Diseases of the ear / A. Marmaduke Sheild.

DISEASES OF THE EAR

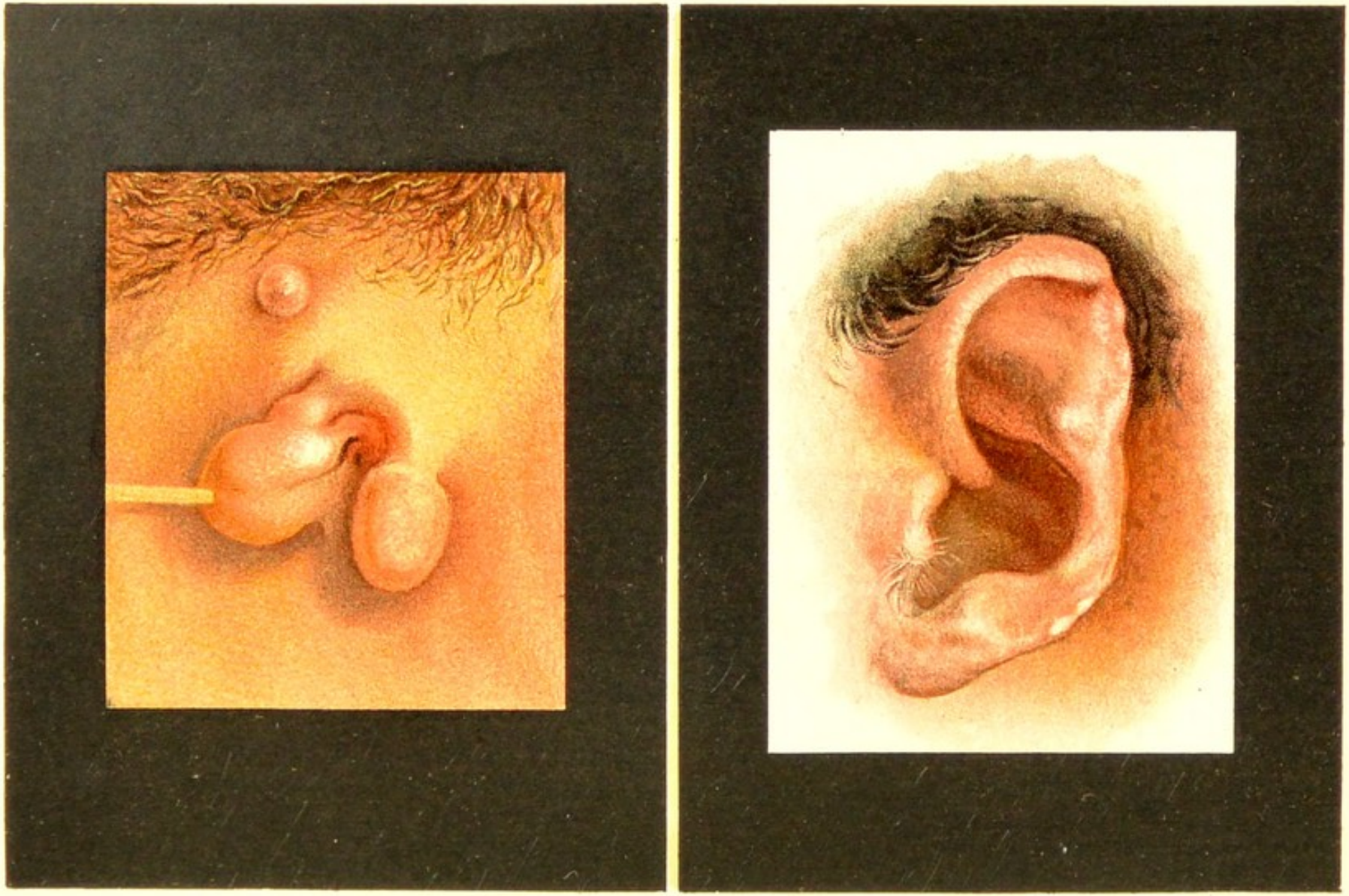

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PLATE I.

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A.—Failure of development of right ear, with rudimentary tubercles and branchial fistula. There was congenital facial paralysis and complete nerve-deafness. (*From a patient under the care of Dr. Mitchell Bruce.*)

B.—Ulceration of the auricle in a man aged forty, who also suffered from *Lichen planus verrucosus.* (January 20th, 1891.)

DISEASES OF THE EAR

A. MARMADUKE SHEILD

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ASSISTANT SURGEON AND LECTURER ON PRACTICAL SURGERY AT ST. GEORGE'S HOSPITAL

LATE ASSISTANT SURGEON, LECTURER ON OPERATIVE SURGERY, AND SURGEON IN CHARGE OF THE AURAL DEPARTMENT OF CHARING CROSS HOSPITAL

WITH FOUR COLOURED PLATES AND THIRTY-FOUR WOODCUT ILLUSTRATIONS.

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BIBLIOTHÈQUE SAUVAGE

PREFACE.

During a period of nearly seven years I had charge of the department for aural diseases at Charing Cross Hospital. Numerous opportunities were there afforded me of observing, treating, and taking notes of a large number of cases. Some of these have been published in the *Archives of Otology*, and others have formed a basis for clinical lectures which have appeared from time to time in the *Lancet*.

This little book is an attempt to place before students and practitioners, in a condensed and easily readable manner, those varieties of aural disease which admit of rational treatment, in accordance with the established principles of general surgery. The size and scope of the work forbid its rivalling the numerous exhaustive treatises on aural surgery which have lately appeared. A desire to economise space will explain the absence of extensive references, and may serve as an apology for the brevity of the first chapter on the anatomy and physiology of the organ of hearing. The bulk of the work is solely drawn from my own experience, and this may explain some diversities from generally received ideas; but I have always tried to give credit to others when quoting their opinions or researches. The brief abstracts of illustrative cases are taken from my own note-books. Stress is laid upon those subjects now so generally coming under the care of the operative surgeon, such as mastoid disease, sinus pyæmia, and adenoid growths.

I have to acknowledge my thanks to Mr. A. W. Head for the care and trouble he has taken in depicting some of the commoner and more important morbid conditions of the membrana tympani and canal. His illustrations were depicted from actual cases under my observation. The anatomical plates are drawn from my own preparations by Mr. Highley. In the Appendix will be found a few hints for prescribing, and some simple formulæ are added which may prove useful.

In conclusion, I have to express my best thanks to the physicians and assistant-physicians, and especially to Drs. Green and Mitchell Bruce, for permitting me to examine many cases under their care complicated by aural symptoms, during the period I was connected with the surgical staff of Charing Cross Hospital.

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DISEASES OF THE EAR.

CHAPTER I.

A SKETCH OF THE ANATOMY AND PHYSIOLOGY OF THE EAR.

THE organ of hearing consists essentially of conducting media and perceptive apparatus.

The conducting media are the auricle or pinna, the auditory canal, the membrana tympani and chain of ossicles. The mastoid cells and Eustachian tube have accessory functions.

