Guide to the examination of the ear and hearing : for the use of students / by Thomas Barr, M.D. ... and J. Stoddart Barr, M.B.

GUIDE TO THE EXAMINATION OF THE EAR AND HEARING

FOR THE USE OF STUDENTS

BY

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INCLUDING THE NOSE AND THROAT IN RELATION TO THE EAR

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PREFACE.

THIS small *Guide* has been prepared primarily for the use of students attending the course of lectures on Diseases of the Ear in Glasgow University. The course is a comparatively short one, the intention being that the student should devote the limited time at his command mainly to practical work. It is therefore desirable that he should at once begin this, and it is hoped that the *Guide* will materially aid him in doing so, while at the same time setting the lecturer free to go on with other parts of his subject. The *Guide* can be conveniently carried in the pocket and, therefore, the student, while attending the practical instruction, can refer to it if in any difficulty, thus to a certain extent rendering him less dependent upon the individual personal attention of the teacher. The authors treat the subject of Diseases of the Ear fully in their "Manual," a fourth edition of which will appear shortly.

Through the kindness of Messrs. Macmillan & Co., Ltd., permission has been granted to incorporate in this *Guide* portions of Dr. Thomas Barr's article on "Methods of Examination and General Semeiology" in the section on the ear in the edition of Clifford Allbutt's *System of Medicine* just published.

13 WOODSIDE PLACE,
GLASGOW, *October*, 1908.

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GUIDE TO
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CHAPTER I.

THE ORDER AND METHOD OF EXAMINING A PATIENT SUFFERING FROM EAR DISEASE.

When making an exhaustive examination of a patient suffering from ear disease, the following order and methods are recommended to the student.

Preliminary Enquiries. The patient usually mentions at once the symptom or symptoms for which he has come, such as dulness of hearing, noises in the ear, pain in the ear, discharge from the ear, etc. We should then enquire as to: 1st, the duration and course of his symptoms; 2nd, the previous existence of any ear trouble; 3rd, his own opinion of the cause.

In regard to the *duration* and *course* of the symptoms, we cannot in many cases get definite or reliable information as to the beginning of the trouble, unless it began (1) as an acute inflammation, especially if followed by discharge or dulness of hearing; (2) in connection with a zymotic or other general disease; (3) with a sudden change from good hearing to marked deafness or tinnitus; or (4) with an injury. More frequently, especially in one-sided deafness, the condition has existed for some time—it may be for years—unnoticed by the patient, till he finds, perhaps quite accidentally, that he does not hear the tick of a watch on one side. In other cases, the occurrence of tinnitus first draws attention to an ear where there has probably been defective hearing for a long time, unknown to the person. Again, in others, the hearing defect, slight at first and slowly progressive, is not

observed or admitted by the patient till it becomes so noticeable as to attract attention and compel admission. We should enquire if the beginning has been sudden or gradual, limited to one ear or involving both, and if the course has been steadily progressive or interrupted. Marked variations in the hearing power are of favourable import, as compared with a steady and continuous deafness. Short duration of the symptoms is usually a favourable point, although we often find that the objective condition of the ear points to a much longer duration of the disease than the patient's account indicates. The *previous existence* of any ear trouble is important and should be enquired into, such as earaches in childhood, discharge from the ear, temporary attacks of deafness. The patient will usually be able to inform us as to these.

The *cause* is frequently attributed by patients to what they term "cold," or to scarlet fever or measles; but they often profess ignorance of any cause, or mention something which has obviously no connection with the affection. As a rule anything like reliable information regarding causation can only be got by special interrogation, when we should have in our mind such possible causes as nasal catarrh—post nasal adenoids—cold impressions on the ear—the exanthematous or other general diseases—injuries—heredity—age—previous disease in the ear—occupation—neglect of treatment, etc.

Subjective Examination—Symptomatology. While the patient has probably already mentioned the symptom or symptoms, such as dulness of hearing or tinnitus, which more prominently affect him, it is usually necessary to enquire as to other possible symptoms, of the significance of which he may be ignorant, and which he may therefore not mention. The following scheme of symptoms will guide the student in his enquiries:—Defective hearing—sounds in the ear (tinnitus aurium)—pain in the ear (otalgia)—discharge from the ear (otorrhœa)—vertigo—nasal and throat symptoms. These are the six most frequent and important indications of ear disease, and are discussed in detail at pp. 52 to 66. They must always be enquired into. The following, however, should also be kept in view as very important, although not so frequent as the others:—Deaf-mutism—facial paralysis—headache—sickness and vomiting—psychical disturbances—pyrexia—intra-cranial symptoms—ocular disturbances—impairment of taste. These are also discussed from pp. 67 to 72.

Objective Examination. We should next proceed to the examination of the patient in the following order, although this exact order

need not necessarily be pursued on every occasion:—1. Methods of testing the hearing and localizing the seat of the deafness (see p. 42). 2. Examination of the superficial or visible parts of the ear (see p. 4). 3. Examination of the tympanum through the external meatus (see p. 7). 4. Examination of the middle ear through the Eustachian tube (see p. 16). 5. Examination of the pharynx, nasal passages, and naso-pharynx (see p. 30).

General Health. Lastly, the general health should be carefully enquired into, as this may have an important relation to the aural disease. This enquiry should, where it seems necessary, include the examination of the urine for albumen and sugar; labyrinthine hæmorrhage may be connected with albuminuria, and furunculi with glycosuria. The persistent presence of urates and oxalates may have a bearing on oto-sclerosis. In certain cases also the state of the nervous system, the circulation and the blood should be examined, such as when persistent vertigo and tinnitus are prominent symptoms, or when there are indications of intra-cranial complications. In the vascular complications of purulent otitis media valuable information may be obtained by a bacteriological examination of the blood. A leucocyte enumeration may also be of service in the prognosis and treatment of otitic intra-cranial complications, while the determination of the opsonic index, in such cases, may guide us in the administration of vaccines.

Of course, an examination such as has been sketched is not necessary in every case; but it is highly desirable that the student should conduct an exhaustive examination in a certain number of cases.

CHAPTER II.

EXAMINATION OF THE SUPERFICIAL OR VISIBLE PARTS OF THE EAR.

As the chief and most important parts of the organ of hearing lie concealed from view in the interior of the temporal bone, we have, in the examination of these deeply seated structures, to employ certain instrumental aids. While these are essential to the due investigation of the ear, we must not neglect the examination of the outer or superficial parts with the unaided senses, for in this way we may derive important information.

Auricle and External Meatus. The various conditions of the auricle may be thus readily recognized, such as the presence of cutaneous affections, morbid growths, congenital malformations, haematomata, injuries, and displacements. If the auricle be pulled backwards and the tragus pressed forwards we may, with the aid of good direct light, see well into the external meatus; and, in the case of a wide canal, we may even secure a glimpse of the tympanic membrane. Purulent secretion or granulation tissue may be seen, or even a polypus (Fig. 1) protruding from the external orifice; and these usually point to a purulent affection of the deep parts. Such conditions as excess of cerumen, exostosis, eczema, thickening of the walls of the canal, and furunculi, may also be discovered by simple inspection, and the existence of the last

FIG. 1.—Polypus protruding from external meatus.

would necessitate great caution in introducing a speculum lest pain or injury be caused. Even a plug of cotton wool in the orifice may yield information by the presence and odour of secretion upon it.

Mastoid Region. Much valuable information may be gained by simple inspection and palpation of the mastoid region, especially in middle ear suppurations. A red painful swelling, with or without fluctuation, causing displacement outwards and forwards of the auricle, would denote mastoid periostitis, or a sub-periosteal escape of pus from the interior of the cells. A hard brawny swelling lower down would point to the escape of pus from the cells at the apex into the digastric groove—Bezold's abscess. Pain on pressure, without redness or swelling, especially in front of the lower part of the mastoid, along with acute profuse purulent discharge from the ear, would probably mean a mastoid empyema. In similar circumstances, pain on pressure behind the mastoid, especially with fulness, would raise the suspicion of lateral sinus involvement. A discharging sinus behind the auricle points to caries or necrosis in the mastoid cortex, while a depressed bony cicatrix indicates the seat of an old sinus or of an operation cavity.

FIG. 2.—Facial aspect in deafness associated with post-nasal growths.

Glandular Structures. The glandular structures are often tender and swollen in purulent ear disease, especially the glands behind the ramus of the jaw and lower down in the neck. There may be simply inflammatory swelling, or an abscess, or tubercular mischief. The mastoid glands and those over the parotid, as well as the parotid itself, may also be involved—pain and swelling of the mastoid glands are sometimes mistaken for mastoid periostitis. Involvement of the glandular structures in the neighbourhood of the ear calls for careful examination through the meatus, when a perforation with purulent discharge will often be found to be the real source of the glandular mischief.

Facial Aspect. The facial aspect may yield information, especially if there be post-nasal adenoids, when the open mouth, the compressed

nostrils, and the dull expression are characteristic (Fig. 2). Facial paralysis, generally unilateral, is not infrequently observed, and is generally associated with purulent ear disease, especially in children. In persons who are very deaf, the keen watchful eye, while striving to read the face of the speaker, is often noticeable.

CHAPTER III.

EXAMINATION OF THE EXTERNAL MEATUS AND TYMPANUM THROUGH THE MEATUS.

In order to survey in all their detail the deep parts of the external meatus, the tympanic membrane and the interior of the tympanum, we require, first, to remove or turn aside any obstructions in the canal of the ear; second, to straighten the curve of the canal; and third, to reflect light into the interior.

During examination the patient should be seated on a revolving arm-chair of simple design, constructed of some plain polished wood, and having a straight back to which an adjustable sliding head rest can be attached. Such a chair is equally well suited for nose and throat work.

Removal of Obstructions in the Meatus. The view of the deep parts of the ear is very frequently obstructed by hairs, particles of

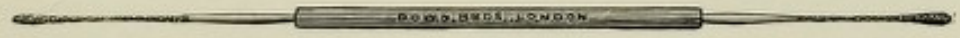

Fig. 3.—Cotton holder.

cerumen, epidermic scales, purulent secretion, etc. The aural speculum suffices to push aside the hairs. The cotton holder (Fig. 3) is the safest instrument to employ in removing other substances. It consists

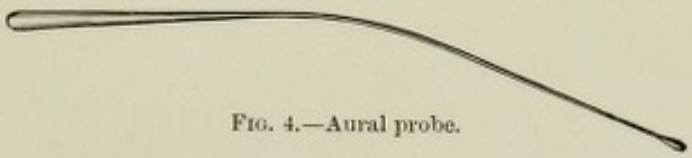

Fig. 4.—Aural probe.

of a piece of iron or steel wire, both ends of which are wrought into the form of a fine screw, round which, before use, a piece of cotton wool is firmly wound into a cylindrical shape. Metallic instruments,

such as forceps or a probe, may be required to remove scales or particles of cerumen. The cautious use of the probe (Fig. 4) often yields valuable information as to the presence of granulation tissue, polypi, or furunculi. Such instruments should only be used when the inside of the ear is properly illuminated, so that the eye may guide the hand. A permanent difficulty is presented by an unusually prominent antero-inferior meatal wall, which in certain cases may admit of only the postero-superior quadrant of the tympanic membrane being seen. For the removal of purulent secretion or an excess of cerumen, syringing the ear is usually required in order to see the deep structures.

Syringing the Ear. A piston syringe (Fig. 5) is generally the most efficient. *It should be furnished with a fixed ledge*, or other contrivance to prevent the slipping of the index and middle fingers when the piston is being pressed down. The nozzle should not exceed an inch and a half in length, should be slender, and should not have a knob-shaped extremity. If the nozzle is too thick, or if it has a bulbous end, the canal of the ear is liable to be stopped up by it, and the injected fluid, having difficulty in passing out again, may produce dangerous pressure on the deep parts. A vessel (Fig. 5) of a suitable size and shape is required to receive the fluid as it issues from the ear. The comfort of the patient is not unworthy of our attention, and the drenching which patients sometimes undergo, not to mention the trickling of water down the neck and under the collar, must be avoided when syringing the ear. The point of the nozzle of the syringe should be placed in contact with the roof of the canal, just within the external orifice. At the same time the auricle should be pulled upwards and backwards with the left hand, so as to remove the curve of the canal. When the object of syringing is to remove pus or other inflammatory products, the syringe should be used efficiently but gently, and with interruptions. A powerful stream of fluid propelled against the softened or perforated tympanic membrane may easily do injury. After syringing, the fluid which remains in the auditory canal should be allowed to drain out, and then the passage is to be dried with absorbent cotton fixed on a cotton-holder (Fig. 3). A plug of cotton wool should be worn in the meatus for a few hours after syringing. In some persons syringing the ear, even when it is done with caution, excites giddiness, and more rarely, nausea and vomiting. These effects are more likely to be produced when the tympanic membrane is perforated, and especially when excessive force has been

FIG. 5.—Mode of syringing the ear.

used, and when *cold* fluid is employed. The fluid may be simple water, as in the removal of ceruminous collections, or water medicated with some antiseptic substance, and it should always be pleasantly warm, say at a temperature of about 100° F.

Aural Specula. The curve of the canal may be straightened more or less by pulling the auricle upwards and backwards, and by the introduction of an aural speculum. The aural speculum is a funnel-

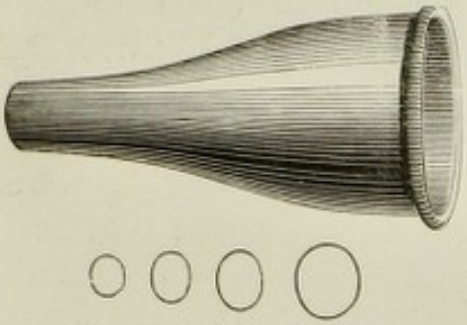

Fig. 6.—Gruber's speculum.

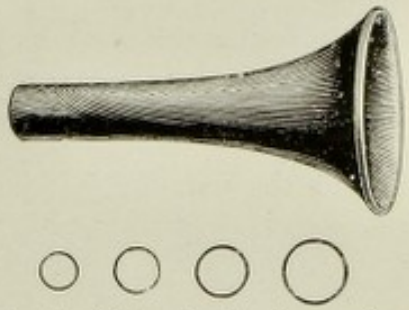

Fig. 7.—Politzer's vulcanite speculum.

shaped tube, about an inch and a half in length, composed of either silver (Fig. 6) or vulcanite (Fig. 7). The metallic ones are the most suitable, especially those known as Gruber's, which have an oval lumen at the inner end. Four sizes are necessary in order to fit the various widths of the external meatus in different persons and at different ages. Grünfeld has, by connecting an oval mirror to the outer opening of a speculum with a hinged joint, constructed a demonstration speculum, so that an observer looking at the mirror may see the reversed image of the tympanic membrane. Long narrow specula are to be avoided, unless in practised hands, as they are apt to cause pain by being introduced too far.

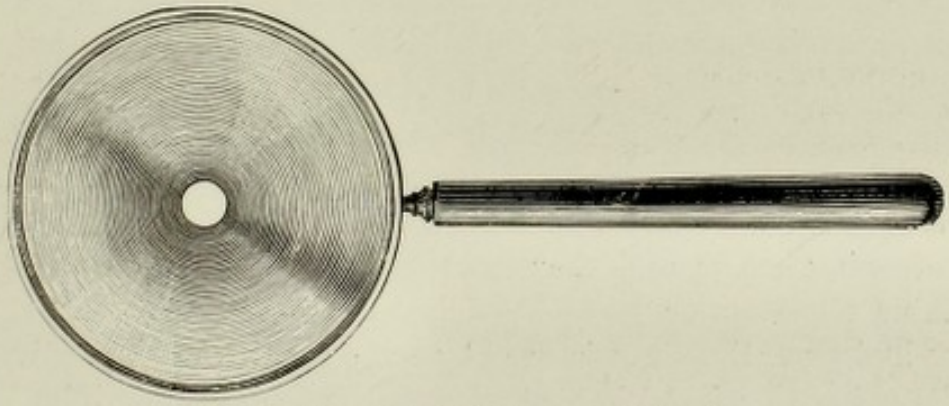

Fig. 8.—Concave perforated mirror with handle.

Reflecting Mirror. The best method of illuminating the interior of the ear is by reflecting light from a concave mirror. This should

have a diameter of about two and a half inches, be perforated by a small hole in the centre, and have a focal distance of from three to five inches. It is used either with a handle (Fig. 8) screwed on to the metallic back, or, if the right hand requires to be free, as is usually the case, it is attached to a head-band by means of a ball and socket joint, or to a metallic head spring, or a spectacle frame, and is thus supported in front of the eye of the operator (Fig. 9). For persons with faulty refraction a proper lens may be fitted behind the perforation in the mirror, or suitable spectacles may be worn.

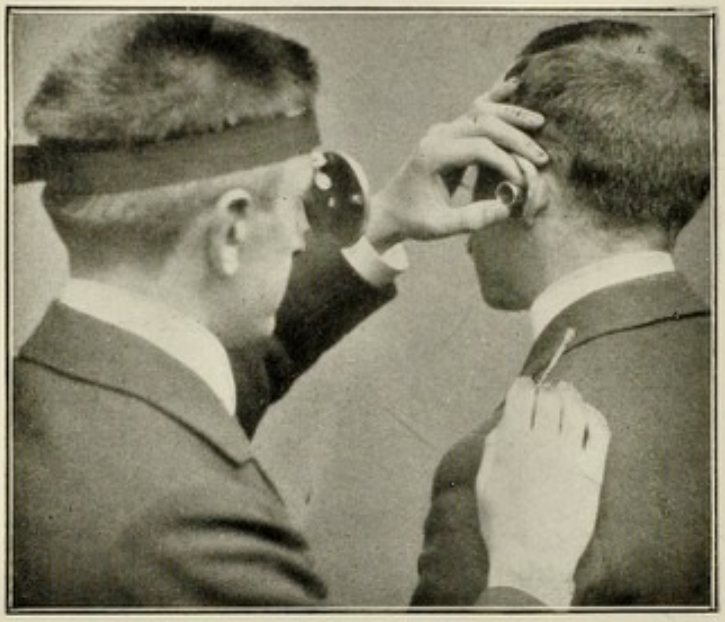

Fig. 9.—Examination of the ear with forehead mirror and speculum.

Source of Light. Bright diffuse daylight, especially the light reflected from white clouds or a white wall, affords the best illumination. The direct rays of the sun show very minute changes on the membrane and may partially illumine the interior of the tympanum. It is usually necessary, however, especially in this country, to employ artificial light, which, it is to be noted, imparts a reddish-yellow tint to the parts. Either lamp-light or gas-light will serve the purpose, and, in the latter case, an Argand burner, or preferably an incandescent gas burner, having a long glass tube covering the light, and supported by a suitable wall bracket or table standard, is most suitable. An incandescent electric lamp, with frosted glass, 32 candle power, or the still more powerful Nernst lamp, affords excellent illumination, used along with a reflecting mirror; it has the advantage over gas or oil of being cooler, and therefore more comfortable to the patient. A portable oil lamp or Baber's spirit lamp is useful for the bedside. The oxy-hydrogen limelight is used by some for delicate operative work. The Photophore or incandescent electric lamp, introduced by Trouvé, fixed on the forehead and supplied with a storage battery, is sometimes employed, or the electric lamp may be attached to the front of the mirror. It is sometimes desirable to magnify the parts. For this

purpose a suitable bi-convex lens is fixed to the wide opening of the speculum, or, for a less magnifying effect, one of longer focal distance may be placed at the back of the mirror, behind its aperture, but arranged so as to be capable of removal when the magnifying effect is not desired.

Mode of using the Mirror and Speculum (Fig. 9). The examiner, having the mirror adjusted in front of the right eye, moves his head sufficiently near to the patient's ear (which should be in shadow), manipulating the mirror so as to direct the reflecting surface towards the light, which is reflected into the meatus. The auricle is now held between the left index finger in the concha, and the middle finger behind the auricle, and gently pulled upwards and backwards in order to straighten the canal, while the right thumb presses the tragus forward. In this way, without a speculum, we may see well into the meatus, and even as far as the tympanic membrane. We may thus detect excess of cerumen, pus or mucus, granulation tissue or a polypus, eczema or a furunculus, or stenosis. It is important to inspect the meatus in this way before introducing the speculum, which might readily conceal such a condition as eczema of the orifice, or excite great pain if there should be a furunculus. The auricle being held backwards in the way described, the speculum (which should be as wide as possible and warmed) is held by its outer edge with the right hand and passed carefully in with a slight rotatory movement, until the membrane is clearly exposed by the light projected into the speculum. The speculum is moved about between the left thumb at its lower edge and the index finger in the concha, so that the examiner may observe the different parts of the meatus and the tympanic membrane (Fig. 10).

Fig. 10.—Position of fingers in using the speculum.

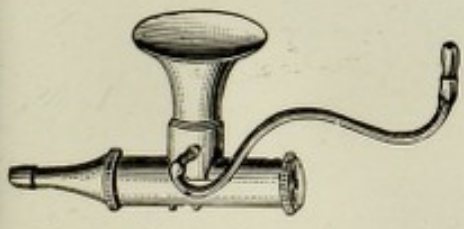

Fig. 11.—Brunton's speculum with suction tube.

Brunton's Speculum. This consists of a metallic tube, furnished with a bi-convex eye-piece at one end and an ear speculum at the other (Fig. 11). Light is admitted through a wide funnel-shaped opening at the side and falls upon a perforated mirror, set at an angle, from which it is reflected into the ear, passing back through the perforation in the mirror to the eye of the observer.

By means of Voltolini's modification the column of air in the external meatus may be condensed and rarefied as with Siegle's speculum. This instrument is now but little used, being inferior in simplicity and efficiency to the speculum and mirror. Owing to its magnifying power it may be employed, in practised hands, for showing minute changes.

Siegle's Pneumatic Speculum (Fig. 12) consists of a vulcanite speculum screwed on to one end of a vulcanite cylinder, closed at the other end by a plate of glass placed obliquely, or, if we wish to magnify the parts, by a convex lens. The side of the cylinder has an aperture, over which a perforated peg is fixed. To this peg is affixed an india-rubber tube, furnished at its other end with a mouth-piece, or with an india-rubber ball or a pump. The speculum is fitted air-tight into the external meatus, and, while we illuminate the interior by means of the forehead mirror, we alternately rarefy and condense the air in the canal either with the mouth, or by compressing and relaxing the ball, or by Delstanche's suction apparatus (Fig. 13). It is necessary to cover the end of the speculum with a short piece of india-rubber tubing, in order to make it fit the external meatus exactly. During rarefaction the tympanic membrane is seen to move outwards, especially

Fig. 12.—Siegle's pneumatic speculum.

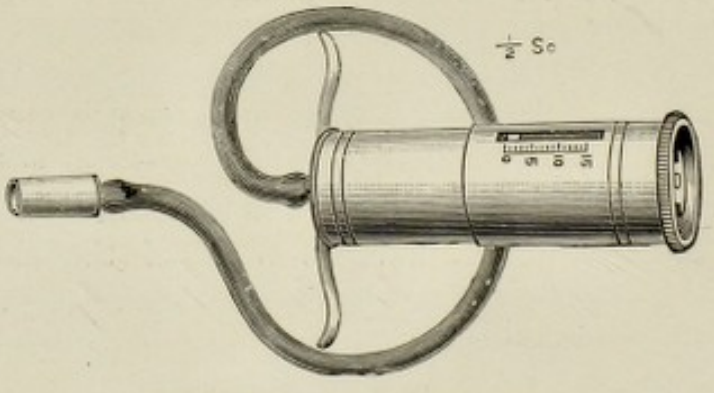

Fig. 13.—Delstanche's suction apparatus.

above and behind. A cicatrix or atrophied portion will bulge outwards. If there is rigidity of the membrane or adhesion to the inner tympanic wall, no movement or only a slight one will be perceived. A small

perforation may be located by observing aspirated secretion at a point in the membrane. Used with an electro-motor, this instrument is now much used in treatment.

Conditions revealed by Speculum and Mirror. We note the condition of the *external canal*, such as its curvature and width, the colour of its lining, the injection of its vessels, and the quantity and character of the cerumen. We must note also if any of the following conditions exist: purulent or mucous secretion, epidermic material, granulation tissue, polypi, hyperostosis or exostosis, cutaneous thickening or swelling, or furunculi.

Appearance of the Normal Tympanic Membrane (Fig. 14). In health this structure presents by daylight a pearl-grey shining surface, darker in front of

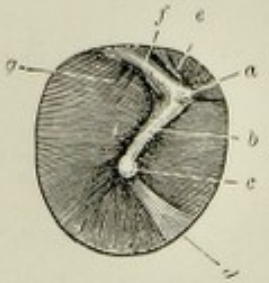

Fig. 14.—Outer aspect of right tympanic membrane—double the natural size; *a*, short process; *b*, middle of manubrium; *c*, umbo; *d*, cone of light; *e*, membrana flaccida; *f*, posterior fold; *g*, long process of incus shining through the membrane.

the handle of the malleus, with a general concavity outwards, and such an obliquity that the upper and back part is nearer the eye of the observer and more easily seen than the lower and front part. Its most prominent feature is the *handle of the malleus* or *manubrium*, a bony ridge, varying in size in different

Fig. 15.

Fig. 16.

Fig. 17.

Fig. 18.

Fig. 15.—Indrawn tympanic membrane caused by obstruction of the Eustachian tube, showing short process of malleus with the indrawn manubrium below; also part of stapes connected with long process of incus—both seen through the membrane lying closely over them.

Fig. 16.—The same tympanic membrane after inflation by Politzer's method.

Fig. 17.—Left tympanic membrane, having patches of calcareous deposition. *a*, Middle of manubrium; *b*, calcareous deposit in front of manubrium; *c*, deposit behind manubrium.

Fig. 18. Left tympanic membrane, showing calcareous patch having a horse-shoe shape. *a*, Manubrium; *b*, calcareous patch.

persons, but broader at the upper end, extending from the antero-superior pole of the membrane downwards, backwards and slightly inwards to a point somewhat below the middle, where it ends in a grey spade-like expansion—the *umbo*. From the obliquity of the membrane the posterior side only of the handle is seen, the anterior being concealed and in shadow. The upper end of the handle

appears as a small rounded white knob, *the short process*. Extending from the lower end of the handle, downwards and forwards, there is usually a bright reflection termed the *cone of light*, with the apex at the umbo. This varies in different persons, and is often broken up into several parts or reduced to one little spot; these varieties have but little significance. From the short process a narrow, more or less distinct fold, passes backwards—the posterior fold—and a less distinct one in front, the anterior fold. The small area above the short process and these two folds is known as the *membrana flaccida*, or *Shrapnell's membrane*, which occupies the Rivinian segment, and varies in size. When the tympanic membrane is

FIG. 19.

FIG. 20.

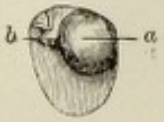

FIG. 21.

FIG. 22.

FIG. 19.—Permanent cicatrix in tympanic membrane, after acute purulent inflammation of middle ear. *a*, Cicatrix; *b*, manubrium.

FIG. 20.—Left tympanic membrane in which there is a cicatrix, including the postero-superior part; through the transparent cicatricial portion is seen, above, the articulation of the incus and stapes; below, the rounded border of the entrance to the fenestra rotunda. The cicatricial membrane lies in contact with these parts. *a*, Centre of cicatricial part of membrane.

FIG. 21.—The same membrane immediately after inflation by Politzer's method, showing the bladder-like bulging of the cicatricial portion. *a*, Centre of cicatricial part; *b*, short process of malleus.

FIG. 22.—Right tympanic membrane after long-continued suppurative process had passed away, showing cicatrix and large calcareous depositions. *c*, Cicatrix; *b*, calcareous deposit; *a*, short process of malleus.

FIG. 23.

FIG. 24.

FIG. 25.

FIG. 26.

FIG. 23.—Injection of tympanic membrane at early stage of purulent inflammation of middle ear.

FIG. 24.—Nipple-shaped perforation in tympanic membrane.

FIG. 25.—Kidney-shaped perforation. *a*, Manubrium; *b*, perforation.

FIG. 26.—Showing almost complete loss of membrane. *a*, short process; *b*, articulation of incus with stapes; *c*, remnant of membrane.

specially transparent, we may see the long process of the incus through it as a whitish streak, slightly behind and parallel with the upper part of the handle, and from its lower end the posterior crus of the stapes may be observed passing backwards, forming with the incus an elbow-shaped appearance; even the tendon of the stapedius may in some cases be discernible. Occasionally there is also visible below and behind a dark semilunar area—the depression of the fenestra rotunda on the inner tympanic wall; while, behind the umbo, a yellowish-grey colour may be reflected from the promontory.

Abnormal Tympanic Membrane without Perforation. We note the colour, polish and transparency of the drum-head. We may observe one or other of

the following changes—hyperaemia, especially along the manubrium or on the membrana flaccida—a yellowish-green moist appearance indicating secretion in the tympanum—local or general opacities or calcareous deposits—a dark depressed area indicating a cicatrix—bulgings which may be reddish, bluish or yellowish, frequently above and behind,—a foreshortening of the handle of the malleus, with increased prominence of the short process and folds, indicating the indrawn membrane—the incus, stapes or promontory seen through an atrophied or transparent membrane—an abnormally prominent and large manubrium or a thin atrophied one.

Abnormal Tympanic Membrane with Perforation. If a perforation exists we should note its size, shape and situation ; the presence or absence of secretion ; the state of the mucous membrane on the inner tympanic wall, whether it is pale and dry, or secreting, congested and swollen, or the seat of granulations or polypi. Observe if the handle of the malleus is shortened, absent or adherent to the inner tympanic wall ; if the incus or stapes is exposed by the perforation above and behind ; if we can see the bulging promontory or the niche of the fenestra rotunda. We should observe the appearance of the remnant of the membrane. Is it greyish, white or congested ; thickened, opaque or the seat of a calcareous deposit ; or does it adhere to intra-tympanic structures ?

CHAPTER IV.

EXAMINATION OF THE MIDDLE EAR THROUGH THE EUSTACHIAN TUBE.

THIS consists mainly in observing the effects produced when compressed air is forced into the pharyngeal mouth of the Eustachian tube, termed inflation of the middle ear. We shall consider, first, the methods of inflating the middle ear; and, second, the information derived from these methods.

There are three methods of inflation usually practised:

(A) Catheterization.
(B) Politzer's method.
(C) Valsalva's method.

(A) *CATHETERIZATION OF THE EUSTACHIAN TUBE.*

A suitably formed tube—the Eustachian catheter—is passed through the inferior meatus of the nose into the pharyngeal opening of the Eustachian tube (Fig. 27), and then a current of air is forced through the catheter.

Eustachian Catheter (Fig. 28). This is a tube about six inches in length, made of either silver or vulcanite, curved at one end. The outer end is widened for receiving the mouth-piece of an india-rubber bag, while the inner end is narrower for insertion into the mouth of the Eustachian tube. In order to suit the varieties in the capacity and form of the inferior meatus and of the naso-pharynx, it is necessary to have a number of catheters differing in thickness, and in the length and degree of curvature of the beak. The most efficient

catheter is one which is fairly wide, and has a strongly curved beak. A ring is attached to that side of the outer end of the catheter which corresponds with the concavity of the beak, so that, when the

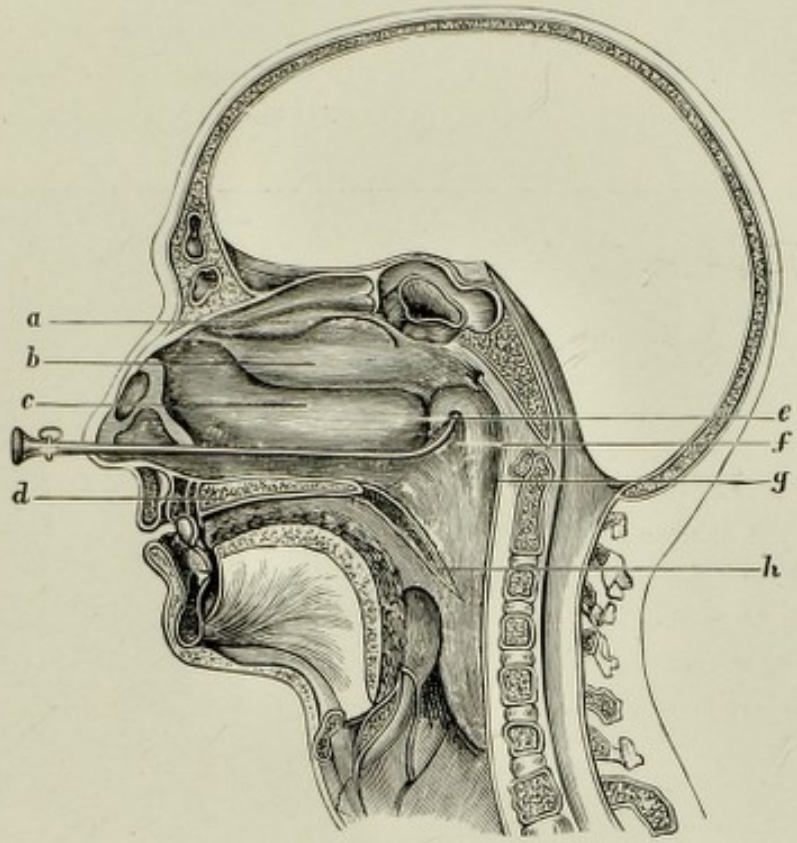

Fig. 27.—Vertical section of head, showing catheter introduced into the mouth of the Eustachian tube (after Politzer); *a*, superior spongy bone; *b*, middle spongy bone; *c*, inferior spongy bone; *d*, hard palate; *e*, posterior end of inferior spongy bone; *f*, mouth of Eustachian tube, with bulging above and behind; *g*, Rosenmüller's fossa; *h*, soft palate.

catheter is introduced, the situation of the ring informs the operator of the position of the beak. Vulcanite catheters possess several advantages over those made of silver. They are not injured by fluids injected through them; they are less unpleasant to the patient;

Fig. 28.—Vulcanite Eustachian catheter.

and by their elasticity the operator can more easily evade obstructions which may exist in the nasal passages.

Precautions before using the Catheter. Before using a catheter it is well to inspect the nasal passages by means of a mirror and

speculum (Fig. 29), in order to ascertain if any obstruction exists to the passage of the catheter, and the nature of it. The application to the mucous membrane of the nose of a 10 per cent. solution of cocaine on cotton wool diminishes the sensitiveness and widens the nasal passage. A current of air should also be forced through the catheter to test its permeability. Both patient and operator should be seated, the face of the former being well exposed to the light. As most

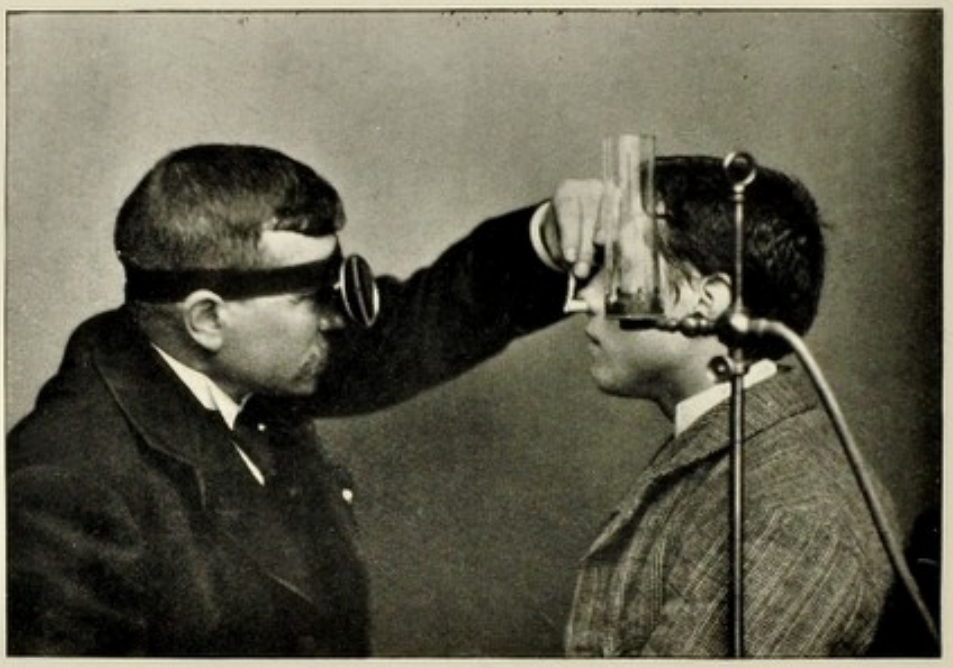

Fig. 29.—Anterior rhinoscopy.

patients tend to move the head backwards, while the catheter is being introduced, the back of the head should rest against some firm support.

First Stage of Catheterization. The first stage of the operation consists in passing the instrument through the inferior meatus of the nose, till the point of the beak is felt to be in contact with the posterior wall of the naso-pharynx. The four fingers of the surgeon's left hand rest on the patient's forehead and bridge of nose, while the thumb gently presses up the tip of the nose. The catheter is held like a pen between the thumb and first two fingers of the right hand, and the point of its beak is placed lightly within the nostril in contact with the floor of the nasal passage, which, it is to be remembered, is under the level of the inferior edge of the nasal entrance. The instrument should now be pushed carefully, but not too slowly, along the inferior meatus, with the point of the beak *kept in contact with* the floor until

it touches the hard posterior wall of the naso-pharynx. When introduced properly, the outer part of the catheter forms a right angle with the face. If it has slipped into the middle meatus—the most common mishap of the beginner—it will form an obtuse angle with the upper part of the face, and while in this position pain is apt to be excited.

Second Stage of Catheterization. This consists in moving the point of the catheter from the posterior wall of the pharynx to the mouth of the Eustachian tube. This may be done in several ways. *Politzer* turns the point of the catheter outwards into the fossa of Rosenmüller, and then, keeping the point in contact with the mucous membrane, he withdraws the catheter, until its point is felt to pass over the usually well-marked rounded projection forming the postero-superior border of the mouth of the Eustachian tube. *Löwenberg's* plan consists in turning the point of the catheter inwards towards the opposite side, and then withdrawing it until the beak hooks round the posterior edge of the nasal septum. The catheter (held between the thumb and index finger of the left hand while the other three fingers rest on the bridge of the nose and the forehead) is now rotated downwards and outwards, so as to describe a half circle, when the point is usually at the mouth of the tube. These methods possess the advantage of having well-marked and fixed anatomical guides, namely, the cartilaginous projection behind the mouth of the Eustachian tube, and the posterior edge of the nasal septum, respectively. Another method consists in withdrawing the catheter till the beak is opposed by the soft palate. The point is then turned outwards. The distance between the posterior wall of the pharynx and the edge of the soft palate presents great varieties during the movements of the palate, so that this method is uncertain. When the point of the beak is in the mouth of the tube, the ring should be directed towards the auricle of the same side.

Difficulties in the First Stage. These are due to obstructions encroaching upon or even obliterating the free space between the outer and the inner wall of the nasal passage. The most common of these are deflections or spurs on the septum or an enlarged inferior turbinal, or, still worse, both combined. By a little manipulation the surgeon is generally able to overcome the difficulties, or a thinner catheter and one having a smaller curve may be tried. The use of cocaine is of great service by shrinking the mucous membrane and widening the passage. Occasionally it may be necessary to introduce the catheter

through the opposite nostril. In this case an instrument is used having a very long beak and a pretty strong curve; it is passed in the way already described, and the point is then turned inwards and withdrawn till the beak is felt to be in contact with the posterior edge of the septum, when the point will be near to, or in the mouth of, the Eustachian tube of the opposite side, that is, the side upon which we wish to operate.

