THE CLINICAL INVESTIGATION OF EAR DISEASES.

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PART II.

PHYSICAL EXAMINATION OF THE EAR.

Inspection of the Ear is most conveniently accomplished under the light reflected from a concave mirror attached to the observer's head by a spectacle frame or head band, and having an aperture in its centre opposite the observer's right eye, the source of light being either sunlight or an artificial light placed on the right hand side.

THE AURICLE

may present congenital *malformations* in the way of *deformities, fistulae, imperfect development, etc.* In case of imperfect formation, hemiatrophy of the face and lower jaw should be looked for as indicating defective development of the structures originating in or about the cartilage of Meckel. Peculiarity in shape will often be noticed.

Acquired abnormalities may show themselves by changes in:

Color.—Skin diseases of various kinds.

Size.—*Hematoma*, a general swelling of the auricle without inflammatory disturbance, often traumatic. *Perichondritis*, an inflammatory swelling preceded by acute inflammation in the external meatus. *New growths*, sebaceous tumors, warts, sarcoma, etc.

Surface.—*Ulcerations*, as from lupus, syphilis, epithelioma, Raynaud's disease, noma, etc.

Position.—Projection outwards, or outwards and downwards, from the side of the head, as in peri-auricular subperiosteal abscess.

THE EXTERNAL MEATUS

has to be inspected without a speculum before any attempt is made to introduce such an instrument, because if the meatus is the seat of an obstruction, and especially of a furuncle, the introduction of an instrument causes an amount of pain which is quite unjustifiable.

To examine the Meatus without a Speculum the auricle must be

drawn upwards and backwards with the thumb and finger of one hand, while the tragus is held forwards with the other by means of the thumb, a probe, or a blunt hook. In very young children, on the other hand, the auricle must be drawn downwards and backwards.

To examine the *Meatus with a Speculum* the auricle should be drawn upwards and backwards with the middle and ring finger of the left hand, while the speculum is insinuated with the right hand and held in position with the thumb and index finger of the left. Two points to be borne in mind are, the *convexity of the floor*, and the forward and inward direction of the meatus causing *conspicuousness of the posterior wall*. The former is especially important in connection with the employment of instruments, as a thin film of cerumen on the floor may look like a solid ball, or a superficial redness of the skin may simulate an abscess, and incautious instrumental procedure might have most unfortunate results.

The meatus may be the seat of *complete obstruction*, as from congenital malformation, inflammatory swelling and formation of a diaphragm; from increased formation and retention of cerumen or epidermic scales; from polypi, granulations, or bony outgrowths, or from the presence of foreign bodies. It may be filled with pus or blood.

Partial obstruction may be of the nature of *general narrowing or stenosis* from skin-disease or general inflammation, or from bony outgrowth (hyperostosis), or of *circumscribed narrowing* from furuncle or the protrusion of a mastoid abscess (N.B., the anterior boundary of the mastoid cells and antrum forms the posterior wall of the meatus), periostitis, flakes of cerumen, granulations, small polypi, exostoses, etc. The outer part may be *collapsed* from senile changes in the lower jaw, the aperture taking a slitlike form.

Figure 5.

The nature and site of growth of some of these obstructions can only be made out by careful use of the *probe* (Fig. 5): a fine silver instrument, so curved that the hand holding it like a pencil may not obscure the view, is desirable. In its use, it is important to remember that the *length of the meatus*, from the posterior margin of the external orifice to the membrane, averages 24 mm.; nearly 1 inch. By its means the presence of caries, necrosis, fistulae, and tender spots may be detected.

Removable bodies may have to be expelled by means of the *syringe*,

directed along the roof of the meatus, straightened as already described, or of a fine *hoe* (Fig. 6), or of delicate *forceps*.

Figure 6.

THE MEMBRANA TYMPANI

should, under normal circumstances, be now visible, and answer to the following description: The normal membrane is somewhat oval, measuring 9 mm. ($\frac{9}{16}$ inch) in its longest diameter, of pearly-gray tint, set in a bony frame discernible all round, except at the upper part, where there is a notch—the notch of Rivinus. The anatomical features of present clinical interest are indicated in the accompanying diagram (Fig. 7).

Figure 7. Semi-diagrammatic view of the Tympanic Membrane.