Sound is also conducted through the air and cranial bones. The perceptive apparatus consists of the membranous labyrinth and semicircular canals. The canals and utricle form the posterior labyrinth, the cochlea and saccule the anterior labyrinth.

Auricle.—The human auricle (Fig. 2) is formed by the coalescence of six tubercles on the dilated margin of the first branchial cleft. It consists largely of a convoluted plate of yellow elastic fibro-cartilage. The integument is closely adherent, and the blood-vessels, being superficial, are readily affected by extreme cold. Hence the frequency of frost-bite in this portion of the body. The pinna is abundantly supplied with nerves; the auricularis magnus posteriorly, the auricularis magnus and auriculo-temporal anteriorly, a twig from the small occipital on the upper

and inner aspect, and the auricular branch of the vagus behind the lobule and in the canal. The distribution of this latter nerve explains the phenomenon of cough on manipulating the canal. Violent pain

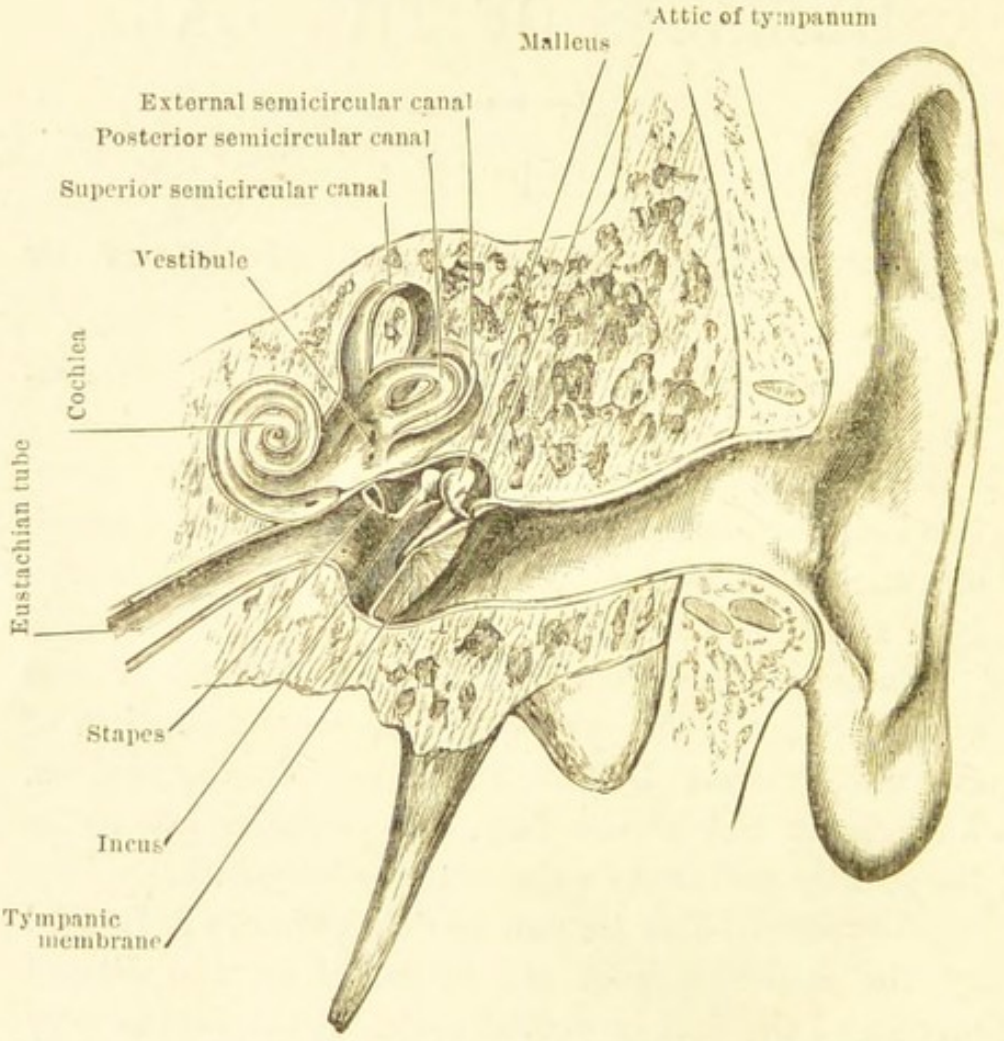

Fig. 1.—Diagram to show Relative Position of Different Parts of Organ of Hearing.

(ear-ache) is often experienced in the course of the auriculo-temporal nerve, in such affections as carious teeth, or malignant disease of the tongue, irritating the other branches of the third division of the fifth nerve. The pinna is fixed to the margins of the external auditory meatus by a tubular prolongation

inwards of the concha. This tubular prolongation is traversed by several clefts, the fissures of Santorini. Through these a parotid abscess may readily burst into the canal. The short muscles and ligaments of the external ear are of no marked surgical importance. The named parts of the pinna will be seen in the accompanying illustration (Fig. 2).

Auditory canal.—The external auditory canal

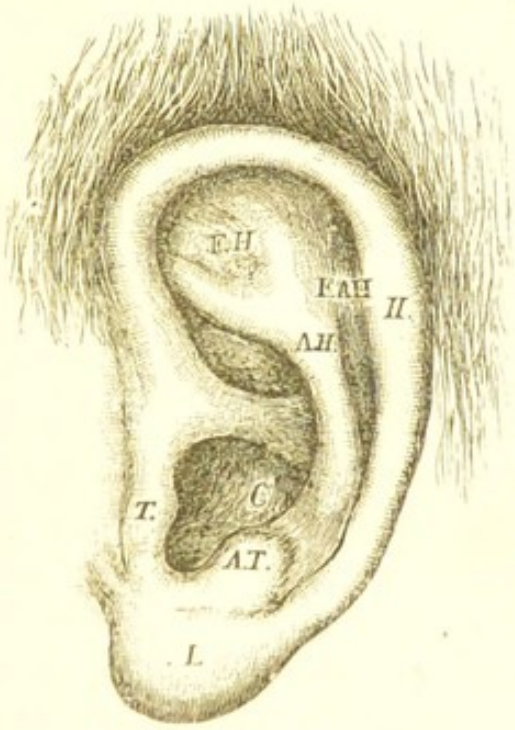

Fig. 2.—The Auricle.

H, Helix ; A H, anti-helix ; F H, fossa of helix ; F A H, fossa of anti-helix T, tragus ; A T, anti-tragus ; C, concha ; L, lobule.

differs widely in length, curvature, and dimensions in different individuals. Its average length is about one inch and a quarter, one-third being cartilaginous, two-thirds bony. It is longer on the floor than on the roof, in consequence of the oblique position of the membrana tympani. The canal runs forwards and downwards, and also takes a distinct vertical curve near the commencement of its bony portion (Fig. 1) It

is elliptical in section, the long diameter being vertical in the cartilaginous part, horizontal in the bony. The narrowest part of the channel is a little deeper than the commencement of the osseous portion. This is a consideration of importance in the removal of foreign bodies from the depths of the canal. The epidermic lining of the auditory canal is continuous, as an extremely thin layer, with the outer lamina of the membrana tympani. It is thick externally, and contains sebaceous and ceruminous glands, being also covered with many short hairs. Cerumen is an unctuous substance, light-coloured and soft in early life, dark and firm in old age, and of a peculiarly bitter taste. It consists of fatty matters mingled with sebaceous material, epidermic scales, and traces of potash and soda. The relations of the auditory canal are of great surgical importance. Below and in front are the parotid gland externally, the temporo-maxillary articulation internally. Thus caries of the walls may implicate the temporo-maxillary joint, and a parotid abscess may burst into the canal. A heavy blow on the jaw has been known to fracture this passage, and cause hæmorrhage from the meatus. Posteriorly, the mastoid cells are only separated from the auditory canal by a thin lamina of bone (Fig. 3). The mastoid cells may be opened through the posterior wall. A mastoid abscess may burst here, and in such cases the soft tissues over the posterior wall of the canal are often so swollen as almost to close it.

The upper wall of the canal is in close relation with the dura mater and middle fossa of the skull. It is worthy of note that the bone may be exceedingly thin, and operations for caries in this situation must be conducted with much caution.

At birth the auditory canal is practically entirely cartilaginous, the cartilage of the pinna being continuous with the membrane round the tympanic ring (Fig. 4). Two bony prominences grow outwards from the margins of the tympanic ring, and finally firmly coalesce at almost the age of six. They form, and progressively deepen, the osseous part of the canal.

Membrana tympani.—The tympanic membrane may be looked upon as a partition interposed

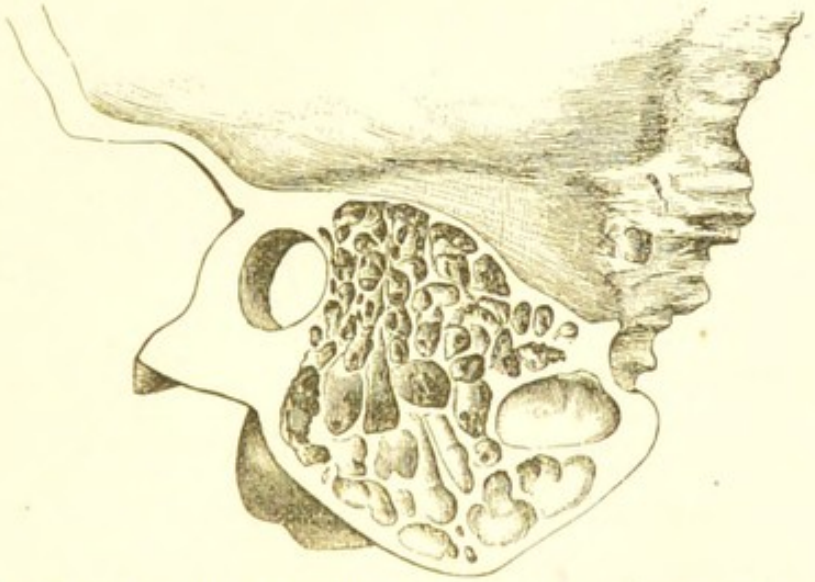

Fig. 3.—Vertical Section through the Centre of the Bony Canal to show close Relation of Mastoid Cells to Posterior Wall.

between the auditory canal and the tympanic cavity. It is an oval disc with the long diameter vertical, set obliquely to the floor of the canal, with which it makes an angle of about 45°. It has a central fibrous layer consisting of two laminæ. The fibres radiate from the handle of the malleus, where the membrane is strong, and arch over the short process of the malleus. They are not found superiorly near a notch (notch of Rivini) in the upper part of the tympanic

ring, where this aperture is completed by the intervention of the squamous bone.

In this situation, the membrane consists of epidermis and mucous coat only, and from its looseness is termed "membrana flaccida." Perforations from disease may be here often detected, and sometimes a tiny opening naturally exists (foramen of Rivini). The small notch observed superiorly in the tympanic ring is bounded by a spicule of bone on either side, and

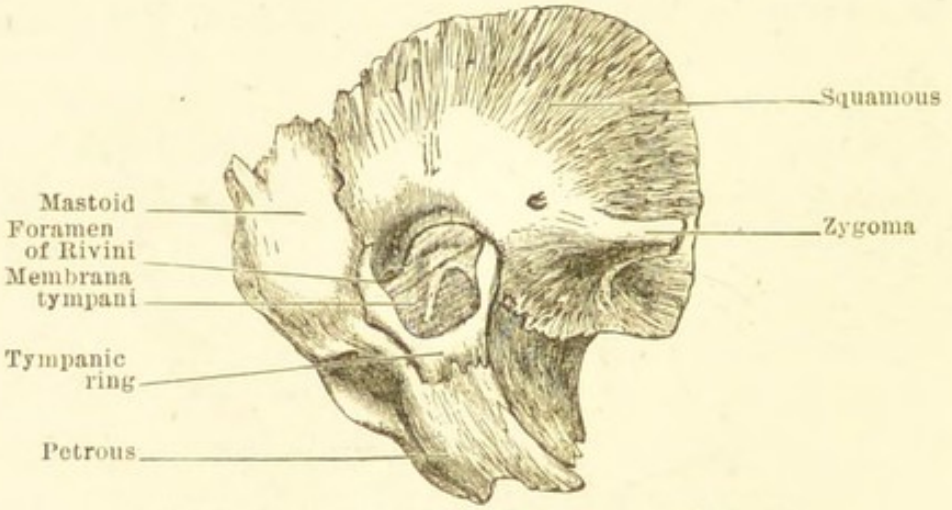

Fig. 4.—Outer Aspect of a Fœtal Temporal Bone.

bundles of fibres pass from these to the short process of the malleus. The fibrous layers of the membrana tympani are covered externally by epidermis, and internally by the mucous lining of the tympanum.

The handle of the malleus descends almost vertically, and its periosteum is firmly incorporated with the fibrous layers of the membrane, which hence is concave externally about its centre. This spot is termed the umbo (Figs. 1 and 5). Descending from the umbo downwards and forwards can be seen, on the normal membrane, a triangular shining spot of light (Plate II. Fig. A). This "spot" is due to the reflection of light from a depression on a plane polished surface, and

hence when the normal lustre of the membrane is impaired, or its curvature altered, the condition of the "light-spot" is of great diagnostic import. The arteries of the outer layer of the tympanic membrane come from the auricular twig of the internal maxillary artery; the vessels of the inner layer from the tympanic arteries. The membrane has numerous nerves from the auriculo-temporal branch of the fifth nerve, and from the tympanic plexus internally.

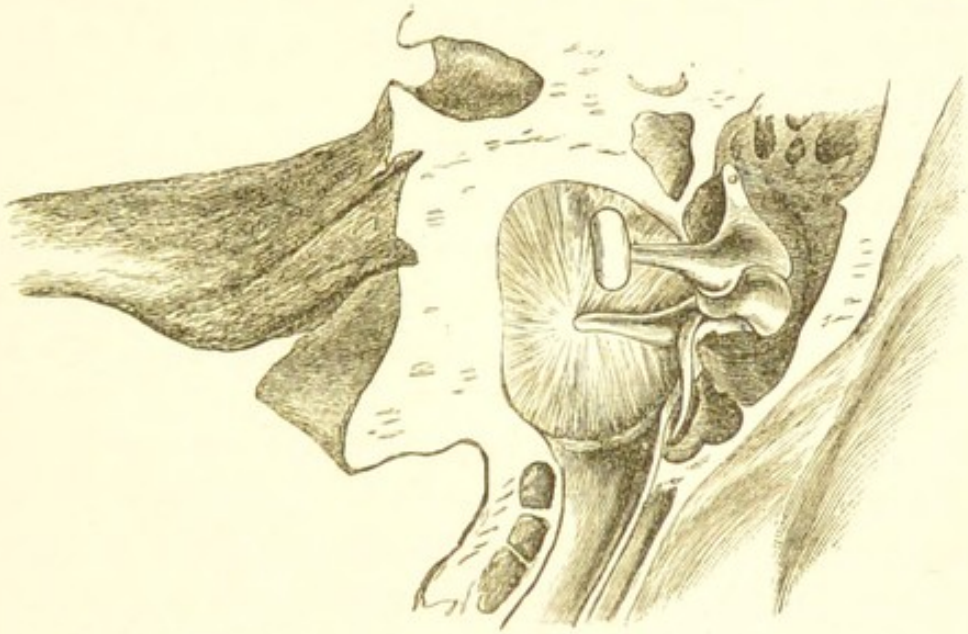

Fig. 5.—Membrana Tympani and Ossicles, seen from the inner side.

The fibrous structure of the membrane prevents it from gaping when incised. An incision in it heals readily, but a perforation from disease, when much tissue is destroyed, unites with extreme difficulty. Its integrity is by no means essential to good hearing. The continuity of tissue between its layers and the lining membranes of the auditory canal and tympanum, explains the readiness with which inflammatory affections of these parts are propagated to it. Indeed, inflammation of one can hardly occur without

inflammation of the other. Incisions through the membrane should be made posteriorly, behind and below the handle of the malleus.

Tympanum.—The tympanum is a small irregular cavity, and, with the Eustachian tube, is the remains of the first post-oral visceral cleft. It measures about one-eighth of an inch across, and is interposed between the membrana tympani externally and the internal ear internally. It is lined with epithelium, which is ciliated on the floor, flattened on the roof and sides, columnar and ciliated towards the Eustachian tube. The mucous membrane is intimately adherent to the bone, of which, for practical purposes, it may be considered the periosteum. Hence, in ulcerative affections of the mucous membrane the bone is apt to suffer caries also. The relations of the tympanic cavity are of extreme surgical importance (Figs. 1 and 8). Externally it is bounded by the tympanic membrane, and presents in front of the membrane the "iter chordæ anterius," through which the chorda tympani nerve leaves the tympanum, and the fissure of Glaser, which lodges the processus gracilis of the malleus.

The inner wall of the tympanum presents above, the fenestra ovalis leading into the cavity of the vestibule. This is occupied by a membranous covering and the base of the stapes in the recent state. Below and behind, in a small depression, is the fenestra rotunda, closed by a membrane in the fresh state, and leading to the scala tympani of the cochlea. Above the fenestra ovalis is a curved ridge, indicating the situation of the aqueduct of Fallopius and the facial nerve. Below it is an obtuse elevation (promontory), caused by the projection outwards of the

first turn of the cochlea. Anteriorly, the roof of the tympanum descends, until we arrive at two bony canals separated by a thin plate of bone, the processus cochleariformis. The upper canal transmits the tendon of the tensor tympani muscle; the lower is the Eustachian tube. Posteriorly, the mastoid cells open into the cavity by one large and (usually) two small openings. These are well above the level of the floor of the tympanic cavity. At the junction of the inner with the posterior walls is the pyramid, from which the tendon of the stapedius emerges.

The narrow floor of the tympanic cavity is separated by a thin plate of bone, not always complete, from the carotid canal in front and the jugular fossa behind. The roof of the tympanic cavity, exceedingly thin and diaphanous, corresponds with the middle fossa of the skull, and is in intimate relation with the brain and its meninges. The petro-squamous suture crosses the roof of the tympanum, and is obliterated by the end of the first year. In suppurative affections of the tympanum these perilous anatomical relations will receive due consideration in the mind of a judicious practitioner. It may be especially pointed out that the relations of the bulb of the jugular vein and the carotid artery to the cavity of the tympanum are by no means constant, and sometimes the bony partitions are incomplete, or thin and diaphanous.

Attic of the tympanum.—(Fig. 1.) Above the malleus and chorda tympani nerve is a small rounded space which would about hold a swan-shot. This is termed the attic of the tympanum or malleo-incudal recess. It communicates with the superior

horizontal mastoid antrum, and in "the attic" suppurative processes prove chronic and intractable.

Development.—The external auditory canal, the tympanum, and the Eustachian tube, are developed from the first branchial cleft. Congenital

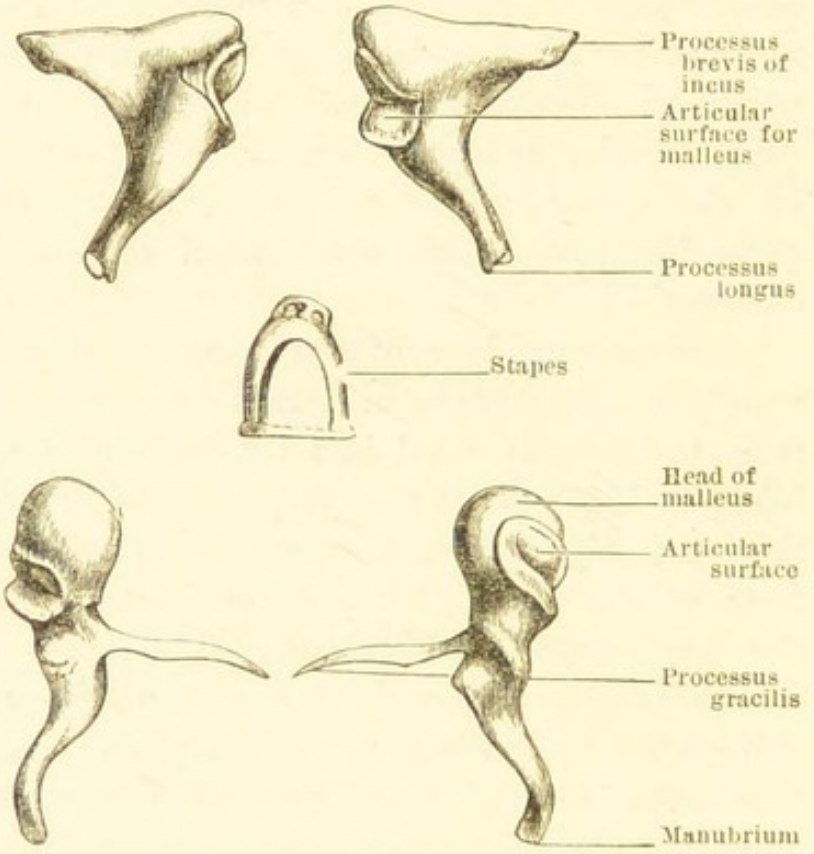

Fig. 6.—The Small Bones of the Ear, enlarged.

fistulous openings may be found in the neighbourhood of the auditory canal, and, in like manner, lappets of skin may be found upon the side of the neck (goat-neck) in the situation of other branchial clefts. These are termed supernumerary auricles. A bad congenital fistula may run right through the tragus and membrana tympani.

Ossicles.—The ossicula auditus (Figs. 5, 6, and 7), suspended like a chain across the tympanic cavity, are the malleus, incus, and stapes.

The rounded head of the malleus has posteriorly an elliptical depression for articulation with the incus. Below this is a slight constriction, the neck, and, still more inferiorly, the various processes arise. The long process, or manubrium, passes downwards, to be inserted into the membrana tympani. The processus gracilis passes outwards to the fissure of Glaser. The processus brevis is a small elevation directed outwards; opposite to this the tensor tympani is attached.

The incus consists of a body and two processes. The body presents a deep concave articular facet, for

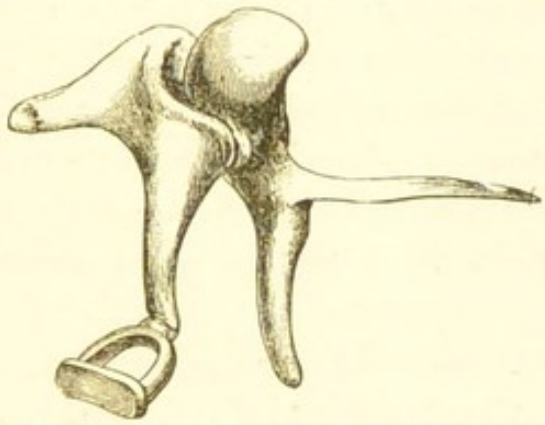

Fig. 7.—The Left Ear-Bones, enlarged and articulated.

articulation with the head of the malleus. The short process projects towards the mastoid cells, and is attached to the back and outer wall of the tympanum by ligamentous fibres.

The long process is deeper, but nearly parallel to the handle of the malleus. At its termination it bends abruptly, and its end is surmounted by a flat tubercle covered with cartilage, the os orbiculare. This exists as a separate bone in childhood.

The stapes is composed of a head, base, and two crura, which converge to form a constricted neck immediately below the head.

The anterior crus is the shorter of the two, and

the triangular space in the middle of the bone is occupied by a thin membrane in the recent state. The head of the stapes, directed directly outwards, articulates with the long process of the incus. The base is covered with cartilage, and fits into the fenestra ovalis. Its margins are connected to the edges of the fenestra by ligamentous tissue. All the joints between the ossicles are covered with hyaline cartilage, and have synovial membranes. The peculiar articulation of the incus with the malleus is worthy of note. When the malleus moves inwards, the incus closely obeys its movement. If the malleus moves unduly outwards, separation of the articular surfaces is permitted, and the incus does not follow. These delicate joints are readily damaged or destroyed by inflammatory processes, and anchylosis of the stapes in the fenestra ovalis is a too common result of chronic inflammatory changes.

Ligaments.—Numerous ligaments are described as keeping the ossicula in position. The principal are as follows :—The anterior ligament of the malleus passes from the base of the processus gracilis to the fissure of Glaser, and to a small spine of bone situated at the anterior border of the notch of Rivini. The superior, or suspensory, ligament passes from the roof of the tympanum to the head of the malleus. The external ligament passes from the processus brevis to the notch of Rivini.

The ligament of the incus extends from the short process to the posterior wall of the tympanum.

The auditory branch of the basilar artery supplies the internal ear, and the terminal twigs of this vessel, like other central vessels, may give way and cause labyrinthine hæmorrhage.

Nerves and blood-vessels.—The mucous membrane of the tympanum is richly supplied with nerves and blood-vessels. The latter will not here receive detailed description. The stylo-mastoid branch of the posterior auricular artery supplies the mastoid cells, the posterior part of the tympanum and the tympanic membrane; it anastomoses freely with the other tympanic arteries. This explains the great relief to deeply-seated inflammations by applying relays of leeches over the stylo-mastoid foramen. The tympanic veins communicate with the lateral and petrosal sinuses, a fact of the first surgical importance. The chorda tympani nerve arises from the facial, near the lower end of the aqueduct, and runs backwards into the tympanum, which it crosses immediately behind the neck of the malleus. It enters by a foramen in the posterior wall, and leaves the tympanic cavity by the "iter chordæ anterius," close to the Glaserian fissure. The situation of the facial nerve has been indicated. The tympanic plexus found upon the promontory is formed by the glosso-pharyngeal, sympathetic, and both the petrosal nerves.

Eustachian tube.—The Eustachian tube extends from the anterior extremity of the tympanum downwards, inwards, and forwards to the naso-pharynx (Figs. 1 and 8). It measures about one inch and a half, the osseous portion being about half an inch long. The pharyngeal orifice of the tube is trumpet-shaped, and it is formed of cartilage above, but of a fibrous membrane below and at the sides. The mucous membrane is continuous with the lining of the tympanic cavity. It is covered with ciliated epithelium, the motion of the cilia being towards the pharynx. Some fibres of the tensor palati are attached to the

wall of the tube, and its orifice, usually closed, is patent during swallowing; but the exact function of the muscle fibres is hardly yet quite clear. The pharyngeal orifice is on a slightly higher level than the posterior extremity of the lower spongy bone.

Mastoid.—The mastoid bone and its cellular cavities are small, and not developed during early life. In the adult the bone is filled by a variable number of spaces, differing in size, shape, and number in different individuals. Sometimes the cells are entirely pneumatic; often they are traversed by numerous laminæ of bone forming diploetic tissue; occasionally they are full of fat and soft connective tissue. The mastoid antrum would about contain a pea. It is situated behind the tympanum, and on a higher level than the tympanic floor, and extends into the base of the petrous bone farther than is usually described. This cavity is surrounded on all sides by the mastoid air-cells. The distance of the antrum from the lateral sinus is from three to six ~~inches~~, mm while its outer wall is from one-half to three-quarters of an inch from the external surface of the mastoid process (*Treves*). The veins join the lateral sinus, and also communicate with the mastoid vein, which appears superficially behind the ear through the mastoid foramen. Clotting in this vein and inflammation of the soft parts behind the ear are frequently found in thrombosis of the lateral sinus.

The mastoid cells are surrounded by a layer of bone which varies much in thickness and hardness. In adults, and in cases of chronic inflammation, the external lamina of the mastoid may be a quarter of an inch thick. In children it is thin, and easily perforated. The mastoid process projects below into a

prominence to which are attached a dense fascia, the sterno-mastoid, splenius- and trachelo-mastoid muscles. When pus gets beneath these structures in cases of mastoid necrosis, the most inveterate abscesses and sinuses form in the neck, making bold surgery necessary (Bezold's mastoiditis). The lining membrane of the mastoid cells is a continuation of that lining the tympanum. It is vascular, and formed of layers of connective tissue covered by a pavement epithelium.

The position of the lateral sinus is of great interest and importance. The S-shaped bend is found about half an inch horizontally behind the auditory meatus, but it frequently extends forwards to nearly the margin of the canal. Also the thickness of bone that separates the sinus from the cellular cavities is too variable, anatomically, to lay down any rules that are always surgically reliable.* It is a practical rule to keep close to the auditory canal in opening the mastoid, and to work exactly parallel with its course.

FUNCTIONS OF THE MORE EXTERNAL PARTS OF THE ORGAN OF HEARING.

Auricle and auditory canal.—The functions of the auricle and canal are to collect and convey the waves of sound to the drum. The auricle has probably but a slight influence in intensifying sound. The author has observed a case where the whole auricle was removed for rodent ulcer and no appreciable deafness resulted. The length and curvatures

* Anyone may realise this for himself, both by actual dissection and also by a careful perusal of anatomical works and investigations on this point.

of the canal may serve to intensify sound by reverberation.

Membrana tympani.—The membrana tympani has, from its peculiar curvatures, probably no fundamental note of its own, and considerable destruction of it may occur and yet the hearing remain useful. Its functions are: (1) to conduct vibrations to the ossicles, and so across the tympanum; (2) to act as a modifier of sound by the action of the tensor tympani and ossicles; (3) to serve as a protecting medium to the tympanum from cold and other injurious influences acting from without. The latter function has been too much lost sight of by those who advocate free removal of this structure in cases of chronic inflammation of the middle ear. The membrana tympani vibrates to the least perceptible sound; but, as it is firmly adherent to the handle of the malleus, and the latter is attached to the tensor tympani muscle, its inward movements must be considerably checked. Thus intensity of sound is modified, the membrane acting as a "damper." When the Eustachian tube is closed by pathological processes, the vibratory power of the membrane is necessarily much diminished. The more tense the membrane, the more readily will it respond to high tones. The vibrations of the "drum" are conveyed to the internal ear by the chain of ossicles. In birds, the ossicular chain is composed of one piece of bone. In man, the chain is divided into several bones connected by joints. As the membrana tympani is much larger than the secondary membrane of the oval window, the vibrations on the latter must be greatly intensified.

As vibrations, alternating condensations and rarefactions of the particles of matter, fall in a longitudinal

direction upon the tympanic membrane, the latter rapidly flutters, as it may be described, inwards and outwards. The vibrations of a membrane arranged like the tympanic membrane will be extremely complex. Thus a tuning-fork will only vibrate to its own note; but the tympanic membrane probably takes up a large number of vibrations. When tense, it vibrates only to high notes. The state of moderate flaccidity in which this membrane usually is placed is probably the most advantageous for receiving a large number of vibrations. It must be remembered that sounds are also conveyed to the internal ear through the bones of the head—a fact taken advantage of in the use of "trumpets" for middle-ear deafness.

Function of ossicles.—The principal functions of the chain of ossicles are as follows:—All fluttering movements of the membrana tympani are conveyed to the bones; the malleus, moving inwards, carries the incus with it, and the stapes is pressed into the fenestra ovalis. A wave passes along the perilymph, and the membrane of the round window bulges outwards. When the onward flow of fluid ceases, the membrane of the round window recedes, and a backward flow takes place. Thus there is a series of delicate ebb-and-flow movements in the perilymph and endolymph. Further, it may be noted that the dimensions of the fenestra ovalis and membrana tympani vary greatly, and that, whatever force is applied to the larger membrana tympani, it must be greatly amplified on the smaller fenestra ovalis. The swinging movement of the ossicles is mainly performed on a fulcrum, which is the short process and posterior ligament of the incus. When the bones move outwards, the stapes is not dragged out of its place,

because the articulations permit of some separation. The joints, covered with cartilage, also act as moderators of sudden and violent movement caused by a sudden loud sound, as the unexpected discharge of a gun. In fact, the function of the chain of ossicles is that of a conducting lever, interrupted by joints to permit of special modifications in its function. The tensor tympani, inserted near the neck of the malleus, draws that bone inwards and tightens the membrane, or prevents it from being unduly drawn outwards. Since waves of sound are only well conducted along uninterrupted media, and especially along those whose length is greater than their breadth (as a string), it follows that the chain of ossicles as a conductor of sound must be imperfect, and their principal function is to convey the vibratory movements of the tympanic membrane to the secondary membrane of the fenestra ovalis. Sound does not pass well from air to solid, and hence the communication of vibrations of sound through the cranial bones, is very inferior to that through the canal and vibrating membrane.

The Eustachian tube conduces to equalisation of pressure between the tympanic cavity and the external air. It permits of percolation of fluids from the tympanum. It is open during swallowing, and this seems sufficient to maintain equalisation of pressure. The exact function of the muscular fibres at the pharyngeal orifice is not clear. The mastoid cells increase resonance, and serve to lighten the dense and heavy temporal bone.

Internal ear.—The complicated internal ear is contained in the petrous bone which, so to speak, is moulded around the membranous structures of the cochlea, semicircular canals, and vestibule. The bone

does not embrace these structures tightly, a space being left between the membrane and the bone, containing

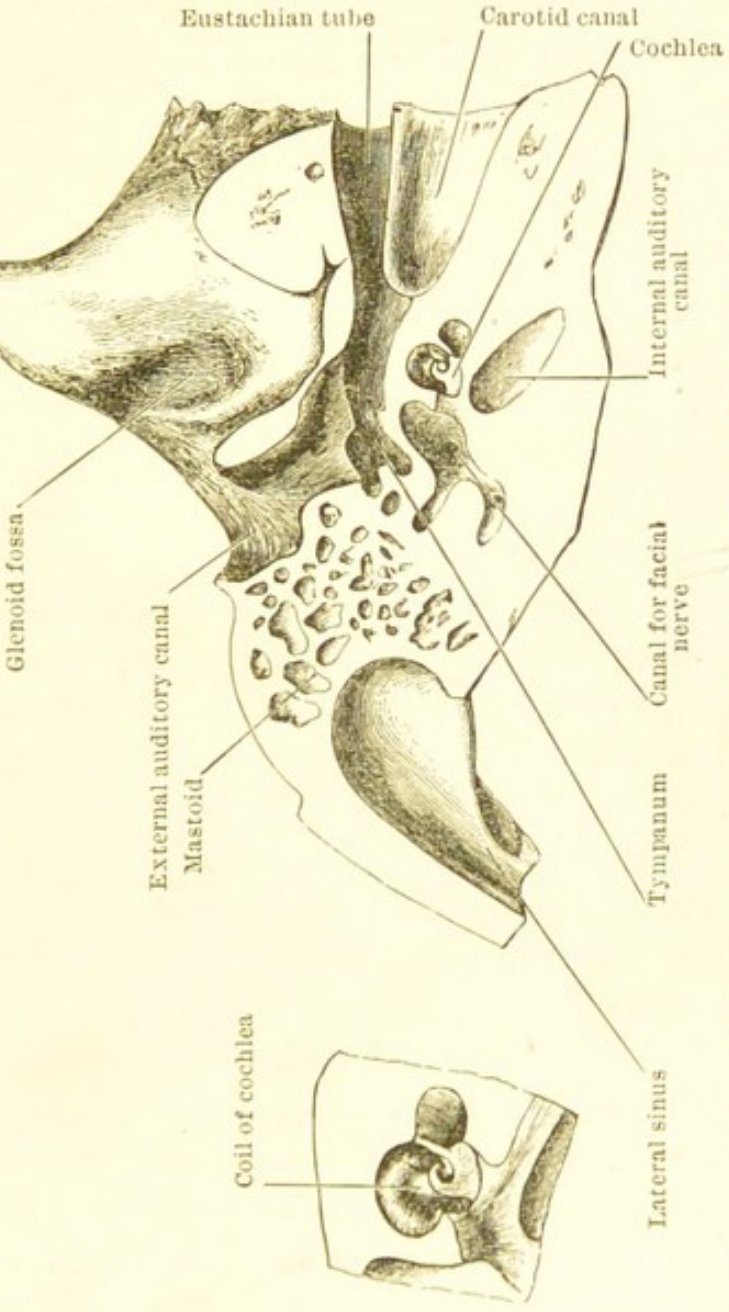

Fig. 8.—Horizontal Section through Right Temporal Bone: coil of cochlea, enlarged. (*From a Preparation of the Author's.*)

the perilymph. The cochlea is anterior, the semicircular canals are posterior, and the vestibule is in the centre (Figs. 1 and 8).

Vestibule.—The vestibule is a small oval cavity, in relation externally with the fenestra ovalis, and it

communicates with the scala vestibuli of the cochlea. It presents on its outer wall the opening of the fenestra ovalis, occupied by the stapes in the recent state, and above and behind this the anterior opening of the horizontally-directed semicircular canal.

On the inner wall are two minute depressions: the fovea hemispherica anteriorly, the fovea hemi-elliptica behind and on the roof. These fossæ are separated by a ridge, the crista vestibuli. The other four openings of the semicircular canals are seen posteriorly. Anteriorly, there is an opening by which the duct of the saccule communicates with the cochlea. The aqueductus vestibuli may be demonstrated with a lens as a tiny canal leading from the posterior part of the inner wall of the vestibule to the posterior surface of the petrous bone. It lodges a process of the membranous vestibule which communicates with the subdural space. The numerous apertures of the lamina cribrosa, where the auditory filaments enter, can only be seen with a good lens.

The vestibule contains two membranous sacs, the utricle and the saccule. Of these the utricle is posterior, lying in the fovea hemi-elliptica. This sac receives the ampullated ends of the semicircular canals. The saccule is anterior, lying in the fovea hemispherica. The saccule is indirectly connected with the utricle by the aqueductus vestibuli, and with the membranous cochlea near the base by the ductus reuniens.

Semicircular canals.—(Fig. 9.) The membranous semicircular canals, encased in their bony shells, are three in number, and are about one-twentieth of an inch in diameter. The superior and posterior canals enter the vestibule by a common orifice,

so that there are five openings into this sac, instead of six. The external canal enters by two orifices. Each canal is situate at right angles to the other. The

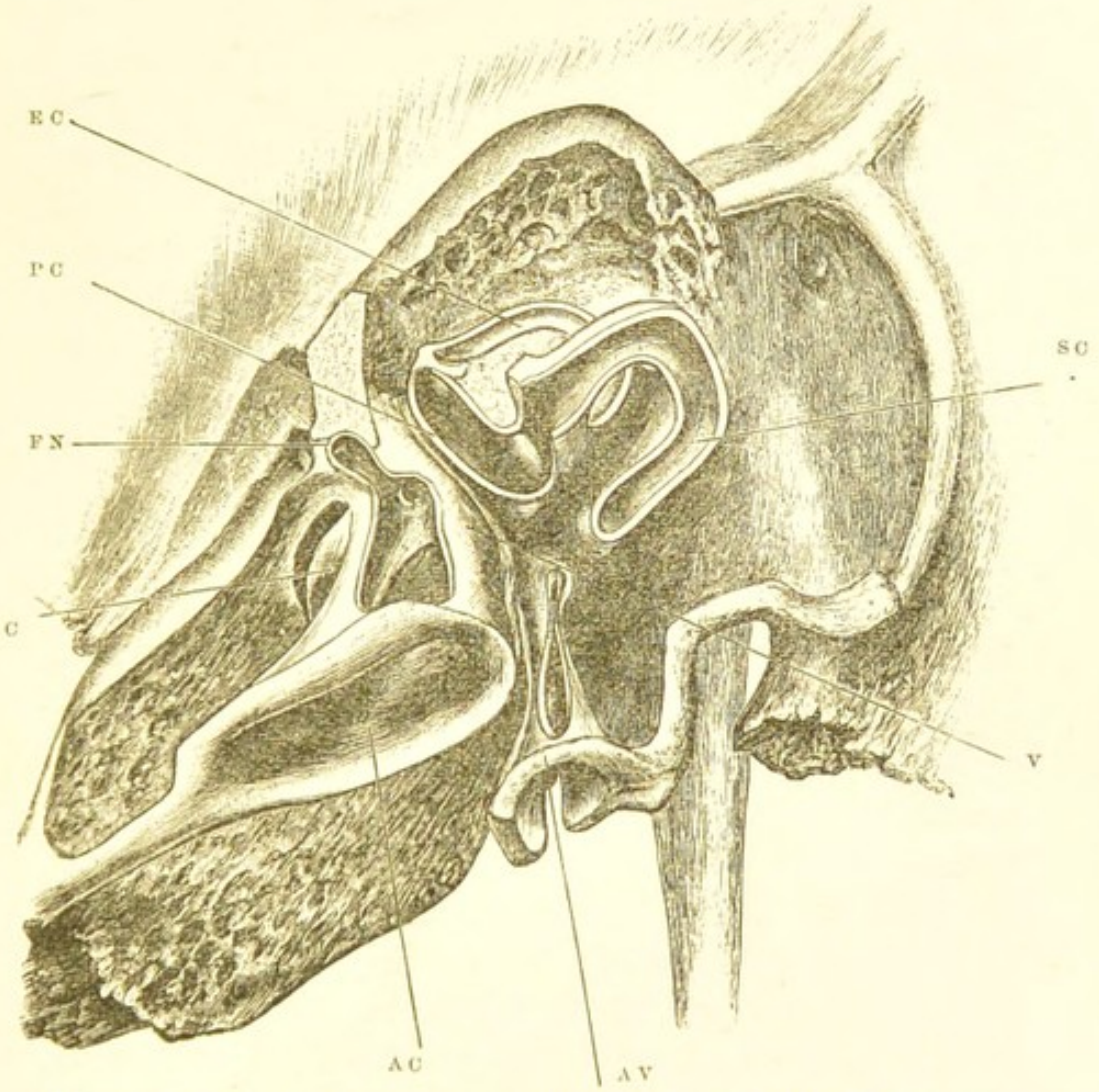

Fig. 9.—Dissection of the Bony Labyrinth to show the Semicircular Canals. (*From a Preparation of the Author's.*)

E C, External semicircular canal; P C, posterior semicircular canal; S C, superior semicircular canal; A C, internal auditory canal; F N, canal for facial nerve; C, first turn of cochlea; V, vestibule; A V, aqueductus vestibuli.

separate ends of the canals are ampullated just before they communicate with the utricle, the flask-shaped enlargements being nearly twice the diameter of the tubes. The canals and the utricle are composed of fibrous

tissue, lined internally with a basement membrane and flattened epithelium, curiously modified in some fishes. Where the utricle is adherent to the walls of the vestibule the epithelium is much thickened, and is columnar in form, the cells terminating in fine stiff hairs. Among these are found crystals of carbonate of lime (otoliths) embedded in a tenacious mucoid material. This spot is termed the macula acustica. On the inner surface of each ampullated canal, where it is attached to the bone, a similar structure is found (crista acustica).

Vestibular filaments of the auditory nerve enter the vestibule and semicircular canals from minute foramina in the bones in the situations above described. They probably terminate in the peculiar epithelial cells before mentioned.

Saccule.—The saccule, of oval form and about one-fifteenth of an inch in diameter, lies in the fovea hemispherica of the vestibule. It has been well compared to a flask, the neck of which (ductus reuniens) leads into the vestibular end of the membranous ductus cochlearis. In structure the saccule has a fibrous coat, a basement membrane, and is lined by flattened epithelium. It is loosely adherent to the bone by fibrous and nerve filaments, so that it floats in the perilymph. It is one of the most important and constant parts of the organ of hearing in birds and fishes.

Cochlea.—(Figs. 1, 8, and 9.) This complex part of the organ of hearing is situated anteriorly to the semicircular canals and vestibule. It is exactly like a small snail-shell, the first turn outwards of the coil forming the promontory on the inner wall of the tympanum. The cochlea is

formed by a tube winding round a central axis—from left to right in the right ear, from right to left in the left—for two and a half turns. This tube is about one-tenth to one-fifteenth of an inch in diameter at its commencement, and gradually gets smaller towards its termination at the apex, where it ends in a blind extremity termed the cupola. The base of the central pillar of the cochlea corresponds with the bottom of the internal auditory canal. Below, this tube runs into the vestibule. Imagine this coiled tube divided into two chambers by a thin lamina of bone and fibrous membrane projecting from the central axis, and following the turns of the tube as a spiral partition. Thus the original tube is divided into two others, an upper and a lower. The upper is termed the scala vestibuli, for it communicates below with the vestibule. The lower is called the scala tympani, for it communicates with the tympanum by the foramen rotundum closed with membrane in the recent state. The scala tympani also communicates with the jugular fossa below, and the subarachnoid space above, by a small canal, the aqueductus cochleæ. If a tiny insect were sent to crawl up one of these canals, it would be able to get into the other at the apex of the cochlea; for at the last turn the bony partition is incomplete, leaving an opening (helicotrema) between the two canals. The spiral partition is not entirely bony; externally, it is continued to the outer wall of the cochlea by a fibrous membrane. The nearer the apex, the more the partition is formed of membrane, and the less of bone.

Organ of Corti.—(Fig. 10.) The fibrous membrane (membrana basilaris) prolonged from the bony portion (lamina spiralis) to the outer wall of the

cochlea is there fixed by a fibrous tissue termed the ligamentum cochleæ. From the edge of the bony plate on its upper surface springs a second membrane, more filamentous and delicate than the last. It passes upwards to the outer wall of the cochlea, just above the ligamentum cochleæ. Thus a small triangular tube is formed along the floor of the upper chamber or scala vestibuli. This small triangular tube ends blindly above and below, and is termed the scala media

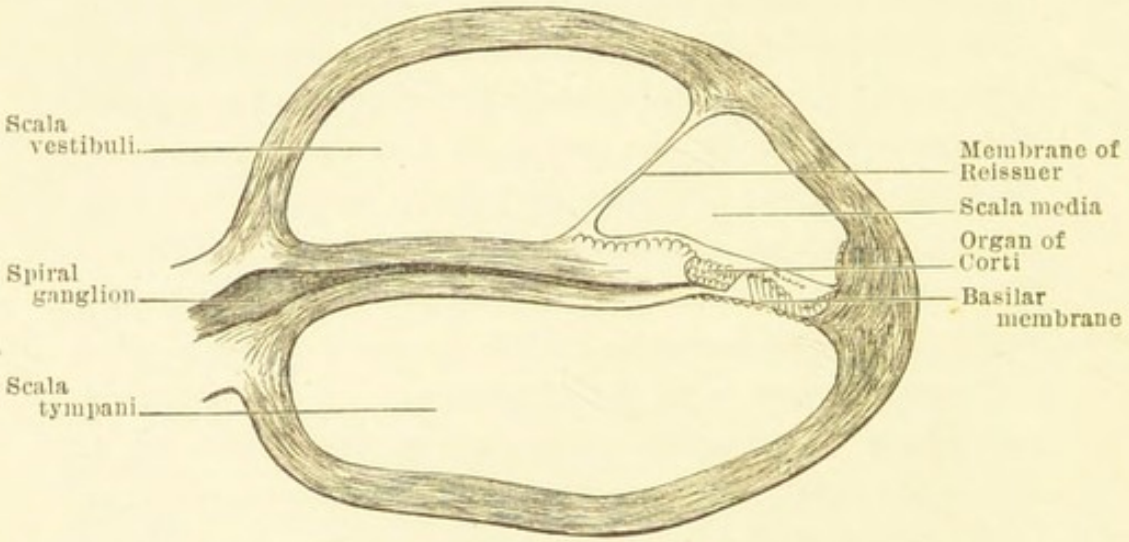

Fig. 10.—Longitudinal Section through the First Turn of the Cochlea. (Diagrammatic.)

of the cochlea or, by some, the ductus cochlearis. Just before its termination at the base of the cochlea it communicates with the saccule by a small canal (ductus reuniens). