with other affections, no observations have been made. Mackenzie out of 10,000 cases of throat affection, *i.e.* of the pharynx and larynx, found 308 examples of laryngeal syphilis (3·08 per cent.), and Schroetter out of 21,044 cases had 947 of laryngeal syphilis (4·5 per cent.). In both instances the severe cases were more numerous than the mild, which is accounted for by the fact that laryngologists see severe cases oftener than can be explained on the grounds of their relative frequency.

* This last statement has undoubtedly many exceptions (Translator).

With regard to age, it has been found that most cases occur between twenty and forty; men are most commonly attacked between twenty and thirty, and women between seventeen and thirty, which corresponds to the general occurrence of syphilis. Laryngeal syphilis seems to be very rare in childhood; Mackenzie has recorded 16 cases of tertiary laryngeal syphilis in persons over sixty.

The time between infection and the outbreak of syphilis in the larynx varies much; the minimum is from two and a half to six months, and the latest period, according to Sommerbrodt, between five and fifteen years.

Evidences of syphilis in the larynx may appear years after every symptom has disappeared, and this also applies to the pharynx.

Changes in temperature seem to be an exciting cause of the development of the affection in its milder forms. Of 118 cases of secondary syphilis observed by Mackenzie, 79 occurred between the 1st of September and the 31st of March, and only 37 between the 1st of April and the 31st of August; while out of 110 cases of tertiary syphilis, 66 occurred in the six winter months, and 44 during the summer. Lewin also arrives at somewhat similar results.

Contrary to the opinion of Ziemssen, Schroetter maintains that employment has no influence upon the development of laryngeal syphilis; at least, according to this author, it is not shown that persons who are much in the open air, or frequently use their voice, show any special predisposition to laryngeal disease.

In most cases no cause is evident why syphilis has attacked the larynx, but sometimes the direct extension of the affection from the pharynx can be demonstrated. We saw this plainly in a case in which ulceration of the pharynx was so deep-seated that it was overlooked by the family physician, and in which, owing to contact of the epiglottis with the ulcer, the syphilitic process attacked its laryngeal surface so that its upper third was completely ulcerated. This direct infection certainly explains why syphilis is particularly prone to attack the epiglottis and the upper part of the larynx.

Pathology.—The pathological changes in the larynx may be manifest, as (1) catarrh; (2) papules or condylomata; (3) inflammatory infiltration or gumma; (4) ulceration with loss of tissue or the formation of membranes; (5) perichondritis.

The catarrh is indistinguishable from simple catarrh, and can only be diagnosed as syphilitic, because it appears and disappears with other manifestations of the disease. It may produce various degrees of redness, swelling, and secretion.

Lewin denies the occurrence of catarrh, and designates as erythema laryngis a condition characterised by diffuse and extensive redness of the mucous membrane, which is accompanied by slight swelling, but

causes no increase of secretion. The distinctive points of erythema as described by Lewin cannot be considered as sufficiently definite.

The mucous membrane is sometimes only hyperæmic, sometimes rose-coloured, livid or brownish; the signs of hyperæmia are sometimes slight, the cords may be grey or greyish red, and, indeed, the changes are only those which may be observed in simple catarrh. Erosions of varying extent may occur, and the epithelium of the cords is sometimes thrown off and sometimes thickened. The secretion may be considerably increased; sometimes it is tough or dries readily, forming crusts, but not uncommonly increased secretion is absent, just as in simple catarrh. Swelling of the mucous membrane is rarely considerable; but sometimes, according to Eppinger, "the tense infiltration of the mucous membrane with round cells admits the assumption of a deeper lesion." According to the same author, this can be well seen in infants affected with hereditary syphilis. Well-defined red spots or maculæ, described by Jullien and Fauvel as characteristic of syphilis, have not been observed by other authors.

Papules or mucous patches (plaque muqueuse, laryngitis papulosa of Lewin) are comparatively rare in the larynx; they sometimes occur on the free edge of the epiglottis, the cartilages of Santorini, the arytenoids, the aryepiglottic folds, and, according to Lewin, most frequently on the middle of the cords. Schroetter, however, thinks that in the last-named situation it is not easy to distinguish them from other kinds of syphilitic ulceration, which by breaking down lead to ulceration. Pathology does not aid us in deciding this question, because the early stage of syphilis is rarely observed post mortem.

Mucous patches appear as round or elongated greyish-white spots of thickened epithelium slightly raised above the congested tissue which surrounds them, and are either sharply circumscribed or shade gradually off into it. Whenever the epithelium has been thrown off and erosions produced, the greyish colour takes on a reddish shade until, finally, after all the epithelium has disappeared, only round spots remain with a yellow purulent base on which a few red points are visible.

Inflammatory syphilitic infiltrations of the larynx have this in common with gummata of the same part, that they are both composed of small-celled tissue, and that they both show a tendency to break down and form ulcers.

The infiltrations are developed, according to Eppinger, by direct inoculation from adjacent syphilitic virus, and on this account those parts which are most exposed to friction and contact with secretion are their favourite seats. They occur most commonly on the cords and on other parts in the following order of frequency: (1) epiglottis; (2) the posterior wall of the larynx. They give rise to uniform thickening, and when extensive give rise to considerable changes.

Gummata occur without showing a preference for any particular part of the larynx wherever there is vascular connective tissue, and hence are usually situated in the submucous layer (Eppinger). They consist either of more or less numerous round nodules varying in size from a shot to a pea, sharply defined, and slightly prominent, which are usually so close to one another that they sometimes appear to be almost confluent (the small nodular syphilide of Lewin), or they occur as solitary tumours more or less diffuse in appearance, which are distinguished from infiltrations by being more circumscribed (diffuse infiltration of a gummous character, according to Lewin); finally, gummata may also appear as circumscribed large swellings with a smooth surface, the colour of which is dark red at first, but yellow at a later stage.

We have already stated that both inflammatory infiltration and gummata of the larynx have a great tendency to break down and form ulcers. This process of ulceration is usually remarkably rapid, and we need not therefore be surprised that ulcers are the most common manifestations of laryngeal syphilis.

The ulcers vary in character according as they result from infiltrations or gummata.

Those which result from infiltrations are irregular, their edges are but slightly raised, rarely undermined, and usually surrounded by a red zone; their bases are covered by a creamy secretion, and when this is removed the peculiar white firm infiltration appears. These ulcers have a greater tendency to extend their surface than their depth, and rarely give rise to perichondritis or necrosis of cartilage.

Ulcers produced by the breaking down of gummata are characterised by their well-defined character; the edges are much thickened, and often appear as if eaten away, while the deep floor looks as if "a piece had been cut or shelled out of previously swollen tissue." When this form of ulcer extends in depth, perichondritis and necrosis of cartilage are apt to result.

Perichondritis is usually a result of deep ulceration, and may attack any cartilage; it leads to abscess, fistulous ulcers, extensive destruction of the diseased cartilage, and exfoliation of portions, or even of a whole cartilage.

Perichondritis may, however, also occur primarily in the course of syphilis, *i.e.* without previous affection of the mucous membrane. In these cases an abscess is subsequently formed, so that the mucous membrane is at first pushed outwards, and finally perforated; the secondary conditions, which we have just specified, may then result. It rarely happens, in the course of perichondritis, that the cartilage becomes infiltrated with connective tissue, as we have described on page 106 (sclerotic perichondritis, perichondritis fibrosa of Diedrich).

The process of healing and cicatrisation in syphilitic ulcers is quite

characteristic. When the breaking down of a syphilitic infiltration or gumma ceases, hard connective tissue becomes formed in the peripheral zones, while the centre, as first shown by Virchow, is unproductive. As a result of this there are formed cicatrices with a remarkable tendency to contract, which thus assume various forms and lead to manifold deformities within the larynx, or give rise to the formation of membranes such as we have already described (page 115).

We must further remark that sometimes as a result of cicatrisation and sometimes without this hyperplastic granulations are formed, and that in addition to ulcers or cicatrices there may arise fibroid degeneration and diffuse swelling of the mucous membrane, or papillary excrescences not unlike pointed condylomata, which occasionally reach a considerable size.

Finally, there may not uncommonly be observed more or less œdema as a result of ulceration and perichondritis.

Symptoms.—Mucous patches, syphilitic infiltrations, and gummata, may produce such slight symptoms that there is either little disturbance of function or none at all.

Usually changes in voice are the first and most constant symptom. They are caused either by syphilitic catarrh, when they are slight, and consist only of roughness or slight hoarseness, or they result from deep-seated changes (infiltrations, gummata, ulcers, and cicatrices), when there may be complete aphonia.

In the milder forms, due to catarrh or mucous patches, there may be in addition to vocal disturbance various uncomfortable sensations (painful feeling of pressure, tickling, etc.). Pain is usually but slight; even in marked ulceration of the upper parts of the larynx it is not usually marked, a point which, under certain circumstances, may aid in arriving at a differential diagnosis. Dysphagia only occurs when a large portion of the epiglottis has been destroyed by ulceration, and it is never so marked as in tubercular ulceration and infiltration. Cough is usually absent or slight; severe paroxysms, such as we observed in one case of syphilitic ulceration of the interarytenoid fold, and which gave rise to the suspicion of phthisis, are exceptional.

Laryngoscopic examination gives different results, according to the anatomical changes, their situation and extent, and thus an immense variety of images may be met with, greater perhaps than in any other form of laryngeal affection. Syphilitic catarrh is by no means characteristic, and a laryngeal catarrh, even when it occurs in a suspected person, should never be looked upon as specific if it be not accompanied by positive evidence of the dyscrasia, which should be looked for especially in the mucous membrane of the nose and pharynx. We may here also remark that a catarrh may be an accidental symptom in the course of syphilis, due to catching cold, etc., and may therefore be non-specific.

We have already seen in the section on pathology that all the characteristics of the catarrhal affection deduced from the appearance and colour of the mucous membrane (which were especially insisted upon by Lewin as pathognomonic of syphilitic disease of the mucous membrane or erythema laryngis) are not trustworthy. All degrees of redness, swelling, and anatomical change, which we have described as occurring in simple catarrh, may also arise in the course of the corresponding syphilitic affection.

Syphilitic catarrh is characterised by its obstinacy, but usually rapidly disappears under local and general anti-syphilitic treatment. We have never seen catarrhs affecting portions of the larynx only, except associated with other pathological conditions, *e.g.* mucous patches and infiltrations; not uncommonly superficial erosions may appear, especially on the cords. Chiari repeatedly noticed paresis of the cords associated with acute catarrh.

The statements of authors as to the frequency of syphilitic catarrh differ widely; according to Lewin, it occurs in 80 per cent. of all mild cases of syphilis, while Mackenzie found it in 43, and Bergh in 25 per cent. Chiari and Dworak found acute catarrh in 4 per cent. of their cases. Catarrh is one of the earliest symptoms of constitutional syphilis, and usually appears from six to ten weeks after infection, but may occur later.

Mucous patches, when seen by the laryngoscope, appear as smooth, round, or oval, greyish-white elevations, varying in diameter from 3 to 7 millimetres. If the epithelial coating be completely thrown off, the surface is covered with yellow pus; mucous patches show but slight tendency to ulcerate, and, according to Mackenzie, usually soon disappear, even without treatment. These appearances vary somewhat according to the locality; on the free edge of the epiglottis and on the aryepiglottic folds, they appear as elongated, pale red swellings, rather larger than a lentil; on the cords they take the form of small, crescentic, flat elevations; while on the interarytenoid fold they are seen as a conglomeration of several white nodules of the size of millet seeds.

Mucous patches usually occur from three to nine months after infection, but they may recur later; they are, undoubtedly, a rare manifestation of laryngeal syphilis.

Syphilitic infiltration is rarely seen with the laryngoscope, because it usually causes no symptoms; it gives rise to diffuse swellings in various parts of the larynx. The epiglottis, which seems to be most commonly attacked, is either uniformly thickened above and below, as a result of which the part assumes the appearance of a shapeless tumour, hindering a view of the larynx, or only one or other edge may be thickened. In like manner, the aryepiglottic folds may be converted into thick tumours, and the cords may be so swollen that suffocation is threatened. The

mucous membrane, which covers the infiltrated portions, is either normal or reddened. Usually an ulcer is seen in the centre, which gradually extends. Infiltrations are late manifestations of syphilis, and commonly occur three or four years after infection, but sometimes after an interval of many years, according to Mackenzie, "after twenty, thirty, forty, or even fifty years, without the occurrence of intermediate symptoms, and when, indeed, the primary cause may have even been altogether forgotten."

Gummata commonly appear as rounded elevations, similar in colour to the surrounding tissue. They occur both on the upper and lower surface of the epiglottis, the aryepiglottic folds, frequently in the interarytenoid commissure, on the ventricular bands, and lower surface of the cords. When they break down, deep ulcers are formed which often rapidly lead to extensive destruction.

With regard to the changes liable to be produced by perichondritis and cicatrisation, we must refer to pp. 109 and 115.

Course, Result, Prognosis.—The early manifestations of laryngeal syphilis (catarrh and mucous patches) may, particularly if antisyphilitic treatment be adopted in time, heal without leaving any permanent effects. The case is different with the later forms—infiltrations, gummata, and above all ulcerations and their results. Certainly cases in which they cause death are rare, but, on the one hand, there may result stenosis, which, if tracheotomy be not performed, threatens life, and, on the other hand, the following symptoms may occur: (1) Loss of voice, due to destruction of the cords, necrosis of cartilage and cicatrices; (2) dysphagia from destruction of the epiglottis; (3) impeded respiration from thickening of the parts, which may render a permanent opening in the windpipe necessary.

So long as infiltrations or gummata have not broken down, or if the ulceration be slight and superficial, complete resolution may take place, so that hardly a trace is left to indicate the seat of the disease; very rarely do syphilitic deposits become organised into fibrous tissue, leaving permanent thickening. If such thickening be considerable, and if it affect the middle and lower portions of the larynx, difficult respiration and aphonia naturally result. If extensive ulceration has taken place, considerable loss of tissue is followed by cicatrisation and various deformities.

The prognosis then as to life is favourable, but doubtful as to the persistence of disturbed function.

Diagnosis.—In most cases this is not difficult, because laryngeal syphilis is associated with other manifestations of the dyscrasia, especially in the pharynx. If, however, the affection of the larynx be the first or only symptom of the constitutional malady, the diagnosis may, for a time, be doubtful.

If only catarrh be present, it cannot, in the absence of other condi-

tions, be decided whether it be simple, specific, or premonitory of phthisis.

Syphilitic infiltrations, too, may be confounded with the tubercular variety. The latter are, however, at first rarely so extensive as the former; the mucous membrane is pale in phthisis, and reddened in syphilis. Tubercular infiltrations break down slowly and late, while in syphilis they ulcerate rapidly, and the ulcers speedily increase in size. In many cases, however, nothing remains but to determine the nature of the infiltration by the effects of iodide of potassium.

Gummata are less difficult to diagnose. They might be confounded with tumours, but the latter are much more clearly defined, while the former gradually merge into the surrounding congested mucous membrane. Gummata commonly occur on the epiglottis, the interarytenoid and the aryepiglottic folds, where neoplasms rarely or never occur.

For the differentiation of syphilitic ulcers, a number of points have been detailed, but none of them are pathognomonic. Türck gives the following as the characteristics of a syphilitic ulcer: "More or less circular shape; deep floor covered with yellowish-white secretion; well-defined, sometimes raised edges, surrounded by an inflammatory zone." We have, however, seen that the characters of the ulcers vary according as they result from infiltration or gummata, and, further, according to their position and stage of development. It is always better to combine all existing local and general conditions, and bring them to bear in differentiating syphilitic from tubercular and malignant ulcers.

Tubercular and syphilitic ulcers always differ in their mode of development. The syphilitic ulcer results from an infiltration or gumma, acutely or in a few days. If it be seen early this may be recognised, and the ulcer will be found in the centre of an intumescence; the latter may then be recognised as gummatous by its nodular aspect, or may be distinguished from a tubercular infiltration by its red colour and inflammatory character.

An ulcer arising from a gumma might be mistaken for cancerous destruction, which also results from a tumour; in the latter, however, the edges are the seat of nodular growths, which are not present in syphilis (compare chapter on tumours).

If the ulceration has extended so much that its origin, from an infiltration or gumma, is no longer distinguishable, it causes such deep and extensive destruction as is rarely seen in phthisis.

The situation of the ulcers gives but doubtful information in diagnosis, as both the syphilitic and tubercular variety may occur in any part of the larynx; but it should be remembered that the former are more commonly situated in the upper part. Ulcers which affect the upper surface of the epiglottis are always syphilitic.

According to Mackenzie, the tubercular ulcer is, in the majority of cases, "solitary, and therefore usually, except when situated on the epi-

glottis, in which case it is often central in position, unilateral." The tubercular ulcer may also be unilateral, but commonly there are ulcerations on both sides, or there may be an ulcer on one and an infiltration on the other.

The edge of the syphilitic ulcer is usually sharply defined and irregular. In tuberculosis this appearance is rare, but it is occasionally met with in ulcerating cancer.

The floor of the ulcer in syphilis is covered with a moderate amount of secretion, which, however, is so firmly attached that it cannot be rubbed off with a brush (Schroetter). In phthisis the secretion is copious, and covers not only the floor of the ulcer, but also the adjacent tissue.

Schroetter asserts that he has found only one appearance which is common around tubercular ulcers, but never results from syphilis, viz. more or less scattered yellow points from the size of a pin-head to a millet seed, which, in the later stages, may gradually approach one another, and indicate infiltrated glandules. These yellow points should not be confounded with the nodules seen around cancer, which may also have a yellowish colour; in the latter case they are always larger, and project distinctly from the mucous membrane.

Swelling of the submaxillary and cervical lymphatics may occur in tubercle, syphilis, and cancer, but in the first named it is less marked (an instance in which glandular swelling, among other points, gave rise to an error in diagnosis, has been already described).

We see then that no single characteristic, in the development, condition, or appearance, of an ulcer is pathognomonic of syphilis, but still an experienced laryngologist will be able, in most cases, to recognise its nature from a consideration of the various local features of the case, and we consider that Schroetter goes too far when he says of these ulcers, "their nature can, as a rule, only be positively made out by other clinical evidence of syphilis, and by a process of exclusion." Special difficulties only arise in those cases in which syphilis and tubercle are combined, and which we have previously discussed.

It is probably extremely rare for syphilitic ulcers to be mistaken for cancer (of which an instance is recorded by Ziemssen) or *vice versâ*.

As to the differentiation between lupus and syphilis, we must refer to the chapter on the former.

In all doubtful cases it is advisable to make certain, by the use of anti-syphilitic remedies, which can never do much harm, and may be of value.

Treatment.—On account of the great ravages which syphilis may cause in the larynx, the rapidity with which deep destruction occurs, and the danger to function and sometimes to life, which may be caused by extensive cicatrisation, the chief indication for treatment is to combat the progress of the disease. Treatment should be general and local,

but the former is the more important, and may, by itself, lead to cure.

We cannot here discuss the merits of the various forms of antisyphilitic treatment, but will only remark that treatment by iodides acts much more rapidly than mercury, especially in advanced forms (infiltrations and gummata), and that we should therefore always begin with iodide in the treatment of a condition which every day may produce additional morbid changes. We use the following prescription :—

* Potass. Iodidi 4
Aq. destillat 200. } or approximately gr. 10 ad. ℥i.

A tablespoonful three times a day.

Or, Potass. Iodidi.
Extract. et. pulv. rad. gentian $\overline{aa}$ q. s. ut. f. pil. 100.

From three to six pills three times a day.

We prefer solutions to pills, and in ulceration of the upper part of the larynx the latter cannot well be swallowed.

Either at the same time, or after threatening symptoms have disappeared, a mercurial treatment may be begun, and we should recommend inunction from 4–6 grammes being used daily [15·43 grains = 1 gramme].

Lewin prefers rapid mercurialisation by means of subcutaneous injections of corrosive sublimate. Each dose is from ·02–·025 of a gramme, and, according to the severity of the case and the condition of the patient, this is repeated at intervals of from four to eight hours until the danger to life has passed. Afterwards he uses injections containing the usual dose (·01–·012) until all syphilitic manifestations have subsided. When these large doses are used we must be prepared for symptoms of poisoning ; the latter may be gastric, producing loss of appetite, nausea, pain in the stomach and intestines, diarrhœa, and bloody stools ; or they may be cerebral, evidenced by headache and exhaustion, sleeplessness, giddiness, and fainting ; indeed even coma and collapse may be produced. In spite of these untoward accidents, Lewin has never had a fatal case ; the injections must be stopped when poisoning sets in. Tonics and stimulants are useful in relieving the nervous symptoms, while opium is indicated for the diarrhœa. After symptoms, such as weakness, tremor, etc., were never observed. Among 26,000 syphilitic patients in the Royal Charité of Berlin, no death occurred from laryngeal stenosis.

Local treatment, as already stated, is of secondary importance, but may, when associated with general remedies, hasten a cure. In syphilitic catarrh the application of a solution of nitrate of silver, by means of a brush, or better still, a solution of iodine in iodide of potassium and glycerine may be employed (iodine ·2, iodide of potassium 2, glycerine

* The dose of iodide here recommended may, with advantage, be increased (Translator)

10) [approximately iodine grs. 10, iodide of pot. grs. 100, glycerine ℥i.]. In infiltrations and gummata we consider local treatment unnecessary, so long as no softening has occurred. For ulcers, painting with a solution of iodine, with iodide of potassium, or carbolic acid (·1–·2 to 10 parts of glycerine, or about grs. 5–10, ad. ℥i.), or the insufflation of iodoform may be used. Demarquay, Schnitzler, Waldenburg, and others recommend a spray containing corrosive sublimate.

Hydrarg. perchlorid. ·2 Spirit. vini rect. 50 Aq. destillat. 200	grammes.

From a tenth to a fifth of this mixture to be inhaled two or three times a day.

We always, however, prefer the direct application of remedies by means of a brush to inhalations.

Sometimes it is necessary to treat individual symptoms. If dyspnœa be present, and if it be caused by marked œdema, benefit may be derived from scarification, but if suffocation be imminent, tracheotomy should be performed at once.

If stricture of the larynx has resulted, treatment must be dependent upon the nature of the pathological conditions. Many membranes may be removed by means of the knife, cutting forceps, or galvanic cautery; unfortunately the openings so produced tend to close, and it is therefore better to associate Schroetter's method of dilatation with the operation. Dilatation should, as a general rule, be attempted in all strictures due to cicatrisation and perichondritis (compare page 40, *et seq.*).

CHAPTER III.

LARYNGEAL DISEASE IN MEASLES.

Etiology.—The larynx may be attacked during every stage of the disease. In the stage of incubation, which is always marked by affections of the respiratory organs, more or less laryngeal catarrh may be looked upon as a normal symptom, which increases or diminishes with catarrhal affections of other mucous membranes; in some epidemics, however, laryngeal complications are more marked. With the appearance of the rash laryngeal symptoms usually subside, but sometimes, on the other hand, a simple catarrh passes into a severe form of laryngitis, or croupous inflammation is developed; very rarely the laryngeal symptoms begin with the appearance of the rash. Croup may appear at any stage of measles, but usually sets in when the rash begins to subside; its occurrence is favoured by the presence of an epidemic of diphtheria, but may also result independently. Laryngeal croup is commonly associated with pharyngeal diphtheria, but may be confined to the larynx. Among 1176 cases of measles Rauchfuss found 11 of pharyngeal and 9 of laryngo-pharyngeal diphtheria, 13 of fibrinous laryngitis and laryngo-tracheal bronchitis, and 12 of the most severe form of catarrhal laryngitis. When an epidemic of diphtheria exists patients affected with measles are more commonly attacked by laryngeal croup than by pharyngeal diphtheria. Out of 93 cases of secondary diphtheria in measles Sanné found the larynx affected in 87 (93·5 per cent.); this condition existed alone in 20 cases, was associated with pharyngeal diphtheria in 19, with nasal diphtheria in 4, with plastic bronchitis in 7, with diseases of the pharynx and bronchial tubes in 3, and with other diphtheritic affections (nose, mouth, conjunctiva, genitals) in 34. Measles evidently produces a tendency for the diphtheritic process to localise itself in the larynx.

According to Löri, there seems to be, in certain families, a special predisposition to the development of laryngeal croup in the course of measles; at least he repeatedly found that several children in a family, even when attacked by measles singly, at intervals extending over years, were always also affected with laryngeal diphtheria; in one family, in the course of several years, four children died of laryngeal diphtheria complicating measles.

Pathology and Symptoms.—In laryngitis, resulting from measles, there is either uniform deep redness of the mucous membrane, with reddish-yellow discolouration of the cords, or patchy redness corresponding in character to that seen on the palate. According to Löri, both forms are about equally frequent. From one to twelve hours after the occurrence of diffuse or patchy hyperæmia, papules, varying in size from a grain of sand to a poppy seed, are formed ; these are closely packed, and sometimes confluent, so that there are seen on the mucous membrane tortuous, dark red, raised lines, from which the larger papules project as nodules. "Shortly after the appearance of the exanthem increased secretion occurs from the mucous surface of the pharynx, larynx, and trachea, while the epithelial covering is rapidly thrown off, so that the surface acquires a velvety, uniformly red appearance, or it is here pale and there dusky, the pale parts appearing sunken, and thus the normal shade of the pharyngeal and laryngeal mucosa is lost" (Löri). Sometimes single, small ecchymoses, or, more commonly, erosions, and even ulcers are found ; the latter are situated on the posterior laryngeal wall, the apices of Santorini's cartilages, or the posterior portion of the cords, and are shallow with irregular edges, while the surrounding mucous membrane may swell so as to produce symptoms of stenosis. The ulcerations seem to arise from swollen follicles.

Croupous inflammation of the larynx, when secondary to measles, is not different in its phenomena from simple croup.

Laryngeal disease, due to measles, is always associated with vocal disturbance, which may amount to aphonia. Dyspnœa may be caused not only by croup, but even by catarrh. The mucous membrane is not uncommonly so swollen in the last-named condition, that this, favoured by the anatomy of the larynx in childhood, causes marked stenosis. We can only decide whether the symptoms are due to croup or catarrh by means of the mirror ; but care must be taken not to mistake the delicate white spots, due to throwing off of epithelium, for fibrinous exudation.

Prognosis and Treatment.—The prognosis is usually favourable in catarrh, but in young children the stenosis may assume a threatening form. The catarrh is often very obstinate, and tends to become chronic, while, when associated with ulceration, it gives rise to the suspicion of tubercle.

The prognosis in croup, due to measles, is not more unfavourable than in the simple variety.

The treatment is similar to that of catarrh and croup ; even mild catarrhal conditions demand strict dietetic regimen, rest of the voice, and avoidance of irritation, lest they become chronic, or cause erosions and ulcers.

CHAPTER IV.

LARYNGEAL DISEASE IN SCARLETINA.

This is much less common than in measles. The larynx is rarely attacked primarily in scarlet fever, but the affection may extend from the pharynx. Rauchfuss found, in 943 cases, 17 of marked pharyngeal diphtheria, 2 of laryngo-pharyngeal diphtheria, 3 of fibrinous laryngo-tracheitis, 4 of acute submucous laryngitis, and 4 of the most severe form of acute catarrhal laryngitis. Many epidemics show a marked tendency to attack the larynx. Gaupp described an epidemic in Würtemberg, where, in the majority of cases, croupous symptoms appeared on the third and fourth day, and death sometimes occurred before the appearance of the rash. Laryngeal croup occurring during scarletina is always very severe, and gives rise to considerable ulceration. Albers twice saw numerous ulcers extending into the trachea; Franque found the thyroid cartilage ulcerated; and in a case reported by Smith, the cords and ventricles of Morgagni could not be recognised, while diphtheritic exudation extended into the trachea, as far as the bifurcation; finally, Mackenzie has described a preparation taken from a patient who died of scarletina, in which the larynx was covered by a thin layer of membrane, which concealed the whole mucosa, while one arytenoid cartilage was exposed by a large ulcer. In some cases large vessels are opened into, and death results from hæmorrhage.

At a later stage of scarlet fever acute laryngeal œdema, associated with rapidly occurring general dropsy, may cause death from suffocation.

The treatment of laryngeal affections in scarletina is almost useless.

CHAPTER V.

LARYNGEAL DISEASE IN SMALLPOX.

Etiology.—The larynx is very frequently affected in variola, probably, indeed, in most cases, though sometimes but slightly. Rühle, out of 54 autopsies of smallpox patients, found the larynx and respiratory tract always in a pathological condition; Eppinger also states that during the last epidemic in Prague, even although pustules were not constantly present, still a morbid condition of the laryngeal mucous membrane could always be demonstrated. During the stage of incubation there are no laryngeal symptoms, but from the third to the sixth day after the appearance of the eruption, the larynx seems usually to be affected.

Pathology and Symptoms.—During the course of smallpox there may occur in the larynx: (1) simple catarrh; (2) catarrh with pustules; (3) interstitial bleeding; (4) croupous inflammation; (5) perichondritis; (6) muscular paralysis.

In mild cases the mucous membrane of the larynx is uniformly and intensely injected, moderately swollen, and covered with a thin layer of secretion; at individual spots, especially on the epiglottis, arytenoids, and cords, there are whitish, sharply-defined points of discolouration, which, according to Eppinger, represent necrosed epithelium. In other cases there are seen in addition to intense catarrh, very small dots varying in size from a pin point to a hemp seed, and slightly raised, which much resemble the previously described points, but which on microscopic examination are found to be due to cellular infiltration of the epithelium. These two conditions cannot be differentiated by means of the laryngoscope, and must be looked upon as due to severe catarrh.

The opinions of authors differ as to the occurrence of pustules in the larynx. E. Wagner states that out of 170 cases he found pustules in the larynx 144 times. Rühle, on the other hand, in his 54 autopsies only found here and there "pustule-like elevations," and other authors also only noted their occurrence occasionally on the epiglottis, arytenoids, or cords, while in the trachea they are often found, and may even be confluent. Eppinger altogether disputes the occurrence of true variolous pustules in the larynx, but admits that vesicles may exist on the

epithelial surface which have the appearance of pustules; he cannot, however, with reference to their histological characters, recognise them as variola pustules, because on microscopic examination they are seen to be nothing more than groups of necrosed epithelium infiltrated with micrococci, and he therefore designates them "pseudo-pustules."

Sometimes small abscesses covered by epithelium simulate pustules. These are, however, absolutely subepithelial or still deeper, but never just above the *membrana propria*, and are nothing more than miliary metastatic or septic abscesses; they only occur where septic poisoning has already begun, and are liable to cause extensive destruction of the organ.

However much vesicles in the larynx may differ from an anatomical point of view, they have this in common, that, owing to raising of the epithelium, they may give rise to loss of tissue, *i.e.* to more or less marked ulceration.

The occurrence of hæmorrhage is also intimately connected with that of pustules. It is particularly apt to occur in hæmorrhagic variola, and takes place either into the pustules, so that they become dark coloured, or into the submucous tissue, when the mucous membrane appears ecchymosed.

Diphtheritic inflammation of the larynx is much more commonly observed than the occurrence of pustules. The mucosa is covered with yellowish—or owing to extravasations—dark coloured, adherent membrane, while the subjacent submucous tissue is œdematous. Such false membranes may form without the previous existence of pustules; in some cases they occur not in the immediate neighbourhood of these, even when the latter exist; sometimes they follow the evacuation of their contents, arising from the seat of the pustules, or threads of false membrane may connect the separate pustules (Löri). Gradually the false membrane is peeled off, usually at the time when the pustules dry up, and erosions are left without much loss of tissue. Marked stenosis may result from diphtheritic accumulation. The croupous symptoms never reach such an advanced degree as in pure croup, and the stenosis is sometimes due to secondary œdema.

If the pustules in breaking down give rise to ulcers, the latter may penetrate to the perichondrium and produce inflammation. According to Eppinger, it is principally the variety of pustule described by him as miliary septic abscess which produces this result. In other cases perichondritis may become developed owing to diffuse purulent infiltration of the submucous tissue—as a result of the adjacent variolous process—without any destruction of the mucous membrane.

Perichondritis attacks the thyroid cartilage just as frequently as the cricoid and arytenoids, and leads to ulceration either of whole cartilages or of portions of them. After the sequestra are thrown off, healing may

take place, often with resulting thickening, anchylosis of the crico-arytenoid articulation, etc. Oedema, too, not uncommonly co-exists with perichondritis.

In some cases there is paresis or paralysis of the muscles, probably due to their serous infiltration (Rühle). Mackenzie observed two instances of lasting paralysis of the adductors of one cord, and believed that the condition was probably of a diphtheritic nature. It is also possible that in such cases the cause of the immobility of the cords might be anchylosis of the crico-arytenoid articulation.

The most constant symptom in all variolous affections of the larynx is vocal disturbance. Croup, occurring, during the course of variola, differs from simple croup in the following respects: (1) Absence of cough. (2) The disturbance in respiration is but exceptionally so marked as in genuine croup. (3) The absence of the suffocative paroxysms which are characteristic of the latter. Perichondritis gives rise to severe shooting pain in the larynx, and sometimes dysphagia. The diagnosis of this condition is not always easy, but it is justified when, in addition to marked swelling and ulceration of the mucous membrane, immobility of individual parts can be demonstrated with the mirror. Other changes in the larynx can likewise only be demonstrated by means of the laryngoscope.

Prognosis.—The local condition as such usually results more favourably than one would expect, from the severe nature of the primary disease; even croupous laryngitis in variola is not as dangerous as idiopathic croup. Differences, however, seem to be due to the character of an epidemic, for, while Rühle writes, "the course of this form of croup (variolous) is, if the primary disease runs a favourable course, almost always favourable," Löri considers diphtheria a very serious complication of smallpox; "most smallpox patients, attacked by it, die." Ecchymoses are of more serious import, partly because they are a symptom of decomposition of blood, and partly because they may be so large as to cause impeded respiration; perichondritis and œdema of the larynx are of equally unfavourable significance.

Treatment.—Variolous catarrh requires no treatment, usually disappearing spontaneously; the same commonly applies to pustules and croupous exudation. If ulceration has taken place, attempts may be made to promote healing by the use of astringents. If large extravasations of blood or œdema interfere with breathing, punctures may be made with the laryngeal lancet. If perichondritis has occurred without ulceration of the mucous membrane, an attempt may be made by means of deep incision to evacuate the pus. Whenever there is danger of suffocation, whether from croup, œdema, or perichondritis, tracheotomy must not be too long delayed.

CHAPTER VI.

LARYNGEAL DISEASE IN TYPHOID AND TYPHUS.

Etiology.—Both typhoid and typhus may produce important or slight changes in the larynx ; these may occur either during the febrile stage, or convalescence. As the symptoms are often but slight, and the general condition of the patients makes laryngoscopic examination either very difficult or impossible, no certain date as to the frequence of laryngeal complications exists, but this is certain that the latter occur more commonly in typhoid than typhus. Zülzer states that in 20 per cent. of those who die of typhoid, there is laryngeal ulceration ; Heinze found in 113 bodies dissected at the Pathological Institute of the University of Leipzig, laryngeal ulceration in 13 (11·5 per cent.). It must also be remembered that mild laryngeal affections, such as catarrh and erosions, are not found in autopsies. Ziemssen thinks that laryngeal affection in typhoid has been much diminished in severity owing to modern antipyretic treatment.

Pathology and Symptoms.—The laryngeal implication in typhoid may in many instances be a part symptom of general infection due to a localisation of the virus ; as Rokitansky says : " To a certain extent the typhoid affection of the larynx is the conclusion of the disease."

The affection is either catarrhal or due to a specific infiltration. The catarrh occurs in the first or second week, and may, as observed by Löri in one case, be the only symptom if we except enlargement of the spleen, the characteristic temperature, and slight cerebral symptoms. Typhoid catarrh is characterised by the secretion being much less than in the ordinary form, and by its tendency to produce desquamation of the epithelium, erosions, and ecchymoses. The patients are hoarse and sometimes aphonic ; cough is slight if there be not also bronchitis.

Erosions, according to Eppinger, occur chiefly on the lateral margins of the epiglottis ; they look as if the mucous membrane had burst, and the sharp margin of the cartilage appeared between the edges. He describes them as fissures, and explains their occurrence on the hypothesis that œdematous swelling, which results from the intense infective catarrh, produces bursting of the mucous membrane at the side of the epiglottis, where it is thin, and only united with the cartilage by a very

delicate submucous connective tissue; and further the more the infiltrating fluid can escape, the more retraction of the edges does there occur, and thus the cartilage is laid bare.

Infiltration of the larynx must be regarded as a serious condition in the course of typhoid; it occurs in two forms, the circumscribed and the diffuse.

Circumscribed infiltration, or nodular typhoid laryngitis, is confined to those parts in which structures similar to the intestinal follicles occur —the base of the epiglottis, the ventricular bands, and the inner surface of the arytenoids. A nodular swelling is formed, soft and homogeneous in structure, which is composed of numerous cells of two kinds, viz. (1) lymphoid cells with free nuclei; (2) large cells which are sometimes furnished with from two to three nuclei. Fresh nodules may, according to Eppinger, whom we have chiefly followed in this description, be seen to be identical in structure with the swollen follicles of the intestine in typhoid.

In diffuse typhoid infiltration, the mucous membrane on the laryngeal surface of the epiglottis, the inner surface of the arytenoids, or the ventricular bands, is markedly swollen, succulent, soft, and pale, so that it is easily distinguished from the remaining catarrhal parts. Histologically this diffuse swelling is similar to the other variety, and Eppinger believes that it is nothing but "a diffuse nodular form, as here and there thickened points can be seen which correspond to the original glandular swellings." This is analogous to typhoid infiltration of the intestinal patches, as in them not only the follicles, but also the intervening structures are infiltrated.

Both nodular and diffuse infiltration may end in ulceration. The ulcers show their mode of development from the infiltrations, by swelling of the tissue which surrounds them, undermined edges, and the firmness of their floor. They have a great tendency to extend in all directions, especially in depth; they may thus reach the cartilage and lay it bare.

Diphtheria also must be looked upon as a laryngeal affection which is sometimes secondary to typhoid and typhus. The third week of the disease is the earliest period at which it may occur, and it is characterised by extreme thinness of the false membrane, and may also give rise to ulceration. Eppinger, from anatomical researches, has arrived at the conclusion that the yellow deposits most commonly seen on the mucous membrane of the posterior surface of the epiglottis, the aryepiglottic ligaments, or beneath the cords, is not an inflammatory product, but is composed of quantities of necrosed epithelium, which has undergone metamorphosis, while between the cells lie masses of micrococci. By the penetration of the latter, one layer of epithelium after another dies, and thus ulcers are produced which differ from those developed

from infiltrations even in appearance. They are surrounded by sharp perpendicular margins of normal mucous membrane, which are but slightly undermined, and quite soft; the floor varies in depth, and may reach the cartilage which is either superficially eaten away, or may be hollowed out by caries. These "septic ulcers" may be associated with "typhoid ulcers," and lead to extensive destruction; the whole epiglottis may thus disappear, or the arytenoids become necrosed.

Both forms of ulceration may heal without leaving deformity or even appreciable scars, or they may produce more or less extensive cicatricial contraction in various parts of the larynx; after typhoid we may also see, although rarely, synechiæ between the cords at the anterior extremities, between one cord and its corresponding ventricular band, etc.

We have seen that the cartilage may be affected in one of two ways; the "typhoid" ulceration may extend in depth and lead to perichondritis, or the cartilage may be involved in the septic process by the penetration of micrococci. Exceptionally the inflammation may exist in the perichondrium and lead to the formation of an abscess, which may burst into the larynx or œsophagus or through the skin.

Both ulcerations and perichondritis may be complicated by very acute and more or less extensive œdema.

Löri also notes the occurrence of paralysis on the laryngeal muscle, which may attack them singly, or may affect those of one side; in rare cases, almost all the muscles are simultaneously affected. The paralysis is complicated with a similar condition of the palate and pharynx, and occurs in most cases during the second period of the fever, or later.

It remains for further observations to discover whether the paralysis depends upon the same fatty or waxy degeneration which has been observed in other muscles.

Among the results of these destructive processes in the larynx, occurring in typhoid, must be reckoned stenosis, which may be due either to secondary œdema, during the acute disease, or to thickening and deformity after healing has occurred. Perichondritis may also produce anchylosis of the arytenoid cartilage.

It is characteristic of the affection that deep destructive changes may occur in the larynx, without marked subjective symptoms during life; this is probably in part due to the associated weakness of cerebral action. Sometimes the patients complain of a feeling of dryness or rawness, and the voice becomes rough, hoarse, or even aphonic. Dyspnœa is not marked, even in diphtheritic disease, partly because the false membrane, as we have seen, is very thin, and partly because the irritability of the medulla is considerably diminished.

We need not be surprised that the diagnosis of the laryngeal complication is very difficult. The subjective symptoms are slight, and by

no means characteristic, while laryngoscopic examination is difficult or impossible; the demonstration of a catarrhal or diphtheritic process in the pharynx, when associated with disturbance of voice, justifies the conclusion that there is a similar condition in the larynx.

Laryngeal affections in typhus fever are much less common, and never produce such deep-seated changes as in typhoid. The reason is probably that all the conditions, which in typhoid we have designated "part symptoms of typhoid infection and localisation of the typhoid virus," are absent in typhus.

Among one hundred and eighty cases of typhus dissected by Rühle he found seventeen of laryngeal disease (about 9·5 per cent.); among these seventeen cases there were five of acute laryngeal catarrh, in three of which there were fissure-like erosions on the cords, while in two there was also serous and sero-purulent infiltration of the tissues; in six cases there was croupous laryngitis, which was associated with a similar condition of the pharynx, in five there were "necrotic ulcerations," and in one œdema of the aryepiglottic ligament of the left side, due to swelling of the parotid.

The catarrh in typhus is by no means characteristic, although the epithelium tends to desquamate, so that accumulations of a yellow or greyish-yellow colour are produced, which may easily be mistaken for croupous exudation.

With regard to diphtheritic laryngitis in typhus, Eppinger is here also of opinion that the condition is not due to fibrinous exudation, but to the mycotic necrosis of epithelium, which we have already discussed under typhoid.

Ulcerations are produced by the diphtheritic or diphtheroid process, and do not so often give rise to deep destruction as in typhoid; according to Eppinger, they only do so when marked changes occur in the lungs, such as gangrene, which are associated with septic conditions.

Prognosis.—Laryngeal affections complicating typhoid are so far unfavourable with regard to prognosis, in that they are apt to give rise to deep-seated destruction. These ulcerations may, not only by healing cause permanent disturbance of function, but they may also cause death by secondary œdema. On the other hand, it must be remembered that even extensive typhoid ulcers may heal without giving rise to deformities. Diphtheria does not produce such severe symptoms as idiopathic croup, and the symptoms of stenosis are much less; as diphtheria in typhoid, however, is always a symptom of a septic process, its appearance must be looked upon as of unfavourable significance. The prognosis is worst in perichondritis, not only because this condition is commonly the result of a septic process, but because its sequelæ—extensive œdema, abscess obstructing the air passage, the impaction of a necrosed piece of cartilage, falling in of the larynx—may cause a fatal termination.

TREATMENT.—Local treatment is only possible when the general condition admits of laryngoscopic examination. If cerebral symptoms be marked, all local treatment is, of course, impossible. When it is possible, mild astringents should be applied in catarrh, and a similar treatment might be tried in ulceration, but the chief indication here, as in the general disease, is to support the strength by means of stimulants, etc. If there be œdema, pieces of ice may be repeatedly swallowed, and when there is danger of suffocation, tracheotomy must not be delayed. Against perichondritis we are powerless. Abscesses should be opened when laryngoscopic examination is possible; but here also tracheotomy is often the only means of preserving life.

CHAPTER VII.

LARYNGEAL DISEASE IN ERYSIPELAS.

Affections of the pharynx are almost constant in erysipelas of the head and face; but are also common when other parts are attacked, whatever be the cause of the condition. In many instances the pharyngeal disease precedes the outbreak of erysipelas on the face. The inflammation may spread from the pharynx to the larynx; more rarely the latter is attacked without the former.

The etiology of the laryngeal disease is in most cases best explained on the hypothesis that the exciting cause (bacilli of Fehleisen) spreads by continuity from the skin of the face to the pharynx, and thence to the larynx; in primary affection of the larynx, however, we must assume a direct localisation of the virus. This view is supported by a case described by Porter, in which the larynx was affected with erysipelatous inflammation without the pharynx or skin.

A man, æt. thirty-five, who was under treatment at the London Hospital for fracture of the fibula, complained on the tenth day of pain in the throat and hoarseness. The mucous membrane of the epiglottis and arytenoids was acutely inflamed, the ventricular bands were so swollen that the cords were covered. There was aphonia, pain, and swelling of the neck externally. In twenty-four hours the symptoms became so serious that tracheotomy had to be performed, which produced temporary alleviation. A dark blush appeared around the tracheal wound, breathing again became difficult, while there was great dysphagia, with increase of erythema, dyspnœa, and dysphagia; death resulted in two days. Autopsy showed the heart normal, lungs œdematous and dark-coloured, mucosa of the epiglottis and arytenoids swollen and ulcerated. The wound of the foot showed no sign of erysipelas, and satisfactory progress in healing had occurred. It is worthy of remark that in the same ward two other cases of erysipelas occurred, and that several nurses afterwards suffered from sore throat.

Strict proof of the erysipelatous nature of a similar case could nowadays only be accepted on demonstration of the specific bacillus.

The morbid changes found in laryngeal erysipelas are either simply catarrhal, or fibrinous, purulent, or serous infiltration of the submucous tissue.

The catarrh may either be diffuse, extending over the whole larynx, or only individual parts may be affected, *e.g.* the epiglottis, aryepiglottic ligaments, or arytenoids. It produces no important symptoms, and usually disappears as the skin desquamates. In an instance observed

by Semeleder, a relapse of the cutaneous affection was accompanied by a return of the laryngeal disease. If the inflammation attacks the submucous tissue, the disease becomes very serious. Aphonia, dry, rough cough, dysphagia, pain in the larynx, increased by pressure, are associated with more or less marked dyspnœa. These symptoms often set in very suddenly, and may increase so rapidly that death results in a few hours.

Whether in these cases there is only simple inflammation, or whether this be associated with mycosis, remains to be proved by future research.

According to present experience, those cases in which the larynx is primarily attacked seem to run a more favourable course than those in which the throat affection is secondary to cutaneous erysipelas. "The spread of the affection to the interior of the throat," says Mackenzie, "shows greater intensity of the blood poisoning." This, however, does not apply to the simple catarrhal affection; the prognosis is then usually favourable, although even here œdema may develop suddenly. In submucous inflammation death is due either to suffocation or to extension to the trachea and bronchi (capillary bronchitis). The treatment on the appearance of the pharyngeal inflammation should consist in the use of iced gargles, administration of pieces of ice, and repeated insufflations of morphia; but, above all, the patient should be nourished by means of stimulants, etc. When suffocation threatens we may, if there be œdema, scarify the parts or perform tracheotomy.

CHAPTER VIII.

LARYNGEAL CHANGES IN WHOOPING COUGH.

In so far as whooping cough is now looked upon as a peculiar catarrh due to a specific cause, and affecting not only the larynx, but the whole respiratory tract, its discussion does not fall within the limits of this work. Since, however, some of the symptoms of this disease must be looked upon as laryngeal, and as in its course demonstrable changes occur in the larynx, we shall refer to the latter.

On account of the resemblance between the paroxysms of cough in pertussis, and the symptoms produced by a foreign body in the larynx, it has been assumed (Gendrin, Beau) that in whooping cough there is catarrh of the upper part of the larynx, and that the attacks of cough are due to the impact of the inflammatory secretion upon the vocal cords. Beau also found what he sought, *i.e.* he has, as he states, found by means of the laryngoscope that localised inflammation of the upper part of the larynx is a constant symptom of the disease, but this observation has never been confirmed.

Although we cannot, with reference to the pathological condition, explain the symptoms of whooping cough, yet there is no doubt that in the course of the affection morbid changes are almost always found in the larynx.

The commonest morbid condition is catarrh, either diffuse and involving larynx, trachea, and bronchi, or localised to one spot. This catarrh differs in no respect (naked eye or under the microscope) from the simple variety; although Letzerich states that in rabbits infected by the introduction of the "Pertussis Fungus" he found in the mucous folds of the larynx and trachea the "specific organism;" and Hagenbach writes that in many cases occurring in infants there may be seen above the ciliated cells and closely attached to them "a fine network of mycelial threads as they are produced directly from the free micrococci." The bacteria and micrococci of whooping cough do not penetrate the epithelium and tissues of the mucosa.

Although laryngeal catarrh is never absent in whooping cough, it cannot be considered a characteristic change, because (1) the severity of the symptoms are by no means proportionate to its extent; (2) the catarrh reaches its acme sometimes at one stage, sometimes at another,

so that during some part of the disease there may be no trace of swelling or redness. Löri, who examined by means of the laryngoscope hundreds of children and numerous adults suffering from whooping cough, found that in a few cases the laryngeal and tracheal catarrh appeared and disappeared several times in the course of the disease, and further, that whenever laryngeal and tracheal catarrh were absent, bronchitis set in; if the latter was previously present, it increased in severity.

The catarrh, as we have already stated, extends over the whole mucous membrane of the larynx; it usually begins on the cords, and then passes to the trachea. Very frequently it is situated in the inter-arytenoid region, and in that part of it which lies below the cord.

If the paroxysms be very severe, there may be bleeding within the larynx, which is, however, slight, and of no clinical importance. These hæmorrhages may occur both in the early and late stages. Ecchymoses likewise may result into and beneath the corium of the mucous membrane, their most common situation being in the sinus pyriformis; they vary in size from a poppy to a hemp seed, and are rarely larger. Löri also observed laryngeal ulcers most frequently situated on the posterior wall; they are small and heal rapidly. "If, however, they last for a long time, so that they still remain after the whooping cough has been cured, or if they enlarge and extend in depth, the suspicion of an early appearance of phthisis is usually justified. Follicular ulcers occurring in the course of pertussis are particularly suspicious."

Very rarely the inflammation extends to the submucous tissue, but laryngeal œdema has been repeatedly observed, and many cases of sudden death from suffocation may perhaps be referred to this cause. Croup is uncommon in whooping cough, but when it does occur is almost always fatal; in a case observed by Biermer, the paroxysms of whooping cough ceased with the advent of croup.

The laryngeal phenomena usually occur as premonitory symptoms of the paroxysm; there may be tickling, a feeling of a foreign body, or a sensation of the larynx being compressed. The actual attack at the height of the disease—"spasmodic stage"—consists of a series of short energetic expirations, followed by a long, whistling, whooping, or crowing inspiration, which is again succeeded by a series of expirations. The analogy between these attacks and nervous cough is evident, but in whooping cough the paroxysm ends by the expulsion of viscid transparent mucus by vomiting and retching, while in spasmodic cough secretion is absent. The spasmodic closure of the glottis during the attack may be so intense as to produce symptoms of apnœa (cyanosis, anxious expression, cold extremities, and perspiration).

During the intervals the laryngeal symptoms are slight. If there be marked catarrh, the voice is hoarse, while if laryngeal œdema occurs,

symptoms of severe stenosis soon result in death. Croup complicating whooping cough does not differ from the simple variety.

The laryngeal affections of whooping cough only influence the prognosis in that severe but rare affections (croup and œdema) may cause death.

We shall only discuss treatment in so far as attempts may be made to counteract spasm by topical medication of the larynx.

Letzerich, on the strength of his theory that whooping cough is caused by the development of fungous growths, has recommended the insufflation of quinine into the trachea and larynx. He orders

Quiniæ muriat.	·01--·015	of a gramme. [1 gramme = 15·43 grains.]
Sodæ bicarb.	·015	
Gum. arab.	·25	

This amount to be insufflated three, four, or six times daily.

He states that by this means he has effected a cure of pertussis within eight or ten days.

Quinine, according to the most experienced and trustworthy physicians, is also the internal remedy upon which most confidence should be placed in the treatment of whooping cough; it is, indeed, not a specific, but has a decided effect in diminishing and shortening the spasmodic stage. It must, however, remain at present an open question whether the application of the remedy to the larynx is indeed more useful than its internal administration. Besides, insufflations can only be carried out with proper accuracy in older and intelligent children. Inhalations of a corresponding dose of quinine as a spray are probably less efficient in their action than insufflations.

Among local remedies we must also reckon inhalations of carbolic acid. By means of Siegle's spray a $\frac{1}{2}$–2 per cent. solution of carbolic acid should be inhaled from four to six times a day. It seems that the use of this treatment lessens the severity of the paroxysms and shortens the disease, while no bad effects have been known to result from its use.

Watson has recommended the application of a 3–8 per cent. solution of nitrate of silver to the larynx; the remedy is applied every second day. Rehn likewise advises the inhalation of a solution of nitrate of silver.

It seems, indeed, that the local application of astringents acts beneficially upon the accompanying laryngeal and bronchial catarrh, although these remedies cannot cure the disease.

With this object, Löri has recommended insufflations of sulphate of zinc and alum. He prescribes the following mixture :—

Morphiæ muriat. 1
Zinc. sulph. 2
Alum. 12
} grammes.

Of this he orders from 1–10 centigrammes, according to the patient's age, to be blown upon the deepest part of the posterior pharyngeal wall. He believes that by this means the descent of the catarrh from the upper part of the air passages to the bronchi, to which there is a great tendency in pertussis, is prevented, and that the disease always runs a milder course.

Erosions and ulcers require no special treatment, while œdema and croup must be treated on the principles repeatedly laid down in this work.

APPENDIX

BY

THE TRANSLATOR.

RECENT OBSERVATIONS ON THE INNERVATION OF THE LARYNX.

KRAUSE ON THE RELATIONS OF THE CEREBRAL CORTEX TO THE LARYNX AND PHARYNX.

KRAUSE in 1883 published the results of his experimental inquiries in this direction.* In these experiments he only used dogs, and found that the gyrus præfrontalis was the motor centre for the pharynx and larynx.

His first series of demonstrations consisted in exposure of this part of the cortex and its stimulation by means of the induced current. Slight irritation at first caused frequently repeated deglutition; and afterwards, according to the strength of the current, contraction of the cervical muscles with elevation of the larynx, rising of the palate, contraction of the upper constrictor, the posterior part of the dorsum of the tongue, and palato-glossal arch; and finally, complete closure of the glottis and laryngeal inlet. Krause, therefore, with justice draws the conclusion that in this part of the cortex is situated the centre for movements of the larynx and pharynx, and, moreover, that it is connected with the first or voluntary stage of deglutition.

In another series of experiments Krause extirpated the above-mentioned cortical region. This was done first on the left side only, without any appreciable change in the voice; but when afterwards a similar operation was performed also on the opposite side, marked changes were noticed, so that the experimenter felt himself entitled to draw the following conclusion, viz. that "the appreciation of movement necessary for placing the cords in the position of phonation was impaired; there only remained the power of roughly adapting the

* Sitzungsbericht der kgl. preuss. Akademie der Wissenschaft zu Berlin, 1st Nov. 1883.

position of the cords by reflex action, such as is present in the new-born animal, enabling it to squeak and whimper."

In the third place, Krause attempted to follow the course of the degenerated nerve fibres in animals which had been successfully operated upon, and found that a considerable number of these passed through the corpora mammillaria (or albicantia).

OBSERVATIONS ON THE DISTRIBUTION OF LARYNGEAL NERVES BY MANDELSTAMM AND WEINZWEIG.

Unfortunately, the original papers by these two authors were not accessible to me, so that the short notice of their contents given here is gleaned from abstracts.*

Mandelstamm's method consisted in dividing nerves and noting the consequent atrophy of muscles. The results so gained were controlled by experiments, in which stimulation was applied. He found that all animals which survived section of the recurrent for from three and a half to four months showed marked atrophy of the posterior crico-arytenoid muscle; the crico-thyroid remained normal, as also did the interarytenoid, and neither muscle showed microscopic changes; the thyro-arytenoid and lateral crico-arytenoid exhibited marked atrophy. On transverse section the portion of the thyro-arytenoid adjacent to the arytenoid was less atrophied than its anterior part, and those fibres which were adjacent to the free margin of the cord were intact. The immunity of the inter-arytenoid muscle is to be explained on the ground of its deriving nerve twigs from both recurrents. After section of the superior laryngeal nerve all the muscles, including the crico-thyroid, were found intact. Stimulation was then tried, and it was found that irritation of the recurrent had no effect on the crico-thyroid, which, however, contracted on stimulation of the superior laryngeal. The absence of atrophy after section was explained by the crossing of the fibres, which Mandelstamm was enabled to demonstrate in the guinea pig, so that each muscle receives its nerve supply from both superior laryngeal nerves. This crossing also takes place in the recurrent, and this fact accounts for the absence of atrophy after recurrent section in that part of the thyro-arytenoid muscle near the free margin of the cord. Stimulation of the recurrent and superior laryngeal seemed to have no influence on the interarytenoid muscle, and in a case in which both recurrents were cut this muscle remained intact; in the same case the internal fibres of the thyro-arytenoids, on both sides, were also normal, so that probably the interarytenoid is innervated by the superior laryngeal, which may also send twigs to the thyro-arytenoid.

Weinzweig in his paper demonstrated the crossing of nerve fibres in the posterior wall of the larynx in the human subject.

* Monatsschrift für Ohrenheilkunde, Kehlkopf, etc. Dec. 1884.

EXNER ON THE INNERVATION OF THE LARYNX.

Unfortunately, here again I have been unable to obtain the original paper,* and my information is derived from an abstract by Chiari.† Exner studied the innervation of the larynx by means of three methods : viz. (1) Continuous transverse sections of the larynx in children and animals ; (2) stimulation of the nerves in animals ; (3) section of nerves and watching the resulting changes in the muscles.

It must be here mentioned that Exner has made a very important anatomical discovery, in demonstrating the existence of a third or median laryngeal nerve in the rabbit and dog ; in the human subject this nerve probably lies in the pharyngeal and laryngeal plexus, but is more difficult to trace into the crico-thyroid muscle.

The results obtained by Exner are briefly as follows :—

a. Motor Nerve Supply.—1. The crico-thyroid in the rabbit is supplied by the internal and external branches of the superior laryngeal nerve, and by the middle laryngeal nerve ; in the dog by the outer ramus of the superior, and by the median, which condition also holds for the human subject. Only a few fibres cross the middle line.

2. The external thyro-arytenoid muscle is usually supplied exclusively by the recurrent (inferior laryngeal) nerve of the same side, though sometimes in part by the external ramus of the superior laryngeal. The internal thyro-arytenoid is supplied equally by the superior laryngeal nerves of both sides, and in its external part by the recurrent.

3. The interarytenoid varies in its nerve supply ; probably it is commonly supplied by both superior and inferior laryngeal nerves. It becomes but incompletely atrophied after section of all four nerves.

4. To produce atrophy of the posterior and lateral crico-arytenoid muscles, it is necessary to divide the recurrent. Microscopic examination showed that the lateral crico-arytenoid receives its supply in a varying proportion from the recurrent, the external branch of the superior laryngeal, and, perhaps, one of the nerves of the opposite side. The posterior crico-arytenoid is principally supplied by the recurrent, but also to some extent by the superior laryngeal nerve.

5. Exner was able to demonstrate the passage of branches from the superior laryngeal into the depressors of the epiglottis (ary and thyro-epiglottic muscles).

b. He seems to consider that the sensory supply of the larynx is also in part derived from the recurrent—an hypothesis quite opposed to present views. The remainder of the paper seems to be devoted to an anatomical description of the ramifications of the laryngeal nerves, and to those who are interested in this matter, I may refer to the original or to Chiari's very full and careful abstract.

* Read before the Austrian Academy of Science in 1884. † Centralblatt für Laryngologie, Feb. 1885.

CHARCOT'S LARYNGEAL VERTIGO.

This affection was first described in 1876 by Charcot as laryngeal vertigo. This author had, up to the year 1879, observed four cases: and, so far as I am aware, other writers have contributed to medical literature five more examples of the same neurosis, making in all nine published cases. To these I propose to add a tenth; but before doing so I shall endeavour to give a short *résumé* of the clinical histories so far recorded.

Charcot's * cases were as follows:—

1. A patient (male) who complained of gout and cough, but was certainly not epileptic, was from time to time, after a slight cough, affected by vertigo without loss of consciousness. During these attacks he fell down without a trace of convulsive movement, but very soon recovered and got up. These seizures were first noticed when the cough began.

2. Another patient, aged fifty-five (also a male), not an epileptic, was subject for more than a year to what he called "attacks." These were preceded by tickling in the region below the larynx, and a short, dry cough, which was followed by a sort of fit, during which the patient fell without loss of consciousness,† while the face became turgid, and some convulsive movements occurred in the head and arm. The tongue was never bitten, and the attack, which was always short, was scarcely over before the patient got up without hebetude or confusion of intellect. These attacks were frequent (fifteen or sixteen a day); and when the fits of coughing were not followed by such severe paroxysms as above described, the patient only experienced an indescribable feeling of giddiness, without falling. He suffered from granular pharyngitis, bronchitis, and emphysema. The application of nitrate of silver to the mucous membrane of the pharynx, the external use of vesicants over the larynx, and the internal administration of bromide of potassium, effected a cure, in these cases, within a few weeks.

* *Revue des Sciences Médicales*, x. 135; *Le Progrès Médical*, 1879, xvii.

† It is right to state here that the account of this case given in the *Revue de Médecine* differs in an important point from that contained in the *Progrès Médical*, where it is stated that the patient lost consciousness.

3. A medical man, about forty years of age, after an attack of acute rheumatism, began to suffer from asthma and bronchitis. The paroxysms of the former were often followed by the expectoration of bronchial casts. During the year 1877 he became subject to attacks quite distinct from asthmatic paroxysms. These were preceded by burning and tickling referred to the region below the larynx, followed by a fit of coughing. The patient then experienced giddiness, and almost at the same time the fingers of his left hand became flexed, the left arm became stiff in the position of extension, and was raised almost as high as the head, while the whole limb gave three or four convulsive twitches. The patient then lost consciousness, and when he recovered found himself lying on his left side. At times the premonitory cough was only followed by noisy inspiration and a feeling of suffocation, without further symptoms. Laryngoscopic examination by M. Fauvel revealed only slight hyperæmia of the larynx. Eventually the patient died during a paroxysm of asthma, being up to the last in full possession of consciousness.

4. A man, forty-five years of age, suffered in July 1878 from bronchitis, which was soon recovered from, but left in the region of the larynx a more or less permanent feeling of tickling and warmth, which were liable to exacerbations producing fits of cough. In August, after one of these paroxysms, he lost consciousness, falling to the ground; and since then such attacks have been frequent, sometimes three or four occurring in the course of a day. During the fits the face became swollen and slightly livid, while convulsive twitching occurred in the face and limbs, but there was no cry, neither was the tongue ever bitten. Immediately after the attack was over the patient got up without a trace of mental confusion. Examination of the larynx gave negative results, while the internal administration of bromide of potassium, with the application of vesicants over the region of the larynx, effected a speedy cure.

Charcot believes that cases of this kind are entitled to be grouped as a distinct clinical variety, and has proposed for them the name of laryngeal vertigo.

In the *Practitioner*, August 1878, Dr Gasquet records the case of a gentleman, seventy years of age, who, after catching cold and suffering from severe paroxysms of cough, became liable to attacks of loss of consciousness, which were always preceded by laryngeal irritation and coughing. Treatment, directed to the larynx alone in this instance, effected a cure, but, unfortunately, neither the laryngoscopic appearances nor the remedies which were applied are recorded.

In the *Annales des Maladies de l'Oreille et du Larynx*, March 1882, Krishaber relates the following case:—

The patient, X. (male), was lame from an old-standing articular affection, but there was no neuropathic history. At the age of twenty-

one he had pleurisy, followed by complete cure, and auscultation revealed no change in the thoracic organs.

At twenty-five patient had syphilis, but no tertiary phenomena showed themselves. He married at thirty-two, and had three children, of whom two died in early infancy, while the oldest is of sound constitution. X. was in the enjoyment of good health when, fifteen months ago, he was attacked by loss of consciousness in consequence of violent emotion. That he did not fall is explained by the fact that he was seated at the time. In the course of the same day he had several attacks of dry cough, followed each time by dizziness, but without loss of consciousness. Little by little the cough was disappearing, when about six or eight days from the first attack, on making an effort, he was attacked by a slight cough, followed by loss of consciousness. This time he fell and bruised his forehead. After recovering he felt slightly stunned, but was soon again able to resume his occupation. Another phenomenon meanwhile appeared; the patient suffered, without preceding nausea, from noisy eructations, which were repeated at short intervals, and only ceased in the evening. On the next day another attack was experienced on the street, produced, according to the patient, by a sudden noise, and he again fell down unconscious, but does not remember whether this attack was preceded by cough, like the others. According to those who went to his assistance, unconsciousness lasted a short time only, but the patient became very pale. About two months then passed without any more severe attack than slight cough, followed by eructation and a peculiar, indescribable feeling of malaise, which seemed to resemble a clouding over of his mind (*obnubilation*). The fourth severe attack occurred under peculiarly characteristic circumstances. X. was in a steamer, looking at the bank of the river, when another vessel crossed near that in which he was; under the influence of this surprise the paroxysm originated. On this occasion the patient distinctly remembered that he was immediately attacked by cough and vertigo, which made him lose consciousness. After this the patient wished to get on the bridge, but on attempting to ascend he was again overtaken by cough and giddiness, which obliged him to sit down. He thought that he did not lose consciousness on the second occasion; during the remainder of the day there occurred fits of coughing, which were only followed by slight mental confusion (*étourdissement*), which the patient compares to the sensation experienced after receiving a blow on the head. He is, however, perfectly conscious of the fact that the starting-point of the attacks is the larynx, and instinctively puts his hand to his throat on each occasion of their recurrence.

"On questioning him closely," Krishaber goes on to say, "I learnt that both in slight and severe attacks, followed or not by loss of consciousness, two phenomena commanded attention: the first premonitory

symptom was cough, slight and not accompanied by much sound, but frequent, like the last of a paroxysm of whooping-cough, while the second was arrest of all the muscles of respiration. It is evident from the description I have been able to obtain that the suspension of respiration is due not only to spasm of the muscles of the glottis, but to arrested action of the diaphragm and other muscles of respiration."

That if the glottis be closed the muscles of respiration will be greatly hampered in their action is evident; but from a mere history given by a patient it seems to me quite impossible to arrive at the conclusion that their action is arrested. In Krishaber's case, laryngoscopic examination revealed only slight hyperæmia, but, unlike other recorded cases, antispasmodic treatment failed to afford relief.

The next case is that described by Gray (*The American Journal of Neurology and Psychiatry*, Nov. 1882). This author writes: "In February 1880 there came to consult me a man aged fifty-five, who stated that about a month before he had begun to have a cough, and that when it was severe he would lose consciousness for a short time. There was no history of any convulsive movements whatever. These coughing spells were always preceded by a burning and tickling sensation at about the level of the larynx. A thorough laryngoscopic examination was made by my friend Dr Thomas French, and nothing abnormal was discovered. In 1863 he had been wounded on the head by a bullet, which ploughed up the tissues over the skull from brow to vertex, somewhat to the right of the median line. He was shortly afterwards affected by losses of consciousness similar to the present ones, and they continued for about two months. During the interval he has had colds innumerable, but never any vertigo or unconsciousness. Under treatment with the bromides he had no return of the losses of consciousness, but he was only under my charge about three weeks, and since then I have not seen him."

In the *Archives of Laryngology* (July 1883), Lefferts describes two cases of so-called laryngeal vertigo. To use his own words: "A gentleman, young, strong, and free—as I have assured myself by careful physical examination—from any abnormality of either heart, lungs, or kidney, is sitting at his dinner-table surrounded by friends. Suddenly he has a slight attack of spasmodic cough, and a second later falls to the floor unconscious. Almost immediately he arises, resumes his seat and the conversation at the point where it was interrupted. This is not the first attack of this character that my patient has had. Several have occurred during the past eight years; and with much greater frequency—so frequent, indeed, that he has retained no recollection of the number—attacks of partial unconsciousness, always preceded by the same paroxysmal attack of coughing, have occurred. They last but a few seconds, are preceded by blurring of vision, with dizziness or

vertigo, and pass away instantly, leaving him clear-headed and bright. I have said that he is a young and strong man, free from organic lesion. He has an incomplete history of hereditary neurosis. There is no evidence of any convulsive movements during his attack. These latter are always ushered in by tickling in the larynx and violent cough; the face becomes suffused. In the worst he falls without cry, but rises immediately, without confusion of ideas, and without remembrance of what has occurred during his brief unconscious interval. In the lighter attacks the premonitory cough is often followed by a few stridulous inspirations and a slight feeling of suffocation, then vertigo and momentary unconsciousness, or it may be slight cough alone, with some spasm of the larynx, slight dizziness, but no unconsciousness. An examination of his larynx shows that, aside from a slight hyperæmia, the appearances are normal; the pharynx is granular, uvula is not elongated."

Of his second case Lefferts gives only a brief history. "It likewise," he goes on to say, "concerns a young strong man, and his history would be but a repetition of the first that I have detailed to you, with the exception that his attacks are not so severe; he has had but two unconscious falls, and he does not live in dread of sudden accident in the street or elsewhere. He has no history of other neurosis. A sister is decidedly neurotic. The history of his affection dates back one year only."

I have thus far endeavoured to describe shortly what is known of laryngeal vertigo, as it has been called by Charcot, who is inclined to believe that in this affection we have the analogue of Menière's disease —the afferent nerve being the superior laryngeal. Gray believes that a more accurate designation is to be found in the term laryngeal epilepsy, but bases his arguments on the erroneous assumption that in all previously recorded cases consciousness was completely lost. There can be very little doubt that the term spasm of the glottis of adults, used by Krishaber, is more in accordance with clinical facts. This author draws an analogy between the neurosis in question and so-called nervous or hysterical cough. The latter is, however, most commonly observed in young girls, and more rarely in boys, while the former has so far only been described as occurring in grown men. Moreover, the term employed by Krishaber would also apply to the stridulous respirations sometimes observed in hysterical females; and for these reasons I think the name complete glottic spasm of adults would be more suitable.

I shall now give briefly the history of a case which has lately come under my care and presents some points of special interest.

D. M., age thirty-five, married, consulted me on the 22nd of October 1883, giving the following history: Eight months ago he swallowed a fish-bone, which stuck in his throat, and, as the patient thinks, remained

there half an hour. Two days afterwards, on going to bed, he experienced difficulty in breathing, and this symptom became so marked that he got up and paced the floor during the whole night. Castor oil was administered, and the throat poulticed, while the patient remained in bed for a week, during the whole of which time—to use his own words—he "felt inclined to be choked." After this he thought himself able to work, but was obliged to desist owing to attacks of giddiness. While sitting at work (boot-closing) his breathing seemed suddenly to stop, and his head began to swim. This sensation was described by the patient as giddiness, but further questioning soon elicited the fact that in no sense was it a true vertigo. In the latter surrounding objects, or sometimes the sufferer, seem to revolve or rotate; but no such subjective phenomena were experienced by the patient whose case we are considering. During the attacks it was noticed by those in the room that his face became pale, and remained so for some time afterwards. Consciousness was never lost, neither was there any convulsive movement. The fits were preceded by a short cough, and the throat felt as if being "squeezed together;" but there was never any feeling of burning or tickling in the region of the larynx, while—again to use his own words—"all the breathing machinery seemed to stop." The patient was never aware of any special exciting cause, and stated that the fits came on when he felt quite "at ease." On one occasion, while standing, he suddenly became pale, and fell back into a chair, so that his wife ran out to get assistance, thinking that death was imminent; but even during this attack the patient retained consciousness.

A peculiar clicking in the throat was complained of, accompanying each act of deglutition, which was referred by the patient to the region of the uvula, and was most probably due to spasmodic action of the palate muscles, more especially those which act on the Eustachian tubes. Examination of the throat showed congestion of the pharynx, the posterior wall of which was granular, and the uvula was drawn to the right. The larynx was congested, and in phonation the slightly thickened vocal cords did not meet as accurately as in health. The whole larynx, including the sinus pyriformis on both sides, was examined, and it can therefore be positively asserted that the symptoms were not due to the presence of a foreign body. Sometimes the patient had difficulty in swallowing solids. This was, however, only occasional, and often followed over-indulgence in stimulants; for although not an habitual drunkard, he sometimes drank to excess.

On examination of the chest, both lungs and heart were found normal. To verify this fact I sent the patient to Dr James, who concurred with me as to the absence of thoracic disease. Tendon reflex is somewhat exaggerated, and Dr James found slight ankle clonus. The sight is good, and there is no colour-blindness nor unsteadiness when the eyes are

closed. There is no history pointing to hereditary neurosis; neither has he ever had syphilis. The giddy attacks recurred about once a fortnight until treatment was begun. The latter consisted in the application of strong astringents to the pharynx, counter-irritation over the larynx, avoidance of alcohol, and the internal administration of the bromides of potassium and ammonium, and the patient has now been for a considerable time without an attack. The diagnosis in this case was simple, for the symptoms could only be due to either locomotor ataxia—which was easily excluded—or to the neurosis under consideration.

I think the description given by this patient of his attacks fully confirms the view of Krishaber, that the paroxysms are due to spasm of the glottis. Indeed, that this is the case has not, so far as I know, been disputed. Charcot, indeed, seems to believe—as before said—that the attacks are of the nature of giddiness, the irritation being conveyed by the superior laryngeal nerve. The latter is, I need hardly say, the sensory nerve of the larynx, and it is well known that its stimulation produces spasm of the glottis. My patient presented a well-marked tendency to spasm, not only in the region of the larynx, but throughout his whole muscular system. Thus he had exaggerated tendon reflex, ankle clonus, spasmodic action of the palate muscles, and occasionally suffered from spasmodic stricture of the gullet.

Let us now turn to a consideration of the actual chain of events which leads to the paroxysms. In every case so far reported the fit was preceded by a short cough, or, in other words, by a series of spasmodic inspirations, followed by spasmodic expiration, with partially closed glottis. Now, there can be little doubt that the complete spasm of the glottis will replace the act of coughing, and that it therefore occurs just after a full inspiration. To the physical conditions thus produced within the thoracic cavity I believe the attacks to be due.

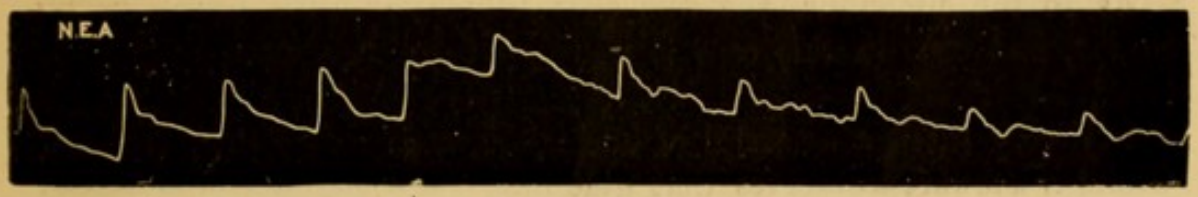
The question next arises as to how these physical conditions can produce dizziness or loss of consciousness. If a healthy person takes a deep inspiration, and then attempts to perform the act of expiration with the glottis closed, it is evident that the thoracic organs are artificially and voluntarily placed under the same conditions which pertain at the beginning of an attack of so-called laryngeal vertigo. The effect upon the circulation produced by this experiment is very striking, as may be observed by placing the finger on the pulse, which becomes immediately slower and feebler than before. The effect upon the pulse is, however, still better shown by sphygmographic tracings, which, with the kind assistance of Dr Mackay and Mr Aldridge, I have been able to obtain. It will be seen that the result of the experiment is almost complete obliteration of the pulse-tracing; and it is a very interesting fact that the gentleman experimented upon actually

experienced a momentary threatening of syncope just after one of the tracings was taken.

I have very little doubt that, in the paroxysms which characterise the disease under consideration, a closure of the glottis occurs

Normal Tracing.

Deep inspir. began at 2nd up stroke.
Forced expir. with closed glottis at 5th up stroke.



Deep inspir. followed by forced expir. with closed glottis.

immediately after full inspiration; this is at once followed by an attempted expiration, and as a result the patient either faints or gets dizzy. Immediately syncope is produced, or, in some cases, just before this stage is reached the spasm relaxes and the attack is over.

To explain exactly how this tendency to syncope is brought about by the physical conditions above considered is a somewhat difficult problem. The increased atmospheric pressure on the walls of the alveoli will in all probability prevent, or tend to prevent, the free passage of blood through the lungs, and therefore lessens the quantity of blood in the left side of the heart. Again, the pressure on the large intra-thoracic veins must hinder the return of venous blood, and thus we can understand that the face will be pale or turgid according as the spasm of the glottis lasts for a longer or shorter time. It is also quite conceivable that the compression of the heart between the unyielding lungs and the chest wall may help to paralyse its action.

With regard to the nerve channel by which the laryngeal neurosis in question is produced, it is difficult to arrive at any positive conclusion. It is well known that stimulation of the sensory nerves of the pharynx,

as well as of the superior laryngeal, will produce spasm of the glottis. In a considerable proportion of the reported cases there was marked pharyngeal catarrh, and in the case observed by me the disease seemed to owe its immediate origin to the presence of a foreign body for a short time in the throat. An interesting fact which I have only just learned is, that my patient has been absolutely free from his attacks ever since treatment was begun, excepting on two occasions, when they followed indulgence in alcohol. On the second of these he was also conscious of a distinct increase of redness and swelling in the throat.

The diagnosis of this affection—if the laryngeal crises of locomotor ataxia be excluded—is easy; but it may be urged that the cases recorded are merely epilepsy with a laryngeal aura. Against this view the most convincing argument seems to me to be the fact that Charcot has spoken of laryngeal vertigo as being quite distinct from epilepsy. Other evidence is to be found in the facts that a considerable proportion of the cases occurred in men of middle or advanced age, that in some consciousness was never lost, that the tongue was never bitten, that convulsive movements rarely occurred, and, finally, that in most of the recorded cases the disease has shown itself very amenable to treatment.

As to the prognosis, the fact that only one death has been recorded, and that in this case it was due to other causes, speaks for itself.

In a very interesting series of clinical lectures on vertigo, Professor Grainger Stewart* observes that giddiness "is sometimes produced by violent fits of coughing, sometimes by violent fits of sneezing." It is then suggested that the immediate cause of the symptom may be changes produced in the middle ear. In view of the effects which I have shown to be produced in the circulation by attempted expiration with closed glottis, it seems more probable that the attacks of giddiness referred to by Dr Stewart are more of the nature of syncope than of auditory vertigo.

While these pages were already in the press, my attention was directed to an interesting series of experiments described by Weber in *Müller's Archiv* † (1851). This author, after pointing out the fact that forced expiration with closed glottis causes weakening and eventually stoppage of the heart's action, gives his views as to the mechanism by which this result is produced, and details graphically the result of carrying the experiment too far, as evidenced in his own person. As Weber's explanation and personal experience go far to corroborate the conclusions which I have independently arrived at, it may be well here to translate two passages from his paper: "The reason why compres-

* *Edin. Clin. and Path. Journal*, 12th Jan. 1884.

† "Ueber ein Verfahren den Kreislauf des Blutes und die Function des Herzens willkührlich zu unterbrechen."

sion of the chest—even if only by the muscles of expiration—has an effect so marked on the heart and circulation is as follows: When the thoracic cavity is narrowed by the expiratory muscles, the air contained in the lungs and bronchi, as it cannot escape, is compressed, and by its elasticity exercises a uniform pressure on all the parts within the thorax, *i.e.* not only on the pulmonary tissue, but also on the heart and large vessels. Now, as the blood contained in the veins only returns to the empty and flaccid heart by virtue of the pressure under which it is placed, it follows that if counter pressure be exercised on the heart and venæ cavæ, as is the case during compression of the intra-thoracic air, the force of the flow must be diminished. If the pressure on the heart be sufficient to balance that of the blood in the veins of the neck and abdomen, or if it exceed it, no more blood can enter the heart or the thoracic veins. The small quantity of blood contained in the thorax, in the venæ cavæ, the heart, or the pulmonary vessels is driven into the aorta by the next contraction, after which no blood can flow from the heart into the aorta. If severe pressure be exercised, the pulse immediately becomes small, because the supply of blood to the heart through the venæ cavæ is cut off, but continues until the blood contained in the thorax has emptied itself through the left side of the heart into the aorta. Then, usually after three or five beats, the pulse intermits altogether, because no blood reaches the aorta from the empty heart, and only returns after compression of the thorax has ceased."

On one occasion Weber, while experimenting on himself, produced actual syncope, which he thus describes: "During this interval of unconsciousness slight convulsive twitchings of the face were noticed by the bystanders; and as consciousness returned all recollection of what had taken place was so obliterated that in spite of the fact that my pulse was being counted aloud as before, I could not at first remember where I was and what was happening."

We have in this description the exact counterpart of what occurs in severe cases of the laryngeal neurosis under consideration, and thus, I think, strong support is given to the views expressed in the preceding pages. These facts also show how dangerous to a patient with weak cardiac action is the act of straining, whether during defæcation or in the second stage of labour. The aural surgeon, too, will do well to abstain from recommending Valsalva's experiment (*i.e.* forced expiration with mouth and nostrils closed) without first ascertaining the condition of the heart.

Since this was written, Massei of Naples has described three cases of laryngeal vertigo, which differed in no respect from those which have been previously referred to—all being associated with some inflammatory condition of the pharynx, larynx, or bronchi. Massei * seems inclined to

* Internat. Centralblatt für Laryngologie, July 1884, abstract.

refer the seizures to reflected irritation from the laryngeal and the inhibitory branches of the vagus. I still think, however, that the views expressed in the preceding pages are correct; in this I am supported by no less an authority than Dr Russell of Birmingham,* and this observer, whose immense experience and well-known powers of observation attach more than ordinary importance to his views, believes that the affection in question is probably by no means so rare as has been believed by laryngologists. To quote from his own words: "Attacks of unconsciousness, attending a violent cough, are not unknown to most medical men, and it seems not improbable that if the immediate precursors of the attack be carefully noted, the form of laryngeal neurosis which Dr M'Bride has demonstrated may prove not to be so infrequent as is implied in the title of his paper."

"The following brief note of a case lately under my own observation affords remarkable attestation to the correctness of Dr M'Bride's explanation, by the very description given by the patient. It is on this account chiefly that I report it, and also with the view to calling attention to the rather remarkable series of phenomena which characterises these attacks."

"A gentleman, aged about fifty, has had irritation at the apex of the right lung for the last twelve or fourteen years, resulting probably from a limited catarrhal pneumonia. It has produced recurring attacks of local catarrh."

"In attending him lately for one of those attacks, he mentioned to me that occasionally, when suffering from his attacks, which are always attended with cough, he has suddenly dropped perfectly unconscious, only remaining so for a very brief period, when consciousness was recovered, returning at once to his previous state of health, without any unpleasant effect remaining."

"On asking him respecting the connection between his cough and these fits of insensibility, he at once replied emphatically, 'It is not when I cough that these fits occur, but when I cannot cough; I try to cough several times, and then I drop.' They are preceded by a tickling in the region of the larynx. He has had about eight attacks; the first occurred at the commencement of his disease, the last about two years ago. They were referred by his physician to venous engorgement. He has a decidedly nervous constitution, and, I may add, that some of the patients, whose cases are quoted by Dr M'Bride, had exhibited a neurotic tendency; in his own case the liability had been preceded by the lodgment of a fish-bone in the patient's throat, causing marked laryngeal trouble."

* *Birmingham Medical Review*, vol. xvi.

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MORE IMPORTANT ADDITIONS BY THE TRANSLATOR.

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