It will be seen that the handle of the malleus runs downwards and backwards to the centre of the membrane, and that at its upper part is a very conspicuous projection, the *short process*—a most important landmark. Forwards and backwards from a little above the process run the anterior and posterior folds which separate the small upper flaccid portion of the membrane—membrane of Shrapnell, or *membrana flaccida*—from the main portion of the membrane—*membrana tensa*. From the tip of the malleus runs downwards and forwards a triangular shiny spot—the *light cone*. It will be remembered that the membrane is placed obliquely across the meatus, so that if it were perfectly flat it would reflect all light thrown upon it on to the anterior wall and floor of the meatus, and none directly back to the observer's eye. It is not perfectly flat, but drawn inwards at the umbo by the tensor tympani, so that a triangular portion at the lower and anterior part is at right angles to the line of sight, and therefore reflects the light directly back. This part therefore appears distinctly luminous, and constitutes the light-cone. It is an important rule that *any point*

which appears brightly illuminated is at right angles to the line of sight.

The Membrane in Disease may vary as follows:

Color.—It may present *general dull redness* in extreme congestion, especially when combined with inflammation of the external ear; or it may be *congested round its margins and along the handle* of the malleus, as in the lesser forms of external or middle ear catarrh; or it may present a *bright coppery lustre* when a congested condition of the tympanic mucosa is seen through a still transparent membrane—the earliest appearance of acute catarrh of the middle ear. It may be *raw and granular* after the removal of a desquamating layer of epidermis. A limited area of *redness in postero-superior quadrant* is not infrequent in disease focussed in the neighborhood of the tympanum and mastoid antrum. Circumscribed *yellow or white patches* of degeneration (fibrous or calcareous) usually indicate previous inflammation of the membrane. A single or double *black line* crossing the membrane horizontally is often visible when the tympanum is partially filled with fluid.

Lustre.—A general dullness, with loss of light-cone, may result from superficial inflammation of the outer layer—cloudy swelling of the outer layer.

Indistinctness of Features results from further thickening of the outer layer burying the visible portions of the malleus, which lies in the middle layer of the membrane beneath the outer one.

Surface.—The surface may be irregular from the projection of granulations, polypi, vesicles, interstitial abscesses, pouches, herniæ of the mucus layer through the middle and outer ones. It may be wrinkled, owing to abnormal thinness, either from atrophy or from the presence of large loose cicatrices like gold-beaters' skin (*vide* "Suction-Speculum").

Indrawing or Retraction may be general or circumscribed. *General* retraction is usually the result of non-ventilation of the tympanum and absorption of the contained air. This is generally caused by obstruction of the Eustachian tube from catarrhal or other changes. The appearance of the retracted membrane is very characteristic. The yielding parts are depressed, and the unyielding parts are thrown into abnormal relief, while other parts are foreshortened.

The main part of the membrane is much depressed, as is seen most distinctly in the portion in front of the malleus where the shadow is very deep. The anterior edge of the manubrium shows up with abnormal sharpness; the short process sticks out like a miniature hat peg, and the manubrium itself appears shorter and more horizontal than in

the normal condition. The anterior and posterior folds are unduly prominent, and in the postero-superior quadrant the membrane is often so closely opposed to the incus and stapes that the descending limb of the former and the posterior crus and muscle of the latter are quite easily distinguishable. The light-cone is more diffuse and less distinct toward the periphery of the membrane than usual.

Circumscribed Retraction is the result of the indrawing of *thin cicatrices* after the healing of perforations extending over small or large areas of the membrane, but usually having definite margins, or of *atrophic* areas with ill-defined margins resulting from dry chronic inflammation. The former may be loose or fixed, and are apt to be mistaken for existent perforations (*vide* "Suction-Speculum" and "Inflation of Tympanum"). This often occurs in the postero-superior quadrant just below the posterior fold. *Bulging* without material alteration in color can generally be recognized after careful study of the lights and shadows, but without this the distinction from retraction under unocular inspection is not always easy. In case of distension with pus, the bulging parts behind and in front of the manubrium leave that bone in the bottom of a groove, and present a yellowish tint at their most prominent parts. The most characteristic appearance in acute or purulent inflammation of the middle ear is that of a bright-red globular mass, more or less beset with small flakes of desquamated epithelium, completely filling the fundus of a narrowed meatus, and (after perforation) swamped in muco-pus. It usually consists for the most part of the postero-superior quadrant of the membrane, and occasionally of Shrapnell's membrane only, and as the swelling subsides it resembles a large granulation or small polypus.

Perforations may vary in size from a pinhole to absence of almost the whole membrane.

Figure 8.
Small Perforation.

Figure 9.
Large Reniform
Perforation.

Figure 10.
Absence of almost the
whole Membrane.

The above are typical appearances of *perforations in the membrana tensa*. The character of the margin must be noted—whether red and raw,

as in recent active perforations with possibility of healing and closing, or *white* and cicatricial, as in permanent ones, or "terraced" inwards, a rarely observable indication of a perforation commencing externally. The perforation must be distinguished from the margins of sunken cicatrices—the mouths of cicatricial pockets—by the suction-speculum and inflator (which see). The objects on the inner wall of the tympanum may be exposed, such as the promontory with its ramifying vessels, the descending process of the incus and the stapes, and occasionally the niche in which lies the fenestra rotunda. Often the mucous membrane of the inner wall is swollen, and projects outwards so much as to simulate a polypus, or a granulating *membrani tympani*, from which it has to be distinguished by means of the probe. The presence of white shreds protruding from the upper part of the perforation, and repeatedly re-forming after removal, indicates a desquamating process in the upper part of the tympanum, and the probable development of "cholesteatoma" in some of the accessory spaces.

Perforations in Shrapnell's Membrane, indicating disease in the "attic," are not infrequent, but are apt to be overlooked, and are often covered by a crust of inspissated secretion. Through them may often be seen masses of desquamated epithelium, and sometimes a portion of the head and neck of the malleus, which may be carious. They often co-exist with a permanent perforation of the *membrana tensa*.

Figure 11. Siegel's Speculum.

The *Suction-Speculum* (*Siegel's Speculum*) consists of an aural speculum widened out at its large end and fitted with a plane, or magnifying, glass. An india-rubber tube is attached to its side, and when the instrument is introduced tightly into the meatus the air can be sucked out through the tube by means of the mouth or a thick air-ball. The latter is preferable, but it must be of considerable strength (Fig. 11). By its means the *mobility of the malleus* and the degree of

relaxation of the membrane can be distinguished. The mouths of sunken *cicatricial pouches* can be diagnosed from *open perforations*, and *adhesions* of the membrane or of sunken cicatrices or other parts to the inner wall of the tympanum can be made out. Collections of *pus in accessory cavities* may often be detected and emptied by means of this instrument. Its *special diagnostic use* is in the detection of impaired mobility of the ossicles, and of relaxation of the membrane.

THE PERIOTIC REGION

must be examined. The *supra-auricular* segment is often the seat of subperiosteal abscesses, both in the adult and in the child. In the child, pus may find its way out through the still patent squamosa-mastoid suture, and burrow upwards. (It is interesting to note Gruber's rule that counter-openings in case of abscesses at or above the level of the upper-third of the auricle should be made in the roof of the meatus.)

The *pre-auricular* or *parotid* region may be the seat of lymphadenitis, parotitis, or pus-burrowing.

The *infra-auricular* region is habitually the seat of swelling and tenderness from *lymphatic inflammation* in acute inflammatory affections of the external ear. In disease of the internal jugular vein (from phlebitis of the lateral sinus) a swelling may be found running from this region down the side of the neck. Burrowing of pus from an abscess in the mastoid process having found vent on the inner aspect (Bezold), may also cause a swelling in the lateral cervical region—one form of "cervical cellulitis" comparable to a form of "retropharyngeal abscess" arising from the same cause. Pressure on such a swelling after opening of the mastoid would cause pus to well up.

The *post-auricular* or the *mastoid* region must in all cases, especially those characterized by pain or suppuration, be examined with care. It may be red, swollen, tender, painful, or the seat of sinuses or cicatrices. It must be noted whether the *swelling* is *circumscribed* and mobile, as in case of an inflamed gland, diffused or *shelving*, as in periosteal abscess, etc. The *point of greatest tenderness*, as *on* or *behind* the process, is important, as it will be remembered that in disease of the lateral sinus there may be tenderness behind and particularly at the seat of the mastoid foramen. *Intense pain*, deeply seated in the mastoid region, possibly without superficial evidence of inflammation, is present in cases of abscess or cholesteatoma in the antrum or mastoid cells. Its clinical significance depends upon its association with acute or else long-standing otitis, and with severe constitutional disturbances, the inflammation in acute cases being usually limited to the cervical cells (Politzer), while in the chronic ones the antrum is

almost universally involved. It is often, however, only after opening the mastoid process that the exact nature and limits of the inflammation can be defined, or further evidence of a *subdural abscess* of other *intra-cranial* disease may be forthcoming, and call for more extensive operative interference. Severe attacks of pain in the mastoid process, without inflammatory constitutional disturbance, constitute *mastoid neuralgia*, which, when occurring in the subjects of former local inflammation, often indicate chronic otitis curable by the chiseling away of a superficial layer of bone. *Fistulae and sinuses* require special attention. Those of *congenital* origin are generally in the præ-auricular region, and associated with other malformations. *Acquired* ones are mostly in the post-auricular area, and may lead to the remains of a superficial (glandular) abscess, to the periosteum, to the bone below the periosteum, or to the interior of the petrous bone. They may run forwards simply to the meatus, but they sometimes lead into the groove for the lateral sinus or the cranial cavity. Pouting granulations at the orifice of a fistula sometimes arise from the dura mater. (The probing and syringing of fistulae, especially if at an unusual distance behind the auricle, should not be practiced without the greatest caution.)

THE VENTILATING APPARATUS,

namely, *The Eustachian Tubes and their Approaches*, should now be examined.

THE NOSE, PHARYNX AND NASO-PHARYNX

call for detailed investigation. The following *special points* may be here noted:

(1) In the examination of the fauces the *activity of the palatal muscles* (which are also tubal muscles) during phonation.

(2) The appearance of the naso-pharynx and Eustachian tubes by *posterior rhinoscopy*, a proceeding which we find most readily carried out early in the interview and before much manipulation has been practiced.

(3) The *patency of each nostril* in relation to respiration, ventilation, and Eustachian catheterization.

THE EUSTACHIAN TUBE

may be tested as regards its patency by means of *inflation* by Valsalva's method, Politzer's method (or one of its modifications), or the Eustachian catheter, while the examiner listens with an india-rubber diagnostic tube, the ivory extremities of which are inserted into his own and the patient's ear. In rare, doubtful instances the skilled manipulator may use *Eustachian bougies*; but in view of the possibil-

ity of mistaking "kinks" for strictures, their diagnostic value is very slight, although their judicious therapeutic employment is often indispensable.

Valsalva's Method.—The patient pinches both nostrils firmly and makes an expiration as if to blow the nose, but without letting the air issue from the nostrils. The air is thus driven up the Eustachian tube, and if it is heard to enter the tympanum—normally a sound like "pick" is heard—it may be assumed that the tubes are freely open. During this process it is advisable for the patient to open his mouth widely.

Politzer's Method.—The patient holds a little water in his mouth, and the observer places the tip of a "Politzer Bag"—a six-ounce india-rubber enema bottle with a conveniently adapted tip—in the nostril. The patient swallows at the word of command, and the surgeon then compresses the bag firmly while closing the other nostril. During deglutition the palate is raised, the Eustachian tube is opened, and the air has no outlet from the nose except through that tube. Loewenberg advises that the compression should be practiced at the moment when the larynx rises in swallowing.

The Writer's Modification of Politzer's Method consists in making the patient blow vigorously with distended cheeks through a very narrow-bored tube while inflation is practiced. This, if not so widely applicable as Politzer's, is well worthy of preliminary trial in every case, as being in many respects easier and more pleasant.

The *Eustachian catheter* in its most practical form is a metal or vulcanite tube, about five inches in length, presenting the following well-known appearance: Its last inch is gently curved till the point is directed at an angle of about 45 degrees to the shank. The point must be well rounded and free from all sharp edges. The outer end is funnel-shaped, so as to receive the top of a small india-rubber bottle, and it has on it a ring pointing in the same direction as the tip of the catheter. In use it is passed along the floor of the nose into the naso-pharynx, and the point is turned outwards and upwards in the direction of the external meatus, the orifice of which is nearly on a level with that of the Eustachian tube. When the point is just inside the orifice of the tube, air is blown in by means of an india-rubber bottle, and its entrance into the tympanum is listened for by means of a diagnostic tube as before.

Several *important points* are to be kept in mind:

(1) A *nasal speculum* should invariably be used on the first occasion, especially by inexperienced operators, and the catheter should be introduced through this under good illumination. In nervous sub-

jects, or in case of rhinitis, cocaine should be previously applied inside the nose. The tip of the nose should be lifted up, and the head should be held in such a position that the *inferior meatus is horizontal*.

(2) Using the *palate as a landmark*, the catheter should be passed into the pharynx with the point downwards. The patient is then ordered to breathe through the nose, so that the soft palate may droop. The posterior margin of the hard palate is then very distinct, and the hook of the catheter is drawn forward so as to hug it. The beak has now only to be turned outwards and upwards, and in most cases may be introduced into the mouth of the Eustachian tube, especially if the patient performs at the same time the movement of swallowing.

(3) Using the *posterior lip of the Eustachian Tube as a landmark*, the catheter is pushed right back to the posterior wall of the pharynx, its beak is then turned outwards and slightly upwards into Rosenmüller's fossa, the hollow behind the Eustachian tube. It is then pulled forwards till it is felt to pass over the more or less pronounced posterior lip of the tube. If a vulcanite instrument is used, there is sufficient "give" to make the proceeding practically painless, but with a metal catheter it is advisable to turn the beak slightly downwards as soon as the lip is felt, so as to "round" the swelling rather than drag the point of the instrument over it.

(4) Using the *septum as a landmark*, the beak of the catheter in the pharynx is turned inwards and hooked on to the back of the septum, being pulled forward so as to press it. The instrument is held at this depth and then rotated so that the tip traverses nearly half a circle in the naso-pharynx, and comes to point outwards towards the auditory meatus.

(5) *When one nostril is very much obstructed*, the other is usually sufficiently patent to permit of the passage of a catheter with a very long beak, bent so as to point at right angles to the shank of the catheter. It is surprising how easy it is to direct this towards the tube of the obstructed side and to inflate the tympanum through it.

(6) *In cases of cleft palate* it is easier to pass the catheter through the mouth. Mr. Cresswell Baber has recommended the use of specially bent Eustachian catheters by this passage, even in cases of normal palate.

THE POINTS TO BE NOTED IN CONNECTION WITH INFLATION

are: (1) The degree of patency of the Eustachian tube; and (2) the effect of inflation on the hearing power and symptoms.

(1) *The patency of the Eustachian tube* is judged of by the readiness with which the air is observed to enter the tympanum. This presupposes some familiarity with the sounds produced by the process in

the normal ear, when the air enters the tympanum at once with a full stream and forces out the membrane with an easily audible "pick." Patency is then normal, or $\pm$. When the *tube is narrowed* the air passes with difficulty, there is a murmur of abnormally high-pitch, and it is only after a little time that it is heard to enter the tympanum. Patency is then diminished, or $-$. When the *tube is impervious* "patency" is absent, or $-\infty$.

(2) *The effect on the symptoms*, especially *hearing*, *tinnitus*, or *pain*. *Improvement* in general may be noted as present, absent or conspicuous by its opposite, deterioration taking place. Thus: "improvement" $+$, $\pm$, or $-$. It is, however, better to note the effect on the chief symptom. Thus the hearing distance for the watch after inflation may be compared with what it was before, the new distance being noted after the observation on patency. Similarly tinnitus, or pain may be diminished $-$, or increased $+$, or unchanged $\pm$, or entirely removed $-\infty$.

THE DIAGNOSTIC VALUE OF INFLATION

lies in the comparison of the patency and the effect produced; thus:

Patency much diminished and improvement on inflation very considerable would indicate a narrowing (catarrhal) of the Eustachian tube without significant tympanic disease.

Patency much diminished and improvement on inflation very moderate would indicate simultaneous affection of the tube and tympanum in the more favorable exudative form of chronic catarrh of the middle ear.

Patency normal and improvement on inflation little or none would indicate a primary affection of the tympanum, as in the obstinate dry or sclerotic form of chronic catarrh.

Patency normal and hearing made worse by inflation are found in cases of healthy middle ear, as in pure nerve-deafness.

Immense improvement on inflation followed by speedy or almost immediate return to the previous degree of dullness of hearing is characteristic of relaxation of the membrane.

In cases of perforation of the membrane a distinct hissing or whistling sound is usually heard on auscultation during inflation—the "perforation sound."

The appearance of the membrane is often altered after inflation, an indrawn membrane being forced into its normal position, and a relaxed one bulged out to an abnormal degree. Similarly depressed cicatrices may be driven out more or less completely according as they are free or bound down by adhesions, very much as when the exhausting speculum is employed.

GELLE'S TEST.

Centripetal pressure consists in compressing the air in the meatus by means of a firmly fitting "Politzer-bag," while a vibrating tuning-fork is placed on the vertex. In the normal subject the sound dies away during the compression and returns on its removal. This is believed to indicate that the stapes moves freely in its fenestra, and Gellé's test is "positive" +; otherwise it is "negative" —.

Binaural Synergy.—This test, also introduced by Gellé, is practiced by holding a vibrating tuning-fork opposite the other ear, while compression is exercised as above in the ear under examination. In the normal subject the sound of the tuning-fork becomes faint and inaudible during the compression, but returns on its removal (always assuming that the vibration of the tuning-fork has not diminished below normal audibility). This is ascribed to a synergic contraction of the opposite tensor tympani reflected through an "oto-spinal" centre in the medulla. The results may be readily noted as "positive" or "negative," but the interpretation is much hampered by the obvious sources of confusion arising from possible disease of the middle ear causing immobility of parts, or of the labyrinth of one or other side. In doubtful cases the test should not be omitted.