Difficulties in the Second Stage. In regard to this stage, there is sometimes difficulty in turning the beak of the catheter. This may be due to the catheter having slipped into the middle meatus or to the space between the posterior edge of the nasal septum and the mouth of the tube being unusually small, or the free space of the naso-pharynx may be diminished by swelling of the mucous membrane or by post-nasal growths. We can overcome these difficulties by keeping the point of the catheter on the floor of the inferior meatus or by using a catheter having a short and slightly curved beak. Spasmodic contractions of the pharyngeal muscles may hinder the turning of the catheter; these pass off when the patient breathes deeply a few times through the nose. The contact of the catheter with the mucous membrane of the nose or pharynx sometimes excites coughing, sneezing, or retching, but it is sufficient simply to let go the catheter until these pass off. There is occasionally slight bleeding, but rarely more than a stain of blood on the beak of the catheter is seen.

Third Stage of Catheterization. This consists in inflating air, by means of an air-bag, through the catheter into the middle ear. During inflation the catheter is retained *in situ* most conveniently by being held between the thumb and index finger of the left hand, while the hand is steadied by resting the other three fingers on the forehead and bridge of the nose (Fig. 30).

The air-bag (Fig. 31) is a pear-shaped india-rubber balloon, of a size capable of containing eight or ten ounces of fluid, furnished with a tubular mouth-piece, somewhat conical in shape, so as to fit accurately into the outer opening of the catheter. While the catheter is being introduced, the air-bag may be conveniently held in the left arm-pit of the surgeon.

The mouth-piece is placed in the outer opening of the catheter (Fig. 30), and the bag is then firmly compressed *laterally* between the four fingers and thumb, so as to force the air into the catheter. Before relaxing the hand, the mouth-piece of the bag should be withdrawn

from the catheter, and then the bag allowed to fill with air. Three or four compressions of the bag are generally sufficient. If the patient swallows during compression of the bag, the air usually passes in more freely, owing to the contraction of the *tensor palati* muscle. The surgeon must be careful not to push the catheter inwards while compressing the bag, which must at first be done *gently*, till he is convinced by the amount of resistance that the point of the catheter is really in the mouth of the tube, and not pressing on the mucous membrane. If, during compression of the air-bag, the point of the

Fig. 30.—Catheterization.

Fig. 31.—Catheter inflating bag.

catheter is forced through the mucous membrane, the air may pass under the mucous membrane and produce emphysema of the neighbouring parts, such as the soft palate, uvula, cheek, or neck. If the hand meet with great resistance, while attempting to compress the bag, we should not persist, but rather re-adjust the catheter, as the point is probably not engaging the mouth of the Eustachian tube. With this precaution, emphysema will be an extremely rare accident and can never prove a serious complication.

After use, the catheter must be cleansed by syringing with very hot water and then placed in a 5 per cent. solution of carbolic acid in water till again required, when it is syringed with very hot water before use. Metallic catheters can be sterilized by boiling. In

syphilitic cases it is imperative that the patient have a special catheter reserved for his use.

Eustachian Bougies. When catheterization fails in opening the tube sufficiently to allow of a stream of air passing into the tympanic cavity, the *experienced* surgeon is justified in attempting gradual mechanical dilatation by means of thin gum bougies with olive-shaped, conical or cylindrical points which, before use, may be dipped in liquid vaseline or other medicated substance. A series is required ranging from a half to one millimetre in diameter. An olive-shaped one is the most useful in overcoming a stricture. Bougies are introduced through a catheter, which is better to be short and to have an acutely curved beak. The point of the bougie should be introduced as far as the tympanic end of the Eustachian tube, the length of which is an inch and a half. The length of the catheter should be marked off with ink on the bougie, so that when the latter is passed into the catheter (properly introduced into the Eustachian tube) we may know from the ink-mark when the point of the bougie has reached the inner end of the catheter. A second mark is made an inch and a half from the other, visible when the bougie is introduced, which informs the operator how far into the Eustachian tube the point of the bougie has at any moment reached. The bougie should remain in position for from five to ten minutes. It should be cautiously and slowly introduced. Difficulty in passing a bougie may not be due to constriction but to folds of the mucous membrane. Several efforts at different times may be necessary before its complete introduction is possible. Air afterwards enters the tympanic cavity by the catheter more fully and freely, and there is often relief to the deafness and subjective sounds. If its action prove favourable the bougie may be introduced twice a week for several weeks.

FIG. 32.—Politzer's method of inflating the middle ear.

(B) *POLITZER'S METHOD OF INFLATING THE MIDDLE EAR.*

We pass now to the very important method of inflating the middle ear (Fig. 32), named after its discoverer, Professor Adam Politzer, of Vienna.

Description of Politzer's Method. After the patient has taken a small quantity of water into his mouth, the beak-shaped nasal piece of a tube connected with an air-bag is placed about one-third part of an inch into the outer angle of one nostril close to the floor, the nasal passages being then completely closed in front by compressing the nostrils firmly

with the thumb and index finger of the left hand. The air-bag is then grasped by the right hand; the patient is told to swallow, and immediately after the bag is forcibly compressed, and suddenly emptied into the closed nasal cavity; the bag must not be allowed to fill with air till the nose-piece is removed from the nostril. The closure of the nasal cavity posteriorly is effected in the act of swallowing by the elevation of the soft palate and its apposition to the posterior wall of the pharynx, while the sudden increase of density in the air contained in the shut nasal cavity, produced by emptying the air-bag, overcomes the resistance in the Eustachian tubes, and air passes freely into the tympana. In the act of swallowing, also, the contraction of the muscles of the Eustachian tubes facilitates the passage of air into the tympana. If there is difficulty in making the inflation synchronize with the act of swallowing, it is a good plan to observe the larynx and compress the bag when the larynx begins to rise in swallowing.

Modifications of Politzer's Method. The ordinary method of swallowing may not yield a successful result, or it may be impracticable, as in young children. In such cases the vigorous sounding of "ah" or the pronouncing of "hook," with prolonged emphasis on the "k," or the act of crying in the case of a child, will often prove successful. Blowing out the cheeks during inflation, as recommended by Holt, often proves a good substitute for the swallowing of water. In most cases, however, the swallowing of water seems to be more effectual, owing to the assistance gained by the contraction of the tensor palati in swallowing. If we desire a greater effect to be exercised upon one ear, we may close the opposite ear tightly with the finger, and cause the patient to incline his head well to the side on which the least effect of inflation is desired. We can often tell by the sense of resistance to the hand during compression of the bag if the soft palate has closed accurately.

Instruments for Politzer's Method. The bag used may be the same as for catheterization with a suitable nasal tube. Politzer himself

Fig. 33.—Politzer's nasal piece and tube.

used a nasal tube shaped like a catheter, and connected to the mouth-piece of the bag by means of a soft india-rubber tube, two or three inches in length (Fig. 33). The beak-shaped extremity of the hard

nasal piece, which may be somewhat flattened, should be covered with soft india-rubber tubing, which renders it less unpleasant, and less

Fig. 34.—Soft nasal piece.

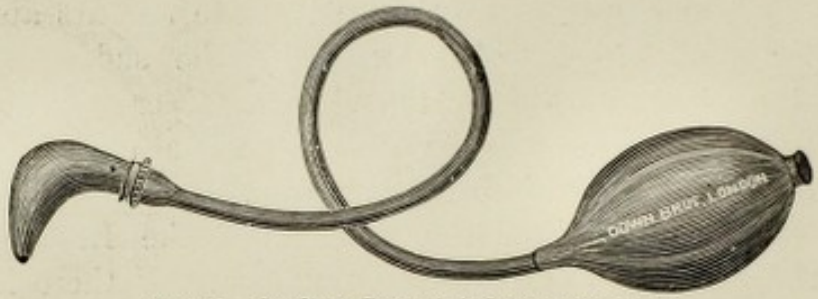

Fig. 35.—Gardiner Brown's inflating apparatus.

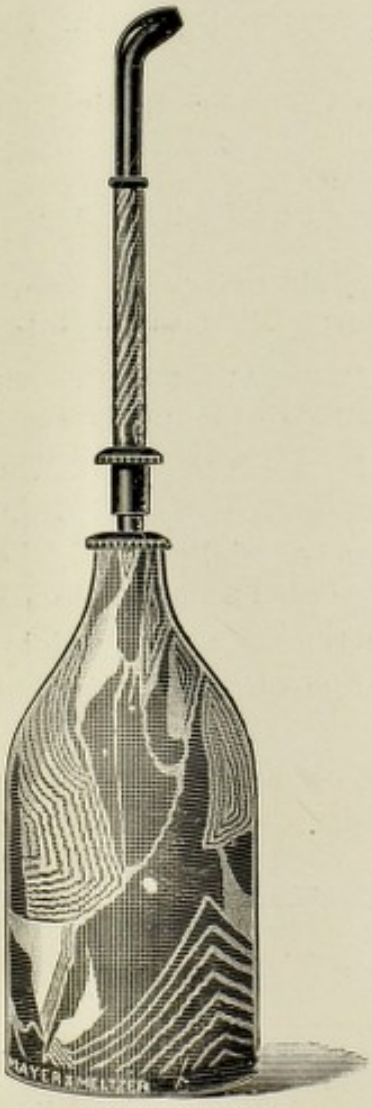

Fig. 36.—Bottle-shaped inflating bag.

likely to hurt the nasal mucous membrane. A fresh piece of tubing should be affixed for each patient. A soft nasal piece (Fig. 34) made of thick india-rubber somewhat flattened at the side is perhaps less disagreeable than the thin nasal piece, and is therefore specially suited for children and sensitive persons; the nasal piece of Gardiner Brown's inflating apparatus is also suitable for children (Fig. 35). Mayer & Meltzer have introduced a convenient bottle-shaped bag with soft nozzle (Fig. 36). When thick olive-shaped nasal pieces are used with the intention of completely closing one nostril, there is apt to be reflux of air rendering the inflation less efficient. An ordinary india-rubber enema-bag of six or eight ounces capacity, with a piece of soft india-rubber tubing covering and projecting from its hard ivory mouth-piece, suits very well. In all cases great care should be taken that the nose-piece is thoroughly cleansed and disinfected after use. An adult patient may practise self-inflation by closing the nostrils firmly over a nose-piece inserted into one nostril, while he himself blows through the tube (Fig. 37).

Disagreeable Symptoms from Politzerization. Occasionally pain in the stomach is set up, owing to insufficient closure of the pharyngeal cavity, and the consequent passage of air down the œsophagus; but this is immediately relieved by eructation, or by a few full inspirations. Temporary giddiness or tinnitus rarely results. There should only be gentle pressure upon the bag at the first inflation, to prevent fright, while if there is atrophy of the tympanic membrane rupture may result from strong pressure, especially if there is marked Eustachian patency; also in acute tympanic inflammation only slight pressure should be employed. The inflation may be quite successful and yet the patient be unconscious of any sensation in his ear.

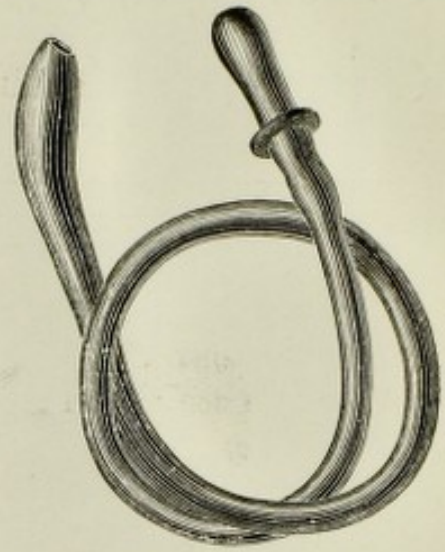

FIG. 37.—Simple inflating tube for children, or for auto-inflation.

(C) *VALSALVA'S METHOD OF INFLATING THE MIDDLE EAR.*

Valsalva's Method of inflating the middle ear consists in making a forced expiration, with the lips closed and the nostrils firmly compressed with the fingers. In this way, the air contained in the naso-pharyngeal space becomes more or less condensed in proportion to the strength of the expiratory muscles in the given case. Where the resistance offered by the walls of the Eustachian tube or by the tympanic membrane is inconsiderable, the condensed air passes through the Eustachian tube into the tympanic cavity, producing an unpleasant sense of fulness or click in the ear. This method is often, however, quite ineffectual, and, even in a normal condition of the middle ear, many persons fail to inflate in this way. Where the membrane is perforated it is more likely to be successful, in consequence of the diminished resistance. Rarely Valsalva's method succeeds in inflating the middle ear after the catheter and Politzerization have failed; *its frequent repetition is apt to be detrimental to the hearing.*

Negative Valsalva's Method. This consists in swallowing several times, while the mouth and nose are closed. A rarefaction of the air in the naso-pharyngeal cavity is thus produced, and, provided the Eustachian tube is in a normal condition, some of the denser air in the tympanum will pass into the naso-pharyngeal cavity. A sensation of unpleasant pressure is experienced in the ear, which is removed when the patient swallows in the ordinary way.

INFORMATION DERIVED FROM THE VARIOUS METHODS OF INFLATING THE MIDDLE EAR.

This information is mainly derived from auscultation, inspection, and the effects upon the hearing.

FIG. 38.—Auscultation of the ear during catheterization of the middle ear.

Auscultation of the Ear (Fig. 38). Valuable information is derived from the kind of sound produced by the current of air on the walls and contents of the middle ear. In order to hear these sounds the surgeon must auscultate the ear during the passage of the current, and for this purpose the external meatus of the patient is connected with that of the surgeon by an india-rubber tube, thirty inches long, termed the auscultation tube (Fig. 39). This tube is furnished at each end with an ear-piece, one for the use of the surgeon, and the other for the patient. Different sized ear-pieces should be at hand in order to fit, without holding, the particular meatus, and they should have distinctive colours or shapes, so that one may be reserved for the surgeon. To prevent interfering with the passage of sound from the patient's ear to the surgeon's, nothing should

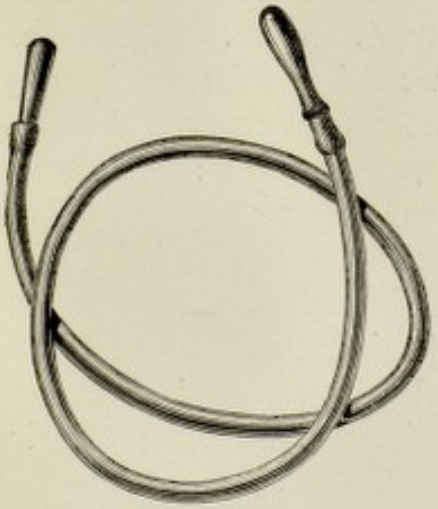

FIG. 39.—Auscultation tube.

be allowed to touch or press upon the auscultation tube when in use, while we must see that the ear-pieces are not obstructed with any material, such as wax. It is important that the student should familiarize himself with the sounds heard by auscultation, and for this end he should always use the auscultation tube while inflating.

Sounds heard during Catheterization. In the normal state the sound has a distinctly blowing character, compared by Politzer to that produced when we place the tongue against the hard palate and make a quick expiration with the lips slightly apart. In undue patency, as in oto-sclerosis, the sound has a fuller, drier, and more frictional character than in the normal. When there is a thin fluid secretion in the tympanum or Eustachian tube, it has a moist crackling or bubbling character. A rough vibrating sound generally indicates that the point of the catheter is not properly inserted in the mouth of the Eustachian tube. If the sound be weak, somewhat distant, or interrupted, there is usually obstruction in the Eustachian tube or tympanic cavity ; this is confirmed if it become fuller and stronger when the patient swallows at the moment of the inflation. When the tympanic membrane is indrawn but movable, the sound is usually very distinct, and of a clicking or thudding character. A crepitating sound may be heard just after the inflation, due to the retraction of adhesions, etc., previously stretched. Probably the most characteristic sounds are heard in perforation of the membrane. If the perforation be small, with fluid secretion in the tympanum, there is a loud hissing sound, with perhaps gurgling. When the perforation is large, a loud blowing sound is heard, sometimes painful to the listener, and conveying a sense of nearness ; but, if there is narrowing of the tympanic end of the Eustachian tube, the sound may be of a whistling or squeaking character. Of course, when there is stenosis of the Eustachian tube these perforation sounds are not heard.

Auscultation during Politzerization (Fig. 40) does not yield us so much or so distinct information as by catheterization, because there may be an absence of sound during Politzer's method, or the sound caused by the act of swallowing may muffle the weaker sounds in the ear. The practised surgeon, however, is often able to hear many of the sounds, which have been described as heard during catheterizing, such as the "perforation râle," the well-marked sound heard when the indrawn tympanic membrane returns to its proper position, or when there is secretion in the tympanum.

Auscultation during Valsalva's Experiment does not yield much information. Its chief value is in diagnosing a perforation by the well-marked hissing sound, caused by the passage of the air through the perforation. During the negative Valsalva's experiment there is occasionally heard a slight crackling sound.

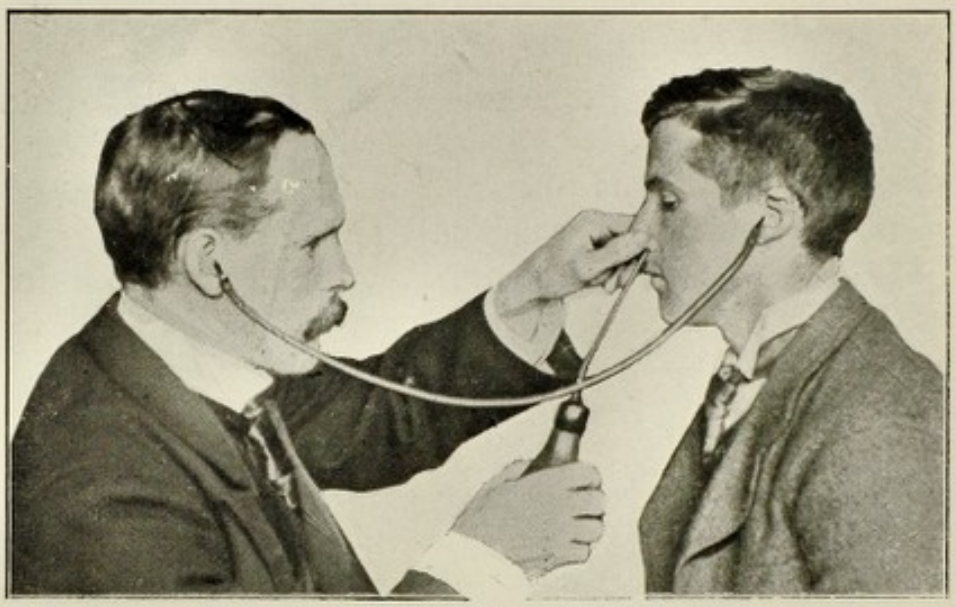

Fig. 40.—Auscultation during Politzerization.

Inspection of the Membrane during Inflation. During Valsalva's method we may get evidence of a perforation by the appearance of secretion at a point in the membrane, or we may observe an outward movement of the membrane, especially at the postero-superior part, while during the negative method it may be seen to recede. More important information is derived from inspecting the membrane during Politzerization or catheterization. By a little practice the examiner is quite able to inflate by Politzer's method and inspect at the same time. We may make out in this way the site of a perforation by observing air bubbles being projected outwards during inflation, or thick secretion protruding like a ball from the orifice. If secretion is in the tympanic cavity without a perforation, we may see little circles through the membrane after the inflation, or its colour may change owing to the membrane being freed from the inner wall of the tympanum. When the membrane is indrawn and movable, we may see the unfolding outwards of the membrane with change of colour. A cicatrix or an atrophied portion will be seen to bulge out like a bladder; and, if watched, these bulgings will be seen to disappear shortly afterwards. The general mobility of the membrane may also be ascertained by inspection during inflation. These various effects also demonstrate the permeability of the Eustachian tube.

Ear-Manometer. This gives ocular demonstration of the changes in the density of the air in the tympanum produced by inflation. A simple form (Fig. 41) consists of a fine glass tube, having the shape of a horse-shoe. This is fitted air-tight into the external meatus by means of an india-rubber plug. A drop of red ink, or a solution of carmine, is placed in the tube near its outer end. The falling and rising of the coloured solution indicate the fluctuations in the pressure of the air in the tympanum or meatus.

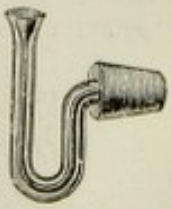

Fig. 41.—Ear-manometer.

Effects of Inflation upon the Hearing. Valuable information is frequently obtained regarding the nature of the disease, from observing these effects. If, for example, in a case of chronic deafness without perforation, successful inflation produces no effect upon the hearing, or sounds in the ear, the prognosis is unfavourable. We have probably to do with intra-tympanic fixations or stiffenings, or labyrinthine trouble. If, on the other hand, distinct improvement is at once manifested, and especially if it continues for several hours or a day or two, we then have probably to do with an exudative middle ear catarrh which justifies a favourable prognosis. If the improvement lasts for only two or three minutes, there are probably adhesions, pseudo-bands, retraction of the tendon of the tensor tympani, or atrophy—the temporary stretching causing a momentary improvement. In purulent disease of the middle ear with perforation, improvement in hearing and mitigation of the sounds in the ear after inflation indicates the probability of permanent improvement. Inflation is sometimes followed by a temporary feeling of increased deafness, probably owing to the excessive tension of the tympanic membranes or to labyrinthine concussion.

Sensations of the Patient during Inflation. The sensations of the patient as to whether the current of air penetrates to the tympanum are not always to be depended upon. A sensation of fulness in the ear is often experienced, continuing, with sometimes a feeling of dulness, for a short time afterwards. In many cases, where by auscultation we know that the air has entered the tympanum, the patient says that he hears nothing. On the other hand, the patient sometimes says that he feels it in his ear, when we know that it has not penetrated to the tympanum. Many patients, however, have a correct appreciation of the sensation, and can tell when the operation is, and when it is not, successful. The perforation sound is usually sufficiently loud as to startle the patient. In children, we may know that Politzer's method is efficient by the child suddenly raising his hands up to his ears—due to the marked sensation which is often felt during inflation in the middle ear catarrh of childhood.

CHAPTER V.

EXAMINATION OF THE PHARYNX, NASAL PASSAGES AND NASO-PHARYNX.

Light. For a superficial examination of the mouth and throat daylight, either used directly (direct method) or reflected by means of a mirror, suffices; but for a thorough and intimate exploration of the nasal and post-nasal spaces one or other of the more intense forms of illumination already described (p. 10) is essential. A 32 candle-power electric light, furnished with a frosted globe and attached to a wall bracket which allows free movement in all directions, is in common use, and the addition of a hood-reflector with a condensing lens increases the intensity of the light. A Nernst lamp or an oxy-hydrogen flame yields a still more powerful light, especially useful when operating in the deeper recesses of the nose.

Mirror. In examining by reflected light (indirect method), a suitable concave mirror is required to collect the rays of light and reflect them into the desired cavity. This mirror has a larger diameter and a longer focal length than that used solely for aural examination. The writer uses one of 4 inches diameter and 8 inches focal length, serviceable alike for aural and rhino-laryngeal work.

Cleansing of Instruments. The greatest care should be exercised in cleansing all instruments before and after use. Failing a small sterilizer into which to place all soiled instruments, thorough washing under the hot water tap, followed by immersion in carbolic acid or lysol solution, 5 per cent. of the former or 1 per cent. of the latter, is sufficient. A separate set of mirrors having some distinguishing mark, such as a handle of a different colour, should be reserved for specific cases.

Examination of Patient. The patient should be seated erect in

a suitable chair (see p. 7), grasping its arms with the hands, whilst the examiner sits facing him at a slightly lower level (his eyes should be on a level with the patient's nose). The position of the light preferred by most examiners is upon the patient's left side, almost on a level with his ear. Some, however, favour placing the light upon the other side as less liable to be obstructed by the operator's hand.

The forehead-mirror, attached to the examiner's head by a band, spectacle frame or flexible metal hoop, and having the perforation in the centre of the mirror opposite the right eye, is manipulated so as to reflect light on to the patient's face. It is important that the beginner should learn to employ both eyes, and not fall into the error of using only the one uncovered by the mirror. When both eyes are used a better perspective view is obtained, and the orientation of the parts is more effective.

The order of examination adopted by most surgeons is as follows:

(A) Pharyngoscopy.
(B) Anterior rhinoscopy.
(C) Posterior rhinoscopy.

As a preliminary it is desirable to view the general aspect of the patient's head, neck and face, noting the state of the eyes and complexion, the presence or absence of scars, enlarged glands, etc.

(A) PHARYNGOSCOPY.

We should first examine the teeth, if present, and note their condition; the gums, lips and tongue for excoriations, ulcers, etc.; also the alveolar arches for defective development or congenital malformation. The hard palate is best seen when the patient's mouth is well open and his head tilted backwards.

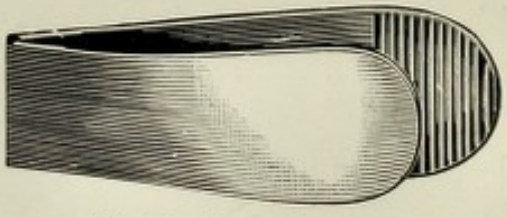

Fig. 42.—Tongue depressor.

Examination of Pharynx. In order to examine the pharynx a tongue-depressor is required in most cases. A serviceable form (Fig. 42) consists of a double spatula hinged together and constructed of vulcanite or metal; the latter is preferable as it facilitates sterilization. The under surfaces of the tips of the two pieces should be corrugated to prevent slipping. Fränkel's tongue-depressor (Fig. 43) is a good one and is widely employed. The thimble depressor of Baber is suitable for children,

although perhaps for the very young the fore-finger alone is best. In default of one of the above, recourse may be had to a tea-spoon or dessert-spoon, the handle of which makes an efficient substitute.

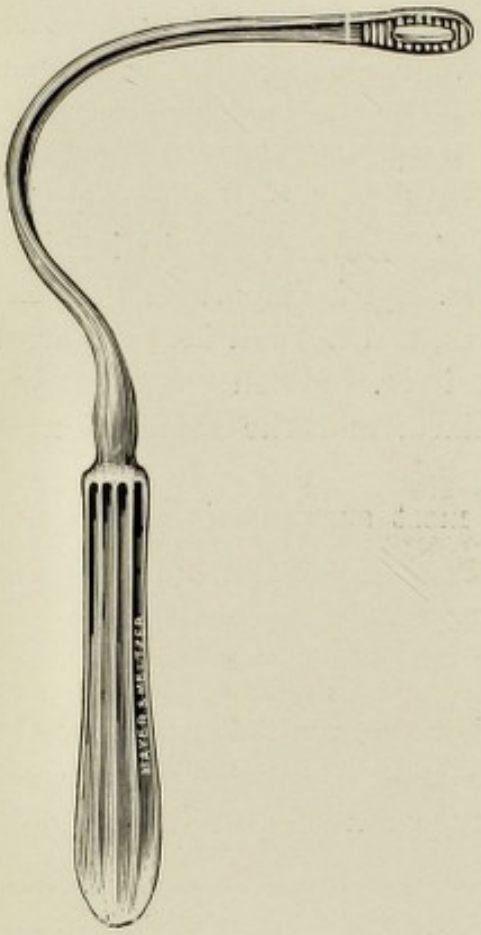

Fig. 43.—Fränkel's tongue depressor.

Light is reflected by the mirror through the widely opened mouth into the pharyngeal cavity, or direct rays from the sky or lamp are arranged so as to pass into the open mouth. The patient is instructed to breathe quietly through the mouth; and, by means of the tongue-depressor applied flat upon the dorsum of the tongue, gentle but firm downward traction is made. Care must be taken not to insert the instrument too far as heaving or retching is apt to be excited. A better and more complete view of the back of the pharynx is obtained when the patient sounds "ah," as during its phonation the soft palate is elevated. The introduction of a tongue-depressor, no matter how gently, excites in some people violent contraction of the muscles of the pharynx and troublesome retching. In these cases the use of the finger may be more successful. Arching upwards of the tongue is sometimes a hindrance to a satisfactory examination. This is best overcome by exerting firm and constant pressure downwards for 20 or 30 seconds with the tongue-depressor, whereupon the muscles become exhausted, and the tongue subsides into the floor of the mouth. In an unruly child the closure of the nostrils by the fingers ensures a speedy opening of the mouth.

Structures seen by Pharyngoscopy. The curtain of the soft palate above, with the uvula hanging down from its free edge in the middle line. Diverging from the base of this on either side the anterior and posterior pillars of the fauces with the tonsil lying in the niche between. Behind is the back wall of the pharynx lined by mucous membrane. Sometimes a view may be obtained of the posterior surface of the tongue, and not infrequently in children strong

traction with the tongue-depressor will bring the tip of the epiglottis into view. The normal colour of these parts is a rosy pink; but considerable variations of tint are compatible with a healthy state.

Pathological changes in the Pharynx. Resulting from catarrhal or inflammatory attacks, especially those associated with a gouty or rheumatic diathesis, the mucous membrane of the pharynx may be thickened, swollen, of a raw fleshy appearance, and intolerant to touch. Associated with this the veins coursing over the back wall are not infrequently dilated and may even be thrombosed. In the condition known as granular pharyngitis small, white or pink, raised patches of adenoid tissue are seen studding the rather pale mucous membrane of the posterior pharyngeal wall. Larger, often elongated, flat elevations of similar tissue may result from irritating discharges from the naso-pharynx. The uvula may be elongated, œdematous, puckered or dragged up to one side owing to paralysis or cicatricial contraction; or it may be bifid.

The tonsils, especially in children, are frequently hypertrophied. They may be so enlarged as to meet in the middle line. The tonsillar crypts may be the seat of inflammation giving rise to "the spotted throat" (acute follicular tonsillitis), or they may be filled with white or yellowish white, cheesy looking matter (chronic follicular tonsillitis). Ulcers on the soft palate or tonsils may be seen. These are most frequently observed in syphilis, diphtheria or scarlet fever; in the two latter they are of course more likely to be observed at the bedside. The fauces may be generally injected and œdematous as in acute pharyngitis, or they may be covered with a membranous exudate as in diphtheria. In peri-tonsillar abscess the soft palate on the affected side is red, tense and much swollen, and protrudes forwards and downwards into the mouth. The soft palate may be cleft, or it may be the seat of scars or adhesions to the pharyngeal wall; or there may be a perforation from old gummatous ulceration. The faucial mucous membrane may be atrophied and dry-looking, and crusts of a dirty green colour may be adherent to the back wall. Pus or mucus is sometimes seen escaping downwards from the naso-pharynx.

(B) ANTERIOR RHINOSCOPY.

By anterior rhinoscopy (Fig. 44) is meant a visual examination of the interior of the nose through the anterior nares. For this purpose an efficient nasal speculum is used to dilate the alæ nasi, and a more powerful light is required than in pharyngoscopy; furthermore, the room should be darkened so as to exclude all other conflicting sources of light.

Nasal Specula are so numerous and varied that a beginner is at a loss which one to select. The following are a few of the more widely used: (1) the bivalve type, of which Roth's (Fig. 45), Duplay's, Fränkel's, Lennox Browne's, and Krause's, are examples; (2) the self-retaining variety, of which Thudicum's spring nasal speculum

(Fig. 46) and Baber's self-retaining nasal speculum are favoured by many. Personally the writer uses a bivalve, either Roth's or Krause's.

Having focused the light on the anterior nares, Roth's speculum, held in the left hand, is introduced with the blades closed and the

Fig. 44.—Anterior rhinoscopy.

handles directed upwards (Fig. 44). By slight pressure on the handles, the blades are forced apart as far as is necessary to obtain a view of the parts, without causing the patient undue discomfort. This speculum has the great advantage that the hand manipulating it

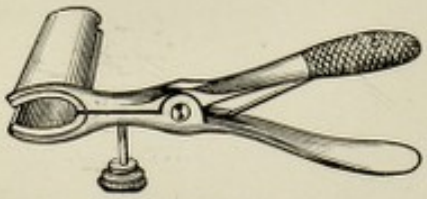

Fig. 45.—Roth's speculum.

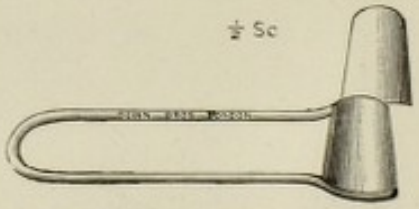

Fig. 46.—Thudicum's spring nasal speculum.

is entirely out of the way. Krause's speculum, with the long handles downwards, admits of a less constrained position, which is no small comfort to the operator during prolonged nasal operations.

Use of Cocaine and Adrenalin. In order to make a thorough examination, it is very often necessary to use a 10 per cent. solution of cocaine, with a few drops of a solution of adrenalin chloride (1-1000) added to it, applied to the nasal mucous membrane either

by means of cotton wool on a cotton holder, or a spray. Cocaine and adrenalin contract and blanch the parts, and at the same time produce local anæsthesia, thereby permitting of free manipulation with a probe. A suitable nasal probe is depicted in Fig. 47. It is Hajek's pattern, constructed of copper nickled over, and can be readily bent to any required angle. It is specially useful in exploring the nasal

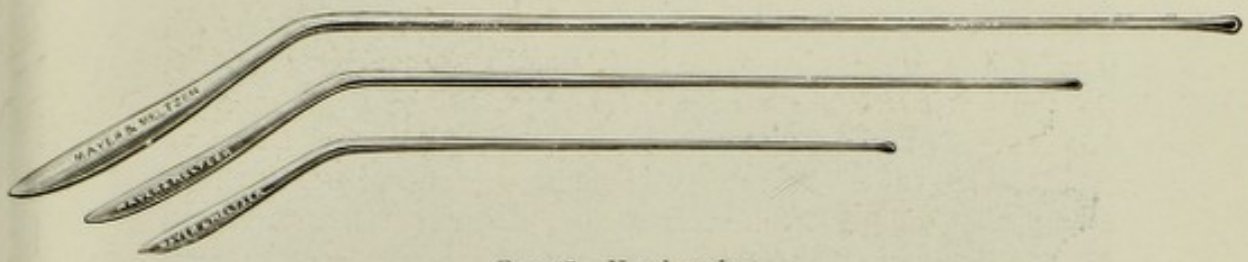

Fig. 47.—Nasal probes.

accessory sinuses; valuable information may also be derived by its use as to the consistence and mobility of growths, such as polypi, localized hypertrophies or bone cysts.

Parts seen by Anterior Rhinoscopy. Generally the most prominent object which first meets our view on looking into the nose is the anterior end of the inferior turbinated body. In the normal condition the colour of its mucous membrane is reddish pink ; but considerable variations in tint are compatible with a healthy condition. In many cases ridges, protuberances or concavities are seen upon the septum. Above and behind the anterior end of the inferior turbinal lies the anterior end of the middle turbinal, and between these two is the middle meatus, a region which merits the closest scrutiny. In the anterior half of the middle meatus, upon the outer wall, is a gutter-like depression, the hiatus semilunaris, curving upwards in front to receive the opening from the frontal sinus (Fig. 48). At its posterior end is the ostium of the antrum of Highmore. Forming the anterior and lower border of the hiatus semilunaris is a crescentic ridge of bone covered with mucous membrane—the processus uncinatus, which varies considerably in size, and may be so hypertrophied as to simulate the middle turbinated body. Constituting part of the upper border of the hiatus is the bulla ethmoidalis, a bony expansion of the lowest and largest of the anterior ethmoidal cells. Opening on the bulla, or in the groove between this and the middle turbinal, generally lie the principal orifices of the anterior ethmoidal labyrinth. Below the inferior turbinated body is the inferior meatus of the nose, along which the Eustachian catheter is passed. In a few cases, where the inferior meatus is unusually wide, and in the condition known as atrophic rhinitis, the posterior wall of the naso-pharynx, the ostium of the Eustachian tube and the movements of the levator palati muscle can be observed.

The commoner Pathological Conditions seen by Anterior Rhinoscopy. On separating the blades of the nasal speculum, one not infrequently sees the

anterior end of the inferior turbinal, red and greatly swollen, obstructing entirely our view of the other parts. At other times inspection of the deeper regions is hindered by a large spur or marked deflection of the septum to one side. The anterior end of the middle turbinal may appear as a large pale rounded mass impinging on the septum, or there may be an appearance as if two middle turbinals were present when the processus uncinatus or the bulla

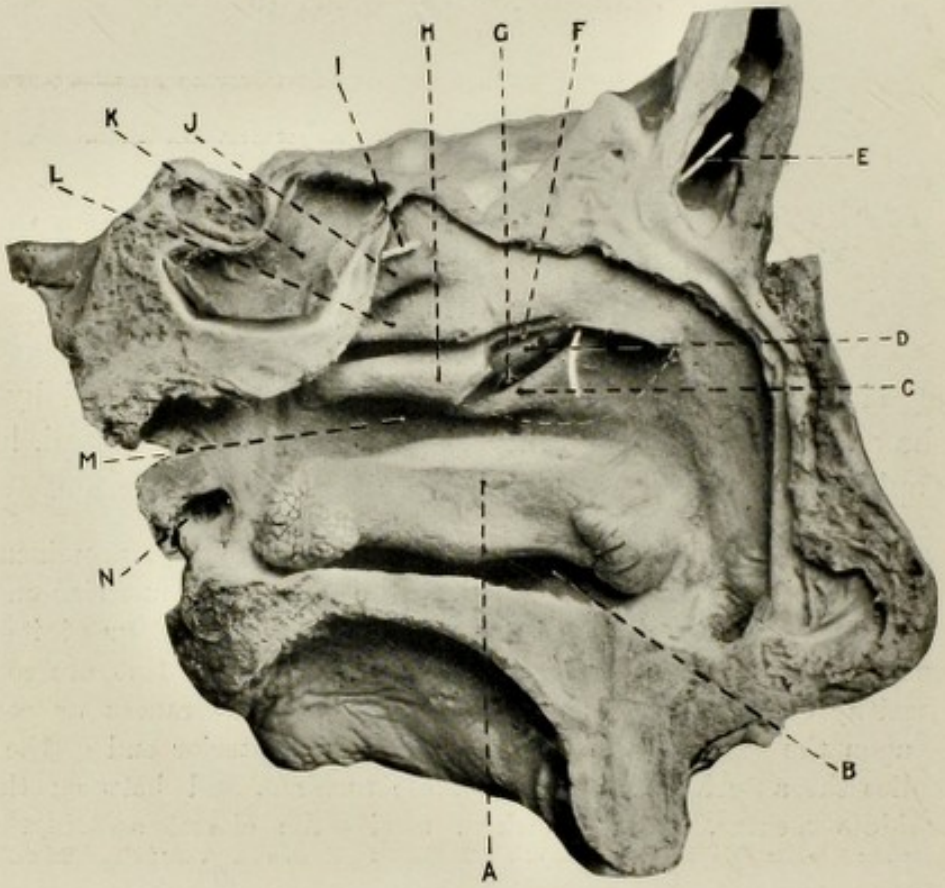

FIG. 48.—The outer wall of the nasal passages. The anterior half of the middle turbinal has been removed in order to expose the contents of the middle meatus. The dotted line indicates the outline of the portion of the middle turbinal which has been removed. A, Inferior turbinal, showing hypertrophy of the anterior and posterior ends; B, inferior meatus of the nose; C, processus uncinatus; D, bulla ethmoidalis; E, bristle passed through the ostium frontale into the anterior end of the infundibulum; F, recess between bulla and middle turbinal where the principal opening into anterior ethmoidal cells lies; G, ostium maxillare; H, middle turbinal; I, bristle passed through ostium of sphenoidal sinus of left side; J, supernumerary superior turbinal; K, right sphenoidal sinus, unusually large; L, superior turbinal; M, middle meatus; N, pharyngeal orifice of Eustachian tube.

ethmoidalis is enlarged. The presence of pus should be carefully noted and its source investigated. Mucous polypi in the nose appear as smooth pendulous pale-blue swellings, freely movable with a probe, and generally accompanied by more or less muco-purulent discharge. The nasal passages, instead of being obstructed, may appear abnormally patent, and the mucous membrane atrophied, dry looking, and covered with greenish or yellowish, badly-smelling crusts (ozœna). In this condition the inferior turbinals usually appear stunted and under-developed; in marked cases they are merely represented by a small low ridge running from before backwards. The middle turbinals, in most cases of

ozœna, participate in the general atrophy, as do also the contents of the middle meatus; but in some instances the middle turbinals appear hypertrophied, while in others the bulla ethmoidalis and the processus uncinatus stand out in marked relief from the surrounding atrophic areas.

(C) POSTERIOR RHINOSCOPY.

By posterior rhinoscopy is signified an indirect visual examination of the naso-pharynx and posterior aspect of the nasal chambers.

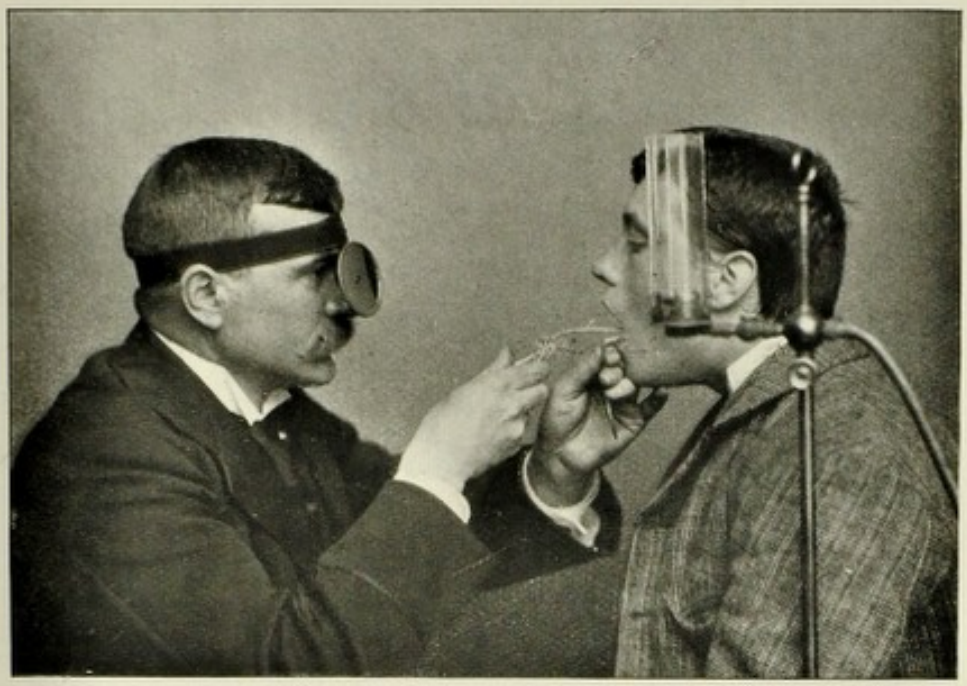

FIG. 49.—Examination by posterior rhinoscopy.

Repeated practice is required in carrying out this method of examination in order to acquire sufficient dexterity, as, even with the most skilful, indifferent success is far from uncommon. In cases of nasal stenosis, it is advisable to cocainize freely the nasal passages before attempting the examination of the naso-pharynx. The tongue must be well depressed by a tongue depressor, in order to secure a clear space between the base of this organ and the soft palate. It is a good practice to encourage the patient to make an effort to respire quietly through the nose while the tongue depressor is in position. Should the soft palate constantly retreat upwards and the attempts to breathe through the nose fail, the patient should be directed to pronounce the French word "on"; this frequently permits of a better view. If, after repeated attempts, only partial success is met with, the throat

may be cocainized; this generally permits of a satisfactory examination. If that fails, one or other of the various palate-retractors should be called into requisition.

Method of Conducting Examination (Fig. 49). A forehead reflector is used as in the examination of the pharynx, the tongue is depressed by one or other of the instruments already described for that purpose, and a small mirror, the face of which has been previously warmed over a spirit lamp or in hot water, is cautiously introduced into the throat with the reflecting surface upwards. Care must be

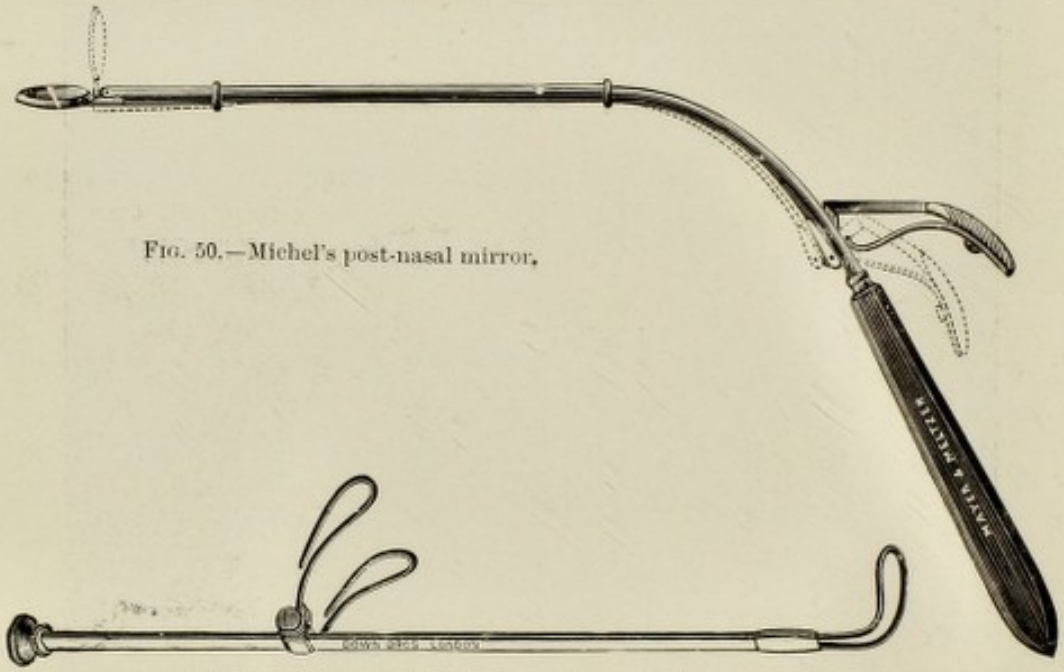

Fig. 50.—Michel's post-nasal mirror.

Fig. 51.—White's self-retaining palate retractor.

taken, in introducing the mirror, to avoid touching the soft palate or uvula. Once past these highly sensitive regions the chief difficulty is over, as the back wall of the pharynx is less sensitive to accidental contact. Perhaps the best form of mirror is that known as Michel's (Fig. 50), having a mechanism by means of which the angle made by the small mirror with the shaft may be regulated as desired. A No. 1 or No. 0 laryngeal mirror does very well, and in point of fact is preferred by many.

Palate-retractor. In the event of great difficulty being experienced in the examination, the employment of a palate-retractor may be necessary. A serviceable form is White's self-retaining palate-retractor introduced by Baber (Fig. 51). It possesses a movable clip, with which to clamp it over the upper lip. The pharynx and naso-

pharynx should be numbed before the introduction of a palate-retractor. For this purpose a mixture of a 10 per cent. solution

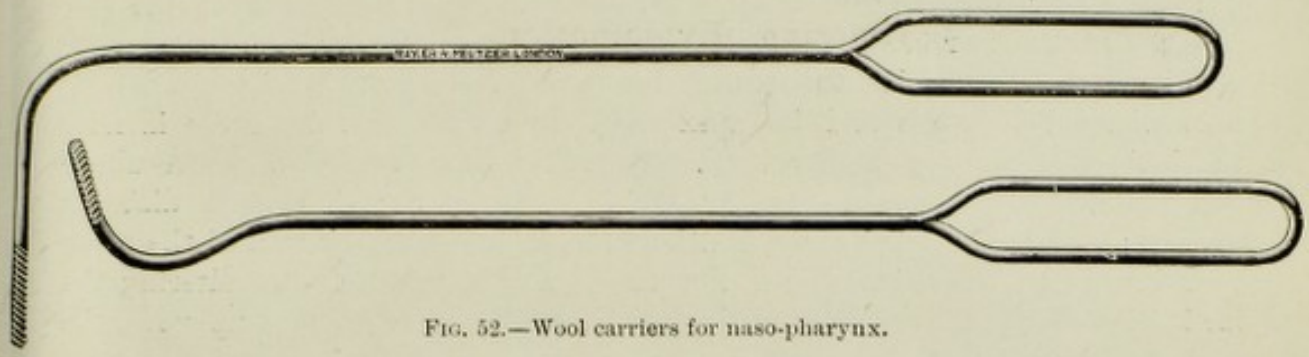

Fig. 52.—Wool carriers for naso-pharynx.

of cocaine and a few drops of solution of adrenalin chloride (1-1000) is first sprayed over the fauces. After a short interval this is followed by brushing the back wall of the pharynx and the lower part of the naso-pharynx and uvula with cotton wool fixed to a wool carrier (Fig. 52), and dipped in the same mixture. Novocain (20 per cent. solution) may be substituted for the cocaine and adrenalin—this is said to be less toxic. The hook of the retractor is rapidly passed up behind the soft palate and the clip adjusted over the upper lip, and steady traction exerted on the soft palate. In this way a very complete view of the naso-pharynx may usually be obtained (Fig. 53), as a much larger mirror, such as a No. 4, or even No. 5, can be used.

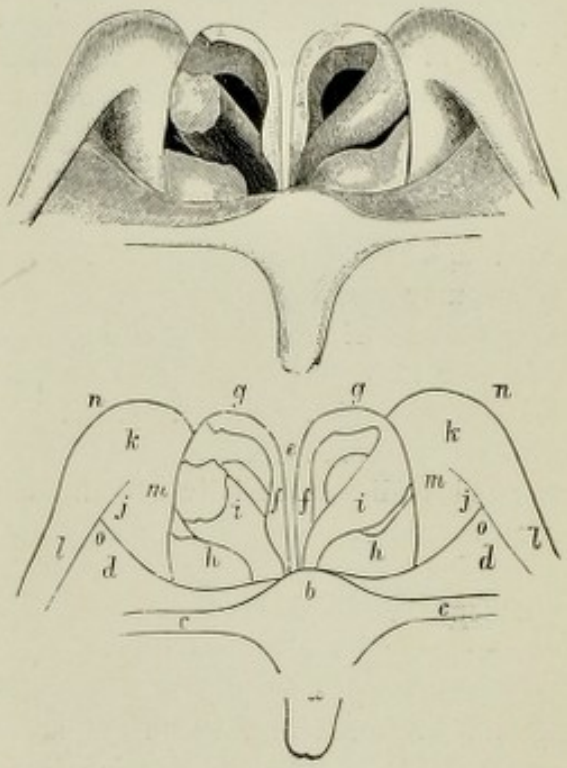

Fig. 53.—Posterior rhinoscopic view, as seen with the mirror in the ordinary position. *a*, Posterior surface of uvula; *b*, uvula cushion; *c*, *c*, posterior margin of palate; *d*, *d*, levator cushions; *e*, septum nasi; *f*, *f*, swellings on the sides of septum; *g*, *g*, choanæ or posterior nares; *h*, *h*, inferior turbinated bodies; *i*, *i*, middle turbinated bodies; *j*, *j*, Eustachian openings, more strictly the depressions leading to them; *k*, *k*, Eustachian cushions; *l*, *l*, salpingo-pharyngeal folds; *m*, *m*, salpingo-palatine folds; *n*, *n*, position of upper part of Rosenmüller's fossæ; *o*, *o*, posterior tubal sulci. (Cresswell Baber.)

Image by Posterior Rhinoscopy (Fig. 53). The image seen in the mirror when its surface is directed upwards and forwards includes: (1) the posterior edge of the nasal septum, which may be recognized as paler in colour than the surrounding parts. On each side of the septum are the posterior nares or choanæ, and projecting inwards from their outer walls are seen the posterior

ends of the three turbinal bodies. The middle one of these is generally the most prominent, and appears as an oblong protuberance of a grey or bluish colour. The superior turbinated body is often invisible, and the inferior is generally only seen in its upper part, the rest being concealed by the soft palate. If the mirror be now inclined somewhat laterally, the pharyngeal mouth of the Eustachian tube comes into view, triangular in shape, with its base directed forwards and its apex backwards, situated behind the inferior turbinal on a slightly higher level. Bounding the Eustachian orifice above and behind is a rounded swelling, which varies in prominence in different persons; and behind that again, and between it and the back wall of the naso-pharynx, is a depression called the fossa of Rosenmüller. On altering the inclination of the mirror, so that the reflecting surface is directed upwards, the roof and part of the back wall of the naso-pharynx can be inspected.

Pathological Appearances in the Naso-Pharynx. The most common pathological change is met with in children, although occurring also in adults, namely, hypertrophied adenoid or lymphoid tissue, the so-called adenoid vegetations. These are the result of hyperplasia of a normal layer of adenoid tissue present in the mucous membrane of the back wall and roof of the naso-pharynx, the pharyngeal tonsil. Their appearance varies from a slight fringe to a large corrugated mass, with vertical rugæ, filling the summit of the pharynx and obstructing the view of the upper segment of the septum. In some there is a simple cushion faintly fissured in the middle line. Occasionally the fossæ of Rosenmüller are occupied with these growths. Associated with adenoid growths there may be hyperplasia of the lymphoid tissue in the lip surrounding the Eustachian orifice, giving rise to considerable enlargement of this structure. We may also find swelling or congestion of the mucous membrane, which may be studded with granular projections similar to those observed in the back wall of the pharynx in granular pharyngitis. The posterior ends of the turbinated bodies, especially the inferior, are frequently seen to be swollen or hypertrophied, and polypi may project through the posterior nares; sometimes a fibrous polypus is seen completely blocking the naso-pharynx. Mucous or purulent secretion may be seen in greater or less quantity, and thin streaks of pus may be observed over the posterior end of the inferior turbinal; the presence of pus in the region of the posterior end of the middle turbinal should be noted and its origin investigated. Ulcerations (tubercular or gummatous), cicatrices, and adhesions are less common.

Digital Examination of the Naso-Pharynx. This method is chiefly used in young children where posterior rhinoscopy is impracticable. It is of great value, more especially in the diagnosis of adenoids, as by this means a better idea of their amount is obtained than by the use of the reflecting mirror.

The little patient is seated upon a chair with the head thrown back resting upon the left arm and body of the examiner, who is standing behind. It is advisable to have an assistant to hold the patient's

hands and secure the legs. The index finger of the right hand, which has been thoroughly washed, is passed into the mouth as far as the posterior wall of the pharynx. To prevent injury from the teeth of the patient, the first phalanx and the metacarpo-phalangeal joint of the exploring finger should be protected by thick india-rubber tubing, or the cheek of the patient should be pressed between the separated jaws by the left hand of the examiner.

On reaching the posterior wall of the pharynx the tip of the finger is quickly passed *behind* the uvula. The muscular spasm which takes place usually passes off when the point of the finger is well in the naso-pharyngeal cavity. During the examination the patient should take full and regular inspirations through the nose. By moving the finger in the appropriate directions a very correct impression can be obtained of the condition of the back wall and roof, the upper surface of the soft palate, the posterior edge of the nasal septum, the posterior ends of the inferior turbinals, the mouths of the Eustachian tubes and the fossæ of Rosenmüller. In a normal condition the mucous membrane lining these parts should be firm and smooth. In addition to its use for diagnostic purposes, the introduction of the finger into the naso-pharynx is often necessary in operating, as in curetting for adenoids, or adjusting a snare round the hypertrophied posterior end of an inferior turbinal or a large fibrous polypus.

CHAPTER VI.

METHODS OF TESTING THE HEARING AND LOCALIZING THE SEAT OF A DEFECT.

We shall consider the tests to be applied, (A) By air-conduction, and (B) By bone-conduction.

(A) *TESTS APPLIED BY AIR-CONDUCTION.*

In testing by air-conduction (the ordinary mode of hearing) each ear should be tested separately while the opposite ear is closed and the eyes are shut or covered. Obviously the room should be as noiseless as possible.

The tests by air-conduction are (*a*) simple tones, and (*b*) speech.

(*a*) *Simple Tones.*

The most convenient instruments for testing the capacity for hearing simple tones are the watch, a special acoumeter, Galton's whistle and tuning-forks.

Watch Test. We must employ a watch the tick of which is a clear distinct sound, not a rubbing or shuffling tick, keeping in mind that the tick of a watch is louder after winding, while it is fainter after cleaning and oiling. A stop-watch is the best, as with it we may at any moment stop the ticking, and in this way we are able to check the veracity of the patient, a precaution specially necessary in the examination of children. As watches differ very much in pitch and intensity of tone, the particular watch used for the purpose should be tried on a number of persons having good hearing. The distance in inches, at which the tick is heard by a person of good hearing power, is termed the *normal* hearing distance, and forms the standard

in testing the hearing power of patients. Thus, if the normal hearing distance of a given watch is 36 inches, and the actual hearing distance of a patient is 20, this fact would be expressed by the fraction $\frac{20}{36}$. This is a very convenient and simple way of expressing, in the record of a case, the state of the hearing power. If the tick is not heard even when the watch is pressed on the ear, we express the condition of hearing as $\frac{0}{36}$; if heard on pressure, as $\frac{p}{36}$; while, if the watch is heard on slight contact, as $\frac{c}{36}$. To ensure accuracy we should use a measuring rule, which must not be touched by the watch, while we are testing the hearing. The watch is first held close to the best ear, so that the patient may know the character of the sound, and thus be able to distinguish it from other sounds. The ear which is not being tested should then be carefully closed, and the watch held, parallel with the auricle, beyond the hearing limit, and then brought gradually nearer to the ear until we find the exact hearing distance. It is well to repeat the test, perhaps more than once, as in some patients we get contradictory statements as to the distance at which the tick is heard. While imagination has something to do with this, it is to be remembered that there is, in special forms of labyrinthine deafness, an uncertain zone of hearing.

Politzer's Acoumeter (Fig. 54) consists of a pillar of vulcanite (*a*) rather more than an inch in length, into which are fitted an immovable cylinder of steel (*c*), about an inch in length, and a short distance above this a movable lever about an inch and a half in length, with a longer arm terminating in a small ball (*b*), so as to form a percussion hammer, and a shorter arm (*e*), pressure on which raises the hammer. The vulcanite pillar is held between the index finger and the thumb, and, the shorter arm of the lever being pressed down by the middle finger, the longer arm with the percussion hammer is raised to a fixed height, and, being allowed to fall on the steel cylinder, a sharp click is produced. As the extent of fall and the dimensions of the instrument are the same in all cases, the amount of sound is uniform. In the vulcanite pillar, above the percussion hammer, is a perforation for the insertion, when required, of a metal pin, four centimetres in length, its free extremity terminating in a round metal plate (*d*). This pin is intended to be used, when testing the perception of sound conveyed through the bones of the head, by pressing the metal plate on the temporal bone

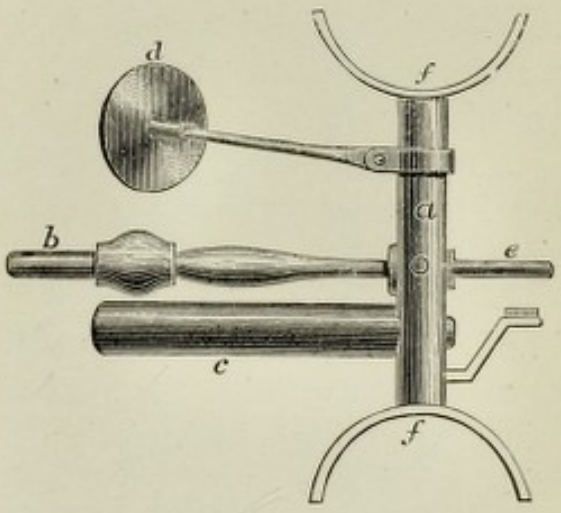

Fig. 54.—Politzer's acoumeter.

or the mastoid process. With the greatest care, after excluding all disturbing elements, the normal hearing distance for this instrument has been found to be fifteen metres, about sixteen yards. The intensity of the click of the acoumeter, being so much greater than the ticking of any watch, makes it possible to determine the degree of sharpness of hearing in many cases where the tick of the watch cannot be perceived. Its chief value is to test the hearing in persons whose deafness is so great that the tick of a watch cannot be heard.

Galton-Edelmann's Whistle (Fig. 55) is very useful for testing the patient's power of perceiving the high tones. It has a very fine bore, furnished with a movable plug by which the tube can be at will shortened or lengthened. A small india-rubber ball is attached, by which the air is blown into the tube. By lengthening the tube the pitch is lowered, by shortening it the pitch is raised. The distance of the piston from the lower end of the tube is marked with a millimetre scale from 0 to 20 mm., and, by referring to a table which is provided, we can tell the exact number of vibrations of the note. While in normal hearing a tone of over 40,000 vs. may be heard, in labyrinthine mischief (such as is found in boilermakers) the hearing may be reduced to 10,000 vs. Failure to hear the high notes of this whistle is usually associated with nerve or labyrinthine disease.

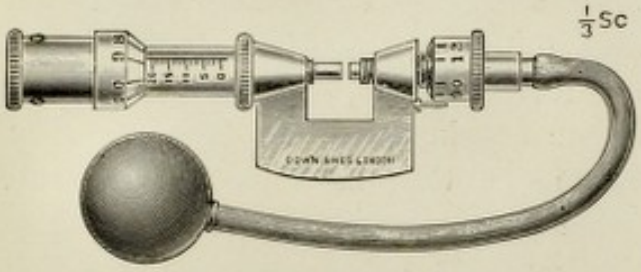

Fig. 55.—Galton-Edelmann's whistle.

König's rods may also be used for testing the upper limits of hearing, but they are comparatively seldom employed in the examination of patients.

Tuning-forks. The tuning-fork most suitable for testing the hearing by air conduction (quantitatively) is $C^1 = 256$ vs. It is made to vibrate by striking the knee with the flat of one of the prongs, or when employing a high pitched fork, striking a piece of wood, covered with a thick layer of cloth, *with a uniform strength of stroke.* The prongs are held near the orifice of the ear, but not touching the skin, until the sound has died away, when the fork is quickly removed to the patient's good ear, or to the ear of the examiner, and the difference in time noted during which the sound continues. The tuning-fork is much more useful, however, in determining the patient's power of hearing the *pitch* of notes (qualitatively). For experimental purposes,

or for the exhaustive examination of the hearing, an extensive series of tuning-forks is employed, ranging from the lowest to the highest notes, but for ordinary purposes five tuning-forks are sufficient, extending from C = 128 vs. to C^4 = 2048 vs. (Fig. 56). Lower forks such as those with vibrational numbers of 64 and 32 are in some cases clinically useful. Useful work, however, may be done with three, one for the lower tones of the scale (C = 128 vs.), one for the medium (C^1 = 256 vs.), and one for the higher (C^3 = 1024 vs.). In using these the time during which a high-pitched fork is heard should be compared with a low-pitched one — using an equal strength of stroke each time—and the difference noted. It is pretty well established that defective appreciation of the lower tones usually points to a defect in the conducting structures, and that failure to hear the higher notes of the scale generally indicates a defect in the nerve structures. If there be defective perception of both low and high tones, but good perception for medium ones, the likelihood is that both the conducting and the nerve structures are implicated. It may be said that the results are more reliable in cases in which the deafness is very pronounced and one-sided. In considering the significance of defective hearing of high notes, it is important to remember that elderly patients usually hear the high notes badly, and the same holds good with those who work amid noisy surroundings. The value of these tests for the hearing of high and low notes depends a good deal

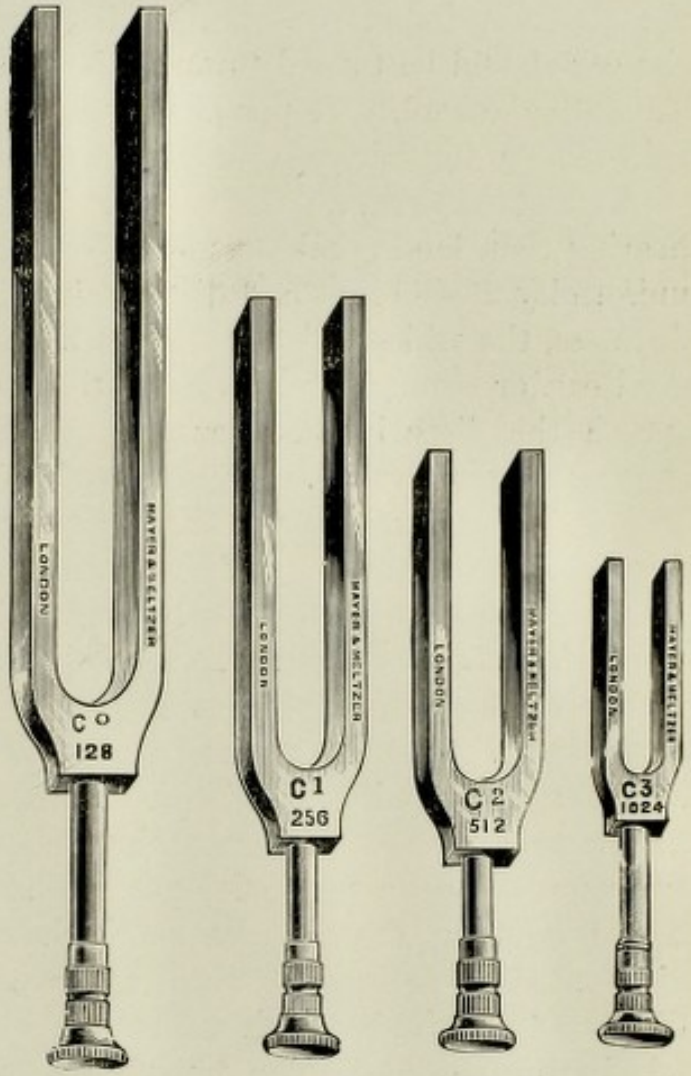

Fig. 56.—Series of tuning-forks.

on the intelligence of the patient as well as his musical appreciation, and in any case much patience and time are required.

(*b*) *Testing by Speech.*

As the power of hearing such a sound as the tick of a watch may be no criterion of the patient's power of hearing speech the testing of the latter is important. In testing the hearing by means of speech, the ear should be turned towards the examiner, while the opposite ear should be carefully stopped, and the eyes of the patient should be shielded or turned away, so as not to see the face of the speaker.

Whispered Voice. A whisper is more suitable for testing the hearing than loud speaking, not only because we can maintain a greater uniformity at different and distant times, but also because in one-sided deafness, the whispered voice is not so likely to be heard through the good ear, or through the bones of the head, and, further, in whispered speech the disparity between the sound of vowels and that of consonants is less marked. In normal hearing, a whispered word should be heard, if we exclude all other sounds, at about a distance of twenty-five yards. To avoid guessing by the patient, it is well to pronounce single words and not sentences, the patient repeating them word for word after the examiner. It must be remembered, however, that the whispers of different persons may vary very much in loudness and distinctness. For the limited size of a consulting room, it is well to cultivate a low uniform whisper, and make the distance at which it is heard by a person of normal hearing our standard. If this were twelve feet, and a particular patient heard it only at three feet, we would express it $\frac{3}{12}$. We should not repeat the same words on different days, as familiar words are heard by deaf persons at a greater distance than words which are not well known; hence the distance at which words of a foreign tongue are heard is sometimes only $\frac{1}{5}$th or $\frac{1}{8}$th that of the mother tongue (Politzer). Friends are also more easily understood than strangers. If the deafness is very great, however, the conversational or loud-spoken voice must be used, and even a conversation tube may have to be utilized.

Vowel Sounds. Vowel sounds, it is well known, are heard much more clearly than consonants. Hence the latter are more frequently mistaken by deaf persons —for example, "marble" may be heard as "gargle," or "man" as "fan." Oscar Wolf, of Frankfurt-on-Maine, has investigated very thoroughly the acoustic characters of the different elements of speech. His researches show the relative distance at which the vowel and consonant sounds can be distinguished when

loudly sounded. If the vowels and consonants are pronounced as in German, and the distances expressed in paces, the highest and richest in tone is *a* (*ah*), which is heard at a distance of 360 paces; while the lowest and feeblest is *h* aspirate, heard only at 12 paces. Between these extreme limits Wolf found *o*=350, *ei* and *ai*=340, *e*=330, *i*=300, *eu*=290, *au*=285, *u*=280, *sch*=200, *s*=175, *g* and *ch* soft =130, *ch* rough and uvular *r*=90, *f* and *v*=67, *k* and hard *g*=63, *t* and *d*=63, *r* lingual=41, *b* and *p*=18. While too much stress need not be placed on these results, they may be useful as a guide in making up a list of words suitable for testing.

Testing very Deaf Children. When testing a young child in whom almost complete deafness is suspected, we may employ the sound of a bell, a loud whistle, a tuning-fork, clapping the hands, or a very loud voice, taking care that the child's face is turned away from the source of sound. We must not produce a sound by stamping on the floor or knocking on the wall or door of the room. If a silent tuning-fork be applied to the forehead or near the ear, the child's features will probably remain unaltered, but if applied afterwards, while vibrating, the child's smile or cry of surprise will frequently shew that he hears the note, because there is even in deaf-mutes usually some degree of perception of sound.

Simulated Deafness. The detection of simulated or exaggerated deafness is often difficult, particularly if *total* deafness is simulated. In continental countries, where compulsory military service exists, this form of malingering is much more common than in this country. To make the deception more easy, foreign bodies are even pressed into the ear, or caustic substances applied to the canal. An objective examination should in the first place be carried out to see if there is any cause for deafness. When the person does not feign *total* deafness, the hearing power should be accurately tested and noted while he is blindfolded, and comparisons made at intervals, when the great disparity in the apparent hearing, as stated by the patient, who does not see how far he hears, reveals the true state of matters. When there is feigned *total* deafness, it is more difficult to expose well-planned deception. Such expedients as observing if loud speech awakens the individual out of sleep, if opprobrious statements made in his presence have any effect on his features, or the effect of informing him "to go, as he is unfit for work," etc., may be tried. In a case under the author's care, that of a young woman, the simulation was discovered by observing that one afternoon she sung the identical songs which had been sung by the servant in the forenoon of the same day. When we have to ascertain if total unilateral deafness exists, it is a good plan to cause

the supposed malingerer to apply to his ears a double-tube stethoscope, having the tube for his hearing ear plugged. When the cup-shaped end of the stethoscope is spoken into, the person will probably say he hears. If the tube is now removed from the hearing ear, and the latter closed with the finger, he will say that he no longer hears, knowing as he does that the hearing ear is shut, while the tube of the stethoscope is only in the ear in which he pretends to be deaf.

(B) *TESTS APPLIED BY BONE-CONDUCTION.*

Bone-Conduction of Sound. Supposing the ears were sealed up so that a vibrating tuning-fork could not be heard by air-conduction, if the fork were placed *in contact* with the head, its note would be heard resounding even more loudly than if the ears were open. Similar exaggeration of the impression of sound may be noted in our own persons, when, in the act of speaking, we close the ears; the vibrations of the vocal apparatus, transmitted by the cranial bones, will then affect our auditory nerves much more strongly. The vibrations of the tuning-fork are communicated to the bones of the head, and are transmitted to the osseous casing of the cavities of the ears, from which they pass to the endings of the auditory nerve in the labyrinth. In testing sound perception through the bones of the head, a tuning-fork yields the most reliable results.

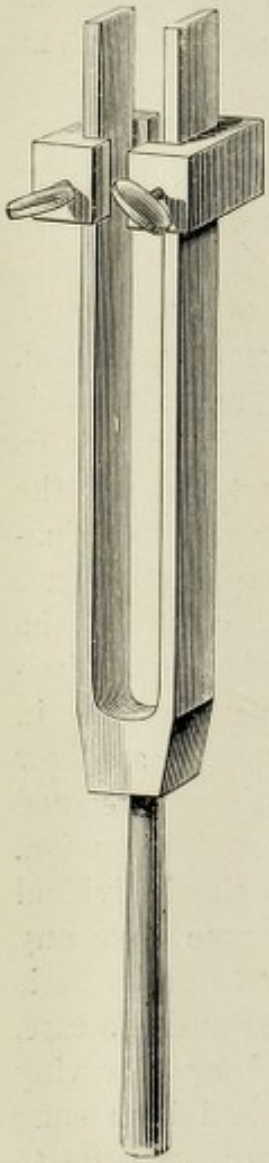

Fig. 57.—Tuning-fork with clamps.

Tuning-Fork Test. The tuning-fork most useful for our purpose should be large-sized, and of the pitch $C = 128$ vs. or $C^1 = 256$ vs. (Fig. 57), with the end of the handle flat, so as to rest on the surface of the head. It yields two simultaneous sounds—the fundamental or deep tone, and the high tones or harmonics. The harmonics are usually appreciated more distinctly when the fork is held some distance from the ear; the fundamental tone predominates when it is held nearer. The harmonics are in great measure destroyed, when the limbs of the tuning-fork are grasped by two brass clamps. When these are attached, only one tone

is appreciated, and that one, on account of the number of vibrations per second being diminished, is much lower in the scale. By shifting the clamps towards the handle we render the pitch higher, until, when we reach the lower end of the limbs of the fork, it is raised a complete octave. In this way one tuning-fork, with the addition of these clamps, can produce a variety of notes according to the position of the clamps.

Watch Test. In testing bone-conduction this is a handy test, but not so reliable as the tuning-fork. The watch should be applied first to the temple, and then to the mastoid process. The sound of even a loudly ticking watch may not be heard although the perceptive power of the auditory nerve be unimpaired; but, if a weakly ticking watch is clearly heard in a deaf person, the indication is in favour of a healthy condition of the sentient part.

There are three methods of employing the tuning-fork, namely, Weber's, Rinne's, and Schwabach's.

Weber's Test. Weber's method is based upon the following experiment. If one ear be closed, and the end of a sounding fork placed in contact with the middle line of the head, such as the bridge of the nose, the forehead, or the vertex, the effect will be striking—the sound heard in the closed ear will be much louder than in the open one; indeed, it will be so intensified on the closed side as to give the impression that no sound is perceived in the open ear at all. Even though the fork, still in contact with the head, be moved close to the unoccluded ear, the sound will still be heard almost exclusively on the closed side. The same effect, which is brought about by this experiment, is produced by the diseases of the sound-conducting apparatus. Pathological obstructions in the external meatus and tympanum, which prevent the entrance of the waves of sound to the labyrinth, also intercept, in their passage outwards, the vibrations which have been conducted to the labyrinth by the bones of the head; and these vibrations, being reflected back on the nerve, intensify the sound of the tuning-fork. Hence, if the sound of the tuning-fork, applied to the middle line of the head, is distinctly referred by the patient to the affected or deafer side (positive effect), the cause of the deafness is probably in the external or middle ear. On the other hand, if it is clearly referred to the normal or less affected side, the mischief is probably in the labyrinth or auditory nerve. In *Weber's test* there is a source of error against which we must be on our guard. The patient being preoccupied by the thought that he *should* hear the tuning-fork better on the good side, and worse on the deaf one, will probably, if

not previously cautioned, at first say that he hears it better on the healthy side. In most cases, however, we will, by a little exercise of patience, succeed in getting an accurate account.

The obstructions in the auditory passages leading to excess in bone-conduction may consist simply of foreign substances, such as impacted cerumen in the meatus, or catarrhal exudations in the tympanic cavity. The same effect is produced, however, by any cause which interferes with the vibrating power of the membrana tympani and ossicular chain, such as their increased tension, anchylosis of the ossicles to one another, or of the plate of the stapes to the edge of the fenestra ovalis. In the case of perforation of the membrane, the increased perception of sound conducted by the bones, generally observed, is due to other changes in the tympanum, such as thickening of the mucous membrane, rigidity of the ossicles, or the presence of purulent secretion.

Rinne's Test consists in applying the vibrating tuning-fork, with moderate pressure, to the surface over the base of the mastoid process, and, after holding it in that position until the sound has completely died away, transferring the prongs rapidly opposite and near to the orifice of the ear. If the note of the tuning-fork again becomes audible, the result is said to be positive ($+R$), the condition in normal hearing and frequently in affections of the labyrinth or nerve. When, on the contrary, the sound of the tuning-fork remains inaudible after the transference, the result is said to be negative ($-R$), bone-conduction being in excess, as in many cases of disease of the conducting structures. The opposite order may be followed, using the tuning-fork first by air-conduction and transferring it to the mastoid the moment the tone has ceased to be heard. For the sake of accuracy the time in seconds should be observed and noted during which the tuning-fork is heard by bone-conduction after it has ceased by air-conduction, or by air-conduction after it has ceased by bone-conduction. The duration of the air-conduction and the duration of the bone-conduction should be compared with the normal standard.

Schwabach's Test. By this test we compare the patient's appreciation of the tuning-fork applied to the head with that of our own, provided that our nerves of hearing are normal. If we hear the tuning-fork on our mastoid clearly and for some time after the patient has ceased to hear it on his mastoid, we may conclude that there is nerve impairment.

Gellé's experiment consists in applying the tuning-fork to the bones of the head, while the air in the external auditory canal is condensed by means of Siegle's speculum. In the normal state the tone is thus diminished owing

to increased labyrinthine pressure due to pushing in of the ossicular chain upon the labyrinthine fluid, if undiminished there is probably fixation of the stapes.

In *Gruber's* test, after the tuning-fork has ceased to be heard by air-conduction, it is applied to the finger closing the ear, when the sound may be again heard.

Modifying Circumstances. It must be remembered, in deciding as to the significance of these tests, that they are not of value in elderly persons, as in them the bone-conduction is usually weak—probably after the age of 55 years. The result may be also obscured by the fact that there may be in the one ear affections of both the conducting and nerve structures. There may be, for example, an undoubted affection of the conducting structures, with a positive Rinne. On inquiring, however, we may find that the person had worked for a long time amid loud sounds, thereby damaging his auditory nerve structures, enfeebling his bone-conduction and so neutralizing the effects on the bone-conduction of the disease in the conducting structures. Or a patient may have clear signs of nerve mischief, and yet there may be a negative Rinne, which, after the removal of a plug of cerumen, may become positive, the plug having so reinforced the bone-conduction that the effects of impaired nerve structures were more than neutralized. We sometimes find that, while Rinne's test gives a positive result, Weber's may refer the sound to the affected ear; in such a case probably the latter is the more reliable. Not infrequently it is found that Rinne's test yields a positive response to a higher pitched tuning-fork, say one of 256 vs., and a negative one to a lower, say one of 128 vs.: this is partly explained by the rule that low notes are badly heard by air-conduction in affections of the conducting structures, while higher ones may be well heard. When the higher notes yield a negative result by Rinne's test there is probably very pronounced disease of the conducting structures. In experiments carried out by the writer, in cases of purulent middle ear disease, he found comparatively few in which, by Weber's and Rinne's tests, bone-conduction was not in excess.

CHAPTER VII.

SYMPTOMATOLOGY OF EAR DISEASE.

THE symptoms of ear disease may be conveniently divided into two groups. The first group includes the following six subjects of enquiry which, on account of their frequency and importance, should never be omitted in the examination of a patient.

I. Defective hearing.
II. Sounds in the ear (tinnitus aurium).
III. Pain in the ear (otalgia).
IV. Discharge from the ear (otorrhœa).
V. Disturbance of equilibrium (giddiness and staggering).
VI. Nasal and pharyngeal symptoms.

The second group of symptoms are not so frequent, but they are important when they do occur.

VII. Mutism and speech defects.
VIII. Facial paralysis.
IX. Headache.
X. Sickness and vomiting.
XI. Psychical disturbances.
XII. Pyrexia.
XIII. Intra-cranial symptoms.
XIV. Ocular disturbances.
XV. Disturbance of taste.

FIRST GROUP OF SYMPTOMS.

I. DEFECTIVE HEARING.

Simple Defect of Hearing (see methods of testing the hearing at p. 42). This is the most frequent symptom of disease in the ear.

Patients often believe that they hear quite well, when the application of tests shows a real defect in one or both ears. The degree of impairment may vary from a defect so slight, that the patient is unconscious of its existence, to total loss of hearing; but the latter is very rare, even in deaf-mutes, of whom a large proportion hear very loud sounds, such as a loud bell or whistle. In very many patients both ears are affected, although one is usually worse than the other, the less affected one being often thought by the patient to be perfectly good. It is frequently difficult to draw from the patient a correct account of the origin and progress of the defective hearing. He may give six months as the duration, and afterwards admit that the hearing has not been good for years.

Many persons with defective hearing have a singular tendency to deny the existence of the defect, or, at any rate, to minimize the degree of it. Only when the deafness is so prominent that it would be absurd to ignore it, do they admit its existence. When friends suggest dulness of hearing, the blame is laid upon the indistinctness of the speaker; and there is no doubt that the prevailing slovenly enunciation of words adds very much to the difficulty of persons dull of hearing.

Defects of hearing are connected with most of the diseases of the ear. Affections of the middle ear are, however, the most common, although the most serious forms of deafness are due to disease in the nerve structures or labyrinth. It is noteworthy that marked lesions may be seen on the tympanic membrane, such as calcareous deposits, opacities, retraction, in persons with apparently normal hearing; even a perforation may exist with comparatively little defect of the hearing.

Lip-reading. We are sometimes apt to acquire a wrong impression of the degree of the deafness by not taking into account the effects of lip- and face-reading—the help given by the eye. It is well known that deaf persons often acquire great aptitude in reading the lips, and in guessing the meaning of what they do not hear from the sense of what they do hear. They are surprised at the degree of their deafness when tested while their eyes are closed or turned away from the speaker. This accounts for the fact that deaf persons often appear to hear worse at the time of dusk, when sight cannot give effective aid; and hence also they are less able to understand bearded and moustached men, from the greater difficulty of seeing the movements of the lips. Some deaf persons acquire extraordinary power of reading the facial movements, and, indeed, this is the basis of the German

method of educating deaf-mutes. Only by careful testing of the hearing of each ear separately, as already described (p. 42), can we properly estimate the extent of the deafness.

Word-deafness. The hearing of words or speech may be very defective in certain cases, while the hearing of a mechanical sound, such as the tick of a watch, or music, or the falling of a pin, is comparatively good. A watch-tick may be heard at a considerable distance from the ear, although loud speech may require to be uttered close to the ear before it is heard. Another form of word-deafness has been described by Broadbent and others, due to disease in the cortex of the left temporal lobe of the brain, while the organ of hearing is apparently healthy, and when, although patients hear speech, they are unable to understand it. Patients say they hear the sounds quite well but cannot gather the meaning. This power of forming word pictures, apart from ordinary hearing, seems to be resident in the first convolution of the left temporal lobe.

Disparity between Hearing a Watch and Speech. There may be, on the other hand, defective hearing for the tick of a watch or other mechanical sounds, while there is comparatively good hearing for words or speech. There is frequently a striking want of agreement between the hearing capacity for the watch and that for speech. A patient may hear lightly spoken words at a considerable distance, and yet not hear the watch even when in contact with the ear. Sometimes, in a patient with both ears affected, the hearing of conversation is better on the side where the hearing of the watch is worse. In the treatment of deafness, we occasionally find this disparity very marked, and the hearing of speech may distinctly improve, while the hearing distance for the tick of a watch may remain unchanged or even, as has been observed, actually become less; or the contrary may be observed. Persons who have become deaf in later life usually hear speech better in proportion than the watch, while the opposite holds good with those who have become deaf in childhood. Probably the greater knowledge of language in the former, as well as experience in reading the facial movements, partly accounts for this difference.

Partial Tone-deafness. It is most common for deaf patients to hear high tones best, such as a woman's or a child's voice, but occasionally we meet with persons who hear deep tones best. Many persons, especially those over sixty years of age, whose hearing may otherwise be regarded as normal, have a defective capacity for hearing

notes of a very high pitch, such as the chirping of a cricket. An elderly gentleman, who loved the songs of birds, remarked that he first lost the song of the lark. This defect is also often noticed in persons, such as boilermakers, who have for long worked amid noisy surroundings. This diminished power of hearing notes of a high pitch seems to be generally associated with affections of the labyrinth. The greater capacity which some patients have of hearing the tick of a watch (comparatively high note) better proportionately than speech (comparatively low note) may be partially due to this peculiar defect. Partial tone-deafness is usually looked upon as evidence of disease in the basilar membrane of the cochlea. The assumption is that a morbid condition of the longer fibres of the basilar membrane disturbs the correct perception of the low tones (bass deafness), while an abnormal condition of the short fibres impairs or destroys the power of correctly recognizing high tones.

False Tone-perception (*paracusis* and *diplacusis*). We occasionally find that the ear interprets the tone incorrectly; instead of the real tone proceeding from the sounding body, a sound may be heard, which is a half tone, a complete tone, a third, or an octave higher or lower. This is *paracusis* or false hearing. If only one ear be affected, we have the phenomenon of *diplacusis*: a double tone is heard, viz.—the true one on the normal side and the false one on the affected side. In these various anomalies of hearing, particular fibres or groups of fibres of the basilar membrane may be supposed to be in some way disturbed. In the hearing of a double tone, probably the fibres of the basilar membrane on the two sides corresponding with each other do not vibrate co-equally. Thus, supposing the sounding object vibrates 600 times in a second, the fibres on the normal side, which are in exact unison, vibrate that number of times, while the corresponding ones on the opposite side from some defect vibrate say 450 times in a second.

Another form of peculiarity is sometimes met with in the perception of tones, namely, the perception of the same tone twice over, or the hearing of a tone for a short period after the objective sound has ceased.

Hearing Better in a Noise (*paracusis Willisii*). In most deaf persons, absolute silence and stillness of the surroundings favour the hearing of spoken words or other sounds; but it has been long known that in certain forms of ear disease the patient hears better in a noise. This peculiarity is termed *paracusis Willisii*, because Willis, in 1680,

first described a case, in which a husband could be heard by his wife only while the servant was beating a drum. Not unfrequently deaf persons hear much better when travelling in a railway carriage, or while in the vicinity of noisy machinery, than in complete stillness. Some writers try to explain such an apparent paradox by pointing out that in a railway carriage the confined space, the nearness to the speaker, the elevation of the voice, and the close attention of the listener may account for the apparently better hearing. This matter has, however, been put beyond dispute by the observation of Politzer and others, including the writer, that the tick of a watch or the click of the acoumeter is actually heard by some deaf persons farther away from the ear in a railway carriage than in a quiet room. The probable explanation is the one given by Politzer, namely, that it is the result of the severe shaking of the ossicles, when their joints have become stiffened by a catarrhal or other process. In this way the small bones are made fitter for the transmission of ordinary sound. Hearing better in a noise, therefore, usually denotes that the cause of the deafness is in the middle ear and not in the labyrinth.

Defective Perception of Locality of Sound (*paracusis loci*). This is the inability to distinguish the direction of sound. This anomaly is generally connected with unilateral deafness, since the power of localizing sound is probably the result of binaural hearing. If the person is deaf in one ear, the report of a gun on that side may appear to him to be coming from the opposite side, a peculiarity which, in certain circumstances, may be fraught with danger.

Excessive or Painful Hearing (*hyperæsthesia acoustica*). Extreme sensitiveness to sound, especially sounds of a very high pitch, occurs in a variety of circumstances. In fevers, in the early stage of inflammation of the middle ear, in hysteria, in migraine, in persons who sleep lightly, and for a short time after the removal of a plug of cerumen which had caused great deafness, there is sometimes an unpleasant or even painful perception of sound, which may be limited to particular notes, especially those of high pitch. Even in persons who may be very deaf, loud sounds such as speech through a conversation tube, or a railway whistle, or loud music such as that of a large organ, are sometimes very disagreeable or even painful.

Hearing by Bone-Conduction. In normal hearing this mode of conduction is somewhat feebler than air-conduction. For we find that, after a vibrating tuning-fork, placed in contact with any part of the head, has ceased to be heard, it will again become audible

if transferred to a point opposite to, but not touching, the orifice of the ear. With deaf people, whose defect is in the conducting structures, this is often reversed, and they may hear much better by bone conduction. This peculiarity may be turned to profitable account, so that the tones of a musical instrument, such as a piano, may be appreciated by a very deaf person, if a rod of wood, in contact at one end with some part of the instrument, be held at the other end between the teeth of the patient. In this way a melody, which would be a confused mass of sound under ordinary circumstances, may be heard clearly. The writer has been informed that when engineers wish to test the smooth working of a piston they place one end of a measuring rule upon the outside of the cylinder and hold the other end between the teeth, while the ears are tightly closed with the fingers. This is also the basis of the use of the audiphone, an artificial aid to hearing. In like manner, the movements of mastication and the sound of their own voices—*autophonia*—are heard much more loudly by deaf patients whose bone-conduction is in excess. Such patients often say that they cannot hear during mastication owing to the loud sounds caused by the movements of the jaw. The various tests applied to determine the state of the bone-conduction in relation to the air-conduction and their value will be found at page 48, to which the student is referred.

II. SOUNDS IN THE EAR (TINNITUS AURIUM).

These are sounds perceived in the ear or head which have no objective cause outside the body. They are probably complained of in 60 per cent. of cases of ear disease, and are sometimes a much greater distress to the patient than the defective hearing, with which they are generally associated. These noises are not unfrequently the only symptom complained of, and the only one for which the patient comes for relief. They are described most frequently as being exactly *in* the ear, at other times as being in the side or back of the head, or "all over the head."

Varieties of Tinnitus. Probably the worst forms of tinnitus are caused by irritation of the cochlear branch of the auditory nerve, either due to pressure upon the roots or trunk of the nerve in the cranium, or to a primary lesion in the labyrinth acting upon the terminals of the cochlear nerve, or to intra-labyrinthine pressure through the fenestrae *induced by middle-ear disease*. The irritation may also be due to vaso-motor changes in the labyrinth, reflex in

origin, arising from more or less distant regions, such as the intra-nasal spaces or the digestive organs. The noises are in some cases really due to vibrations within the ear or in its neighbourhood (entotic and properly objective). For example, crackling or the sound of bubbles bursting may be due to secretion in the tympanum; a creaking or rubbing sensation may be due to cerumen or a foreign body in the external meatus; a slight drumming or buzzing may be caused by spasm of the tensor tympani or stapedius; while a crackling, heard on swallowing, is usually due to separation of the walls of the Eustachian tube when affected by catarrh. Again, a bruit may be heard in the jugular vein under the floor of the tympanum, while a pulsating or throbbing sound often arises from dilated arterioles due to congestion or vaso-motor disturbance in the external or middle ear, or in the labyrinth. A pulsating sound may also be caused by an abnormal condition of the internal carotid artery in the carotid canal; in this case the pulsation is usually stopped by pressure upon the artery in the neck.

The Character of these Sounds as described by patients is extremely varied. It is evident in many cases that patients have a difficulty in describing them or in comparing them with any actual sound outside the body. In the efforts to describe them they often employ terms or comparisons suggested by their particular surroundings or occupations. They are frequently described as buzzing (or "bizzing") hissing, ringing, singing of a kettle, humming, or crackling. They are compared by many to the sound of a shell held to the ear, to the ringing of bells, to the ticking of a watch, to the bursting of bubbles, to the splashing of water, to the twittering of birds, to the rustling of wind among the trees. Those of an intense character are compared to steam blowing off, the noise of machinery, the rushing of a waterfall, the constant whistling of a locomotive, or the sound of a horn. Some again are said to be of a beating or pulsating character, and may be compared to a constant hammering or the working of a pump. Several different sounds may exist at the same time in the one ear, such as a pulsating and a buzzing one. During treatment it is sometimes found that one sound may pass away, while the other may remain unchanged.

While in some these sounds produce very little annoyance, in others they have a most worrying and depressing effect, diminishing power of work and apparently rendering life a burden; indeed cases are on record of sufferers seeking oblivion in self-destruction. Occasionally, though rarely, these sounds are said to be of a *pleasant* nature, such as the singing of birds or a beautiful melody. Complete tunes are sometimes alleged by patients to be heard in the ear without any objective cause.

The Sounds Vary in Intensity. Usually during stillness and solitude the noises appear to be much worse and more disturbing. Patients may declare that during the noise and bustle of daily work they scarcely perceive the sounds, but on returning home to the quietness of their rooms the sounds become very unpleasant. In other cases they are only experienced after indulgence in stimulants; after over-exertion, or mental emotion; during colds in the head; or in dull, damp weather, etc. They are sometimes associated with what is indefinitely called a "nervous state." In such cases the intensity of the symptom is likely to be modified by varying states of the nervous system, aggravated by worry or irritation, and diminished by moods of contentment and serenity. A nervous condition may, on the other hand, be excited by some of the distressing forms of this symptom. In many persons the sounds are unceasing, except during sleep, and they seem only occasionally to prevent sleep.

Relation of the Tinnitus to the Deafness. We sometimes find distressing noises with but slight impairment of hearing. Occasionally cases are met with where the hearing is normal. In such the tinnitus is probably due to a labyrinthine neurosis or to reflex influences, such as from the teeth or the naso-pharyngeal mucous membrane. It is often found in such cases that *defective hearing comes on sooner or later.* More frequently, when the sounds are intense and continuous, the deafness is very considerable. Generally, if the acuteness of hearing improve, the noises diminish; while, on the other hand, with gradually advancing deafness the intensity of the sounds generally increases, until the patient may be deaf to all external sounds while tormented by noises in the head. Sometimes, however, when a state of total deafness has been reached, the sounds completely cease.

Hallucinations of Hearing. Schwartze and Köppe have directed attention to the association of subjective sounds in the ear with *hallucinations of hearing* in the insane. Even persons who have no mental defect may, for a time, confound noises in the ear, such as whistling or the ringing of bells, with actual sounds originating outside. Patients have informed the writer that the sounds were so real as to cause them to search, even by going out into the open air, for the source of them. Generally, however, a little careful observation on the part of the patient is sufficient to convince him that the sound has no existence outside his body. Von Tröltsch relates a case of melancholia with hallucinations of sound in the ear like the crying of a child. The removal of impacted cerumen was immediately attended by the disappearance of the sound as well as of the melancholia. Other cases are on record of morbid states of the mind being connected with the existence of peripheral disease of the ear causing

subjective sounds. Schwartze says, "Subjective sounds in the ears, which are occasioned by undoubted disease of the ear, may, in persons disposed to psychical disease, especially where hereditary tendency to such exists, be the direct cause of hallucinations of hearing, which may provoke at any time the outbreak of pronounced mental disease." The continuous hissing, buzzing, etc., which attend the ear disease, may be associated with the hearing of "voices." Two cases are related by Köppe, in each of which only one ear was diseased, and only on that side were the "voices" heard. In these two cases, as well as in several others, the noises and hallucinations disappeared under local treatment of the ear affection.

III. PAIN IN THE EAR (OTALGIA).

Earache is a frequent symptom of ear disease. We may conveniently distinguish two varieties: 1st, pain associated with an inflammatory process; 2nd, pain without any evidence of inflammation.

Inflammatory Pain. The first variety is obviously connected chiefly with *acute* inflammation, especially with acute inflammation of the middle ear (purulent or non-purulent). The earache is then frequently intense in character. At the beginning of the inflammation there may be simply heat, fulness, and pressure. Afterwards, however, it goes on to sharp, penetrating pain in the ear, which generally extends to the neighbourhood, to the temple above, towards the occiput behind, or to the forehead in front. It may be accompanied by throbbing in the ear, aggravated at night. In the purulent form, the pain often ceases with rupture of the tympanic membrane, and the appearance of discharge from the ear. In some cases, however, the pain continues after rupture, or returns after a period of intermission.

Mastoid inflammations, usually secondary to purulent otitis media, are important sources of pain. In mastoid periostitis there is usually œdema or abscess over the mastoid area, with jutting outwards of the auricle, and great tenderness on pressure. In purulent collections in the mastoid cells, there may be little or no œdema over the mastoid, but often an appearance of bulging of the bone itself, with pain on pressure, especially over the front of the lower half of the mastoid. There is sometimes in such cases, however, very little pain apart from pressure.

In chronic purulent affections of the middle ear, while in most cases no pain may be experienced for years, there may arise at any time severe pain from an acute inflammatory attack, from pressure of retained matter, from caries or necrosis, or from furuncular inflammation in the meatus. It is to be remembered that intense

pain in an ear affected with chronic purulent disease, extending to the side or back of the head, may be the first symptom of an intracranial complication.

Slighter and more intermittent pain may be complained of in connection with simple exudative catarrh of the middle ear or with interstitial or sclerotic processes. If great pain is experienced in such conditions, it generally means an intercurrent acute inflammation.

The external auditory canal is another common source of inflammatory pain, especially when it is the seat of furuncular inflammation. The pain in this case is usually aggravated by moving the auricle, pressing the tragus, or by mastication. This, as a source of pain, is often overlooked, and careful examination of the skin of the meatus with the help of a probe is necessary. Less frequently there is pain in the external canal from eczematous inflammation, from the pressure of cerumen in the osseous portion of the canal, from the presence of fungi, from exostosis, and from caries or necrosis of the osseous walls. In chronic eczema of the meatus the sensation is more that of troublesome itchiness.

Non-inflammatory Pain. The second or non-inflammatory variety of pain is often connected with dental caries, especially of the molars of the lower jaw, and is then often associated with pains in the vicinity—in the neck, temple, or cheek. Intense earache may be experienced in tonsillitis, without any signs of inflammation in the ear; also in carcinoma of the tongue or throat. It is sometimes a manifestation of a neuralgic condition due to anæmia or other constitutional defect. Rheumatic pain in the articulation of the lower jaw, felt during movement or pressure, is often thought by patients to be due to ear disease. A sensation in the ear, as if of a plug of cotton, sometimes complained of by persons with good hearing, has evidently a nervous origin.

It is very important, as a guide to treatment, to distinguish between the inflammatory and the non-inflammatory forms of pain. Objective examination is of course the only reliable means of doing so, and should never be omitted in such cases. We usually find in the inflammatory variety more or less defect in the hearing as well as subjective sounds in the ear; and it is often distinctive of the non-flammatory pain that it has been experienced for a long period, even for months.

It is well always to inquire whether the patient has been liable to earaches in childhood, or later on, as these may indicate past inflammatory attacks.

IV. DISCHARGE FROM THE EAR (OTORRHŒA).

Probably about a third of all diseases of the ear coming before the surgeon are attended by discharge, which is generally due to purulent inflammation of the middle ear. With comparatively few exceptions, there is perforation of the tympanic membrane, though in a small number of cases the discharge is caused by inflammation of the external meatus, especially eczematous. While there is frequently pain at the early stage, in a large number of cases no pain is complained of. Otorrhœa is generally attended by more or less defective hearing, and in many cases it has existed for many months or even years before coming under the surgeon's observation. The discharge may be very slight in quantity, so as *even to escape the attention of the patient*, or to be mistaken for thin wax, or it may be in such quantity as to fill the meatus very soon after syringing and drying.

Character of the Discharge. In character also it varies. It is most commonly muco-purulent. It may, however, be serous-looking, such as in the early stage of an inflammation of the middle ear, or when due to eczema of the meatus. The mucous element may predominate, giving the secretion a tenacious or stringy character, or there may be almost pure pus, which imparts a milky colour to the water used in syringing. It is sometimes tinged with blood, especially when there are granulations or polypi in the ear. It has frequently an offensive smell, particularly when there has been no attempt at cleansing, and in very chronic cases its odour sometimes resembles that of old cheese.

Bacteriological and Cytological Characters. The most serious forms are associated with the presence of streptococci. Diplococci are also frequently found; of these the pneumococcus is the most common, but there are also found the meningo-coccus and the gonococcus. The *staphylococcus pyogenes, albus* and *aureus*, is less virulent than the others, and is found in connection with furunculi in the meatus as well as in purulent middle ear disease. The tubercle bacillus is specially found in very young children. Cytological examination, which should be repeated in any case more than once, yields, in the opinion of so high an authority as Dr. Milligan, very important information. His conclusions are that the presence in the discharge of lymphocytes indicates granulation tissue formation; of lymphocytes, epithelioid cells and myelocytes, bone disease; of lymphocytes and

"acid-fast" squames, cholesteatomatous changes; of lymphocytes, epithelioid cells, myelocytes, and giant cells, tuberculous disease of the temporal bone.

In all cases attended by discharge from the ear, objective examination is essential; and, in order to acquire a proper knowledge of the exact condition, it is generally necessary to syringe and dry the inside of the ear before using the mirror and speculum. Where there is a history of a past discharge, which may have been absent for a length of time, we often find a dry perforation, a cicatrix or a calcareous deposit. The danger of intra-cranial and vascular infective complications, associated with a discharge from the ear, invests this symptom with special significance and importance.

V. DISTURBANCE OF EQUILIBRIUM (VERTIGO, GIDDINESS AND STAGGERING).

Since Ménière's classical paper on "Aural Giddiness," in the *Gazette Medicale de Paris* for 9th February, 1861, the profession has become gradually impressed with the importance of giddiness as a symptom of ear disease; and most practitioners now think of the ear when a case of giddiness or disturbance of equilibrium presents itself.

Frequency of Ear Giddiness. As a symptom of ear disease it occurs in all degrees of intensity, from that of a slight and temporary lightness in the head to so violent a disturbance of the equilibrium as to necessitate the recumbent posture. In a marked form it is far from being rare, while in a comparatively mild degree it is a very common concomitant of ear disease; probably in 6 per cent. of cases of ear disease it is a distinct feature.

Various Forms of Ear Giddiness. Ménière's discovery naturally stimulated much investigation, with the result not only of still more widely connecting the symptom of giddiness with disease in the ear, but also at the same time of modifying some of his views. In the light of the fuller experience of recent years, aural giddiness may now be conveniently described as manifesting itself in four distinct forms: (1) The typical form or true Ménière's disease (sometimes termed apoplectiform deafness), due to the presence of exudation in the labyrinth. In a person with previously normal hearing, the four great symptoms, namely—sickness and vomiting, giddiness and staggering, subjective sounds in the ear, and deafness, occur as a sudden seizure;

accompanied it may be with pallor, cold sweats or faintness. In this class entire disappearance of all the symptoms is rare. (2) Another form is due to pressure upon the walls of the middle ear of air, liquid, or inflammatory products. Here the symptoms are sometimes less severe in character—the sickness and vomiting being occasionally absent while the vertigo is in most cases preceded by other symptoms of auditory disturbance. In more serious forms purulent middle ear disease extends through the inner tympanic wall to the interior of the labyrinth. (3) The giddiness may be due simply to pressure upon the walls of the external meatus or outer surface of the tympanic membrane, such as by ceruminous masses. Here also it is usually preceded by disturbance of the hearing, and entire recovery is often brought about by treatment. (4) In the fourth class of cases, the giddiness is connected with chronic processes in the middle ear, leading to pressure upon the labyrinth at the fenestral openings, or to vaso-motor disturbance in the labyrinth. The vertigo of this class is that usually termed by writers, *vertigo ab aure læsa*, and may occur in almost any affection of the ear; but it is most frequent in the course of a chronic inflammatory affection of the middle ear. The giddiness is generally preceded, accompanied, and followed by subjective sounds and deafness; it is frequently, however, unaccompanied by nausea or vomiting. Recurrences of the giddiness are common from time to time. In most cases it eventually disappears; but the deafness and the noises in the ear are apt to remain permanently.

Characters of Aural Vertigo. In aural vertigo, the giddiness may be so extreme that, if the person cannot clutch a firm support or be supported, he falls to the ground or has to lie down; or it may amount to a mere sense of "swimming in the head," when turning quickly or stooping, or to a tendency to reel when trying to walk in a straight line. The giddiness may be experienced in bed, the patient feeling as if the bedroom were turning round, or the bed rising or sinking. In the severe forms the objects around may appear to rotate, or the ground in front may seem to rise or fall, or there may be a feeling as if the patient were on a suspension bridge which sways under foot. The sense of movement may be confined to the patient's body, perhaps of the nature of a rotation round a vertical axis, when the tendency usually is to turn or fall towards the affected ear, or there may be a sense of moving backwards or forwards on a horizontal axis. Experiments on animals seem to indicate that irritation in the external semicircular canal causes horizontal movements of the head, while

irritation in the posterior or superior produces backward and forward movements. In other cases there may simply be a staggering or want of control of the legs, especially in the dusk or dark, the movements resembling those of a drunken man. The giddiness may pass off or markedly diminish in a few minutes, or it may last for several days, necessitating the lying posture. It may return, even repeatedly, with more or less severity. A certain degree of giddiness or tendency to reel may persist, with exacerbations from time to time, perhaps excited by other causes, such as gastric disturbance. While, in aural vertigo, there is good reason to believe that irritation of the vestibular and ampullary nerves, sending afferent impulses to the centre of equilibrium, is the real source of the mischief, there may supervene other exciting causes which provoke attacks, such as digestive or hepatic disturbance, nervous shock or strain, exhaustion, etc. Without these, while the ear disturbance may be permanent, the vertigo may be absent for long periods of time.

Relation of Ear Giddiness to Intra-cranial Disease. It is necessary to remember that in the course of chronic purulent middle ear disease, and also, but much more rarely, in acute purulent disease, giddiness may be due to extension of the disease to the interior of the labyrinth or to the intra-cranial cavity. In the latter case the giddiness is associated with other grave symptoms which point to involvement of structures more central than the organ of hearing. In this way meningitis, septic-thrombosis of the sigmoid sinus, cerebral abscess, or cerebellar abscess may be associated with more or less disturbance of the equilibrium. It is also to be remembered, however, that grave disease of the cerebellum, such as a tumour, sometimes exists in a person who may be at the same time afflicted with an ear disease, although no connection may exist between the two. In this way there may be great disturbance of equilibrium, which, at first sight, is regarded as of aural origin; but subsequent events show that the disease causing the disturbance of equilibrium is entirely in the cerebellum, having possibly no connection with the ear. It should never be forgotten that *marked giddiness, sickness and vomiting may exist in connection with purulent disease of the ear, which has not extended beyond the cavities of the labyrinth or middle ear.* There is no doubt that practitioners sometimes form an unnecessarily gloomy prognosis of such cases, concluding, owing to the presence of these symptoms, that extension of the mischief has taken place to the interior of the cranium.

Testing the Static Sense in Aural Vertigo. When manifest ear disease exists, and the patient complains of giddiness, we should first make sure that he understands what giddiness really is, and ascertain if deafness and tinnitus be present, also if there be vomiting. We should also inquire whether the giddiness has sprung out of an acute Ménière's attack, or if it has arisen in the course of a chronic ear affection. No doubt the worst forms occur in labyrinthine affections; and therefore it is well to employ the tests already described for differentiating disease of the nerve structures from that of the conducting structures. We should also ascertain whether the vertigo is produced or increased by such processes as inflation, syringing, or the use of Siegle's speculum; or if it is excited by certain movements, such as looking downwards or upwards, or turning to the right or left. We should also inquire if the sense of movement refers to the patient himself or to external objects, and if the tendency is to turn or fall *from* or *towards* the ear affected. We should also determine the absence of any ocular disturbance sufficient to account for the giddiness. By employing the following tests, both with the eyes open and shut, we may, by observing whether there is any tendency to sway or fall, determine the condition of the static sense, and, if impaired, the degree of impairment: (i.) standing on both legs with feet together; (ii.) standing on the toes; (iii) standing on one foot, noting whether equilibrium is more disturbed when standing on foot corresponding with affected ear; (iv.) jumping on the two feet; (v.) walking in a straight line, observing if the patient reels or walks zig-zag, or with his legs apart; (vi.) walking with knees straight; (vii.) rotation with feet together; (viii.) rotation on one foot.

VI. NASAL AND PHARYNGEAL SYMPTOMS.

Nasal and pharyngeal symptoms very frequently co-exist with ear disease. Persons suffering from middle ear affections often complain of "cold in the head," frequently manifesting itself in a sense of nasal obstruction, with or without excessive nasal secretion. Nasal obstruction may only show itself by oral breathing when sleeping. The obstructed nose, and mouth breathing from post-nasal adenoids are the commonest signs of the catarrhal deafness of children. Nasal voice is sometimes a marked feature in children suffering from catarrhal deafness, the nasal tone being due to a concomitant affection of the nose. The frequent desire to clear out the throat, "hawking," is often associated with catarrhal conditions of the middle ear, due to post-nasal catarrh, which may be the root of the ear affection.

SECOND GROUP OF SYMPTOMS.

VII. MUTISM AND SPEECH DEFECTS.

Deaf-mutism. We may generally regard deaf-mutism as a symptom of ear disease, as it is in the vast majority of cases simply a consequence of total, or of a high degree of, deafness, which has either been congenital, or has originated in the early years of life. Deafness for speech, coming on under four years of age, is certain to be attended by dumbness, and even between four and eight years of age, if great care is not exercised, serious deafness is liable to be followed by loss of speech. Probably 75 per cent. of deaf-mutes hear such sounds as a loud bell or a whistle close to the ear, or a vowel loudly pronounced into the ear. In a smaller number, complete words are heard when spoken loudly into the ear or through a conversation tube. It is not easy to determine positively, in the first year of life, whether a child hears. Usually the history of a case is that the mother is surprised to observe that the child is unaffected by noises which awake other children. After the first year, her anxiety may be aroused by the delay in beginning to speak, and by manifest inattention to loud sounds. Suspicion being excited, the child's hearing should be tested, preferably by the parents at home under the directions of the doctor (see p. 47). By objective examination the tympanic membrane is usually found to be normal, and when morbid changes are observed they do not account for the serious deafness, the cause of which is more deeply seated.

Defective Articulation. In less severe forms of deafness in a child, while mutism may not result, a less perfect articulation is very early observed, as he fails to hear all the shades of sound which make up articulate speech. The effect is thus to render the pronunciation indistinct and the voice toneless. If, however, the deafness becomes more aggravated, or if the child is very young and has only recently attained a slight knowledge of speech, the pronunciation becomes more and more imperfect, and, his knowledge and memory of words being insufficient to keep what he has, he may cease altogether to speak, or his utterance may be confined to unintelligible sounds. The child, unlike the adult, ceases to make any effort to hear, and finds it more easy to trust to signs, in the use of which he is usually encouraged by

the parents. After a time, the parents, regarding the child as quite deaf, believe that it is useless to speak to him at all, and resort more and more to gestures, till the child comes to be classed as a confirmed deaf-mute. If the parents took pains to speak in a loud and distinct voice near to the ears of the child, as they would to a deaf adult, and by that means maintain and even increase the child's knowledge of words, the consequences might be much less serious.

VIII. FACIAL PARALYSIS.

This is not an unfrequent symptom of ear disease, especially of the purulent forms. It is more common in young children, and is generally unilateral, affecting the side corresponding with the ear disease. If due to an intra-cranial lesion, it is found on the opposite side, and it is then more partial in character. Rarely the paralysis is bilateral, and, in the only case seen by the author, it was due to syphilitic disease, involving also the auditory nerves. The symptoms produced by pronounced facial paralysis are well known, being chiefly due to the inaction of the facial muscles on the affected side. A minor degree is probably more common in connection with purulent ear disease than is supposed, showing itself mainly in a less distinct naso-labial furrow. Different fibres of the nerve, having different areas of distribution, may be more markedly affected than others. The brow and the eyelids may, for example, be more affected than the mouth or cheek, or *vice versa*. When the lesion is above the origin of the twig for the stapedius muscle, there may be disturbances of the hearing with tinnitus, caused by inaction of the muscle.

IX. HEADACHE.

Headache is not unfrequently experienced in ear disease. In acute inflammatory affections of the middle ear or of the external meatus, shooting pains may be complained of in the temple and occiput. Such pains are often regarded as neuralgic in nature, and, in the absence of objective examination, the condition of the ear may be overlooked. In chronic non-exudative catarrh of the middle ear, similar pains may be experienced in the branches of the fifth nerve, originating in irritation of the mucous lining of the middle ear. In chronic purulent middle ear disease, heavy dull pain in the head is sometimes

complained of, particularly by anæmic and weakly persons. When, however, in purulent ear disease pain in the head becomes a sudden, severe, and continuous symptom, especially if attended by sickness and vomiting, we should think of the possibility of an intra-cranial complication, such as abscess, meningitis, or thrombosis of the lateral sinus. Labyrinthine inflammation, especially the purulent variety, is usually attended by headache. Suppuration in the mastoid cells, or mastoid periostitis, is likely to be attended by pain in the neighbouring regions of the head. A benumbed sensation over the corresponding side of the head is often spoken of by patients suffering from acute catarrhal conditions of the middle ear.

Some patients, especially those who are neurotic, complain very much of a sense of pressure on the top of the head, especially in connection with non-exudative catarrh or oto-sclerosis.

X. SICKNESS AND VOMITING.

These symptoms, when arising directly from ear disease, are generally associated with giddiness and staggering (see p. 63). They usually begin soon after the disturbance of equilibrium, and are probably due to reflex action through the vagus nerve. They naturally suggest the possibility of brain mischief. On the other hand, both patients and practitioners frequently regard such attacks as purely bilious in their nature. The sickness and vomiting rarely last beyond a day or two.

When a patient is seized with such symptoms as giddiness and staggering with sickness and vomiting, the organ of hearing should be carefully examined. It is also to be remembered that sickness and vomiting are marked symptoms in connection with the extension of purulent ear disease to the intra-cranial cavity or to the vascular system.

XI. PSYCHICAL DISTURBANCES.

A feeling of heaviness, confusion, or depression is often mentioned by patients suffering from affections of the middle ear, and they may also assert that an amount of mental work, which they could at one time perform with ease, has now become impossible. These symptoms probably occur in persons whose nerve force or resisting power is either

naturally weak or has been impaired by causes acting on the system independently of ear disease. The distracting influences of noises in the ear, which frequently attend these affections, as well as the strain of attempting to hear, often produce much depression. A special form of diminished power of mental application, termed by Professor Guye "aprosexia," is frequently noticed in children affected with post-nasal growths and exudative catarrh of the middle ear. As the result of the examination of six hundred school children, the writer found twice as many with defective hearing among the backward children as among the forward children. There is no doubt that by the loss or distinct impairment of hearing in youth, the mental faculties become damaged; and, even although hearing should return after some years, the baneful effects upon the mental development of the child of having been partially or wholly shut out from sound at the most valuable educational period of life can never be thoroughly repaired. The results of impaired hearing in youth upon the adult are thus described by von Tröltsch: "Men, who in early youth have suffered from impaired hearing, have, in many cases, as a consequence, something unstable, confused, or undecided, in their disposition and character. They are undecided and faltering in action, illogical and changeable in thought and speech, their answers often not being to the point. An experienced and observant physician can thus, in many cases, after a short conversation, even from the speech and manner of a patient, discover that most probably he had in youth defective hearing."

XII. PYREXIA.

Increase of temperature and other symptoms of febrile disturbance occur in most cases of acute purulent inflammation of the middle ear, and, less frequently, in non-purulent inflammation. In certain cases these symptoms are very marked, and a temperature of 102° F. is not uncommon. Acute mastoid inflammations are also generally attended by rise of temperature. Even in the acute inflammations of the external meatus, some elevation of temperature is usual. When meningitis or thrombosis of the lateral sinus occurs, the feverish disturbance becomes, of course, a very notable feature of the case, and in the latter case presents striking intermissions, each rise of temperature being usually ushered in by a severe rigor.

XIII. INTRA-CRANIAL SYMPTOMS.

The more serious symptoms indicative of intra-cranial disease, such as delirium, convulsions, stupor, coma, and paralysis, are met with in connection with purulent middle ear disease. It is to be noted, however, that acute affections of the middle ear may, in infants and very young children, be attended by convulsions without meningitis or other intra-cranial disease. In the presence of such symptoms, the existence of otorrhœa is of great significance, and imperatively calls for careful examination of the ear.

XIV. OCULAR DISTURBANCES.

These, in the form of iritis or keratitis or both, are often associated with hereditary syphilis affecting the labyrinth. In purulent ear disease, changes in the fundus of the eye are not unfrequently noticed, especially if associated with cranial or vascular complications, when distinct optic neuritis is common. It has been shewn, however, that vascular changes in the optic disc, short of optic neuritis, are very common in persons with purulent ear disease even when there is no evidence of intra-cranial complications. Paralysis of one or more of the ocular muscles is a well-known symptom of the intra-cranial complications of ear disease, especially of temporo-sphenoidal abscess, when the third cranial nerve is frequently involved. It has been demonstrated, both by experiments and by clinical observation, that nystagmus may arise reflexly from labyrinthine pressure or irritation, especially in the semi-circular canals, when it is generally associated with pronounced giddiness. The examiner should observe whether the movements of the eyes are horizontal, rotatory, or vertical, corresponding with the planes of the semi-circular canals; also, if they are excited or made worse when the eyes are turned to the side of the affected ear or to the opposite side. Nystagmus is observed most frequently in purulent ear disease, especially in labyrinthine suppurations, and it is often present in cerebellar abscess. Temporary attacks may sometimes be induced by syringing the ear, or by manipulating the deep parts, such as by applying the probe, or removing granulation tissue or a polypus.

XV. DISTURBANCE OF TASTE.

The sense of taste may be impaired, especially on one side of the tongue, from a purulent disease of the ear on the same side. This is due to implication of the chorda tympani nerve, either as it passes through the tympanum or before it branches off from the facial nerve. Pressure upon this nerve, or even the contact of certain medicaments, when the upper part of the tympanic membrane is destroyed, excites a peculiar taste on the corresponding side of the tongue. A disagreeable taste is, in some cases, due to the escape of pus from the Eustachian tube to the throat and back of the mouth.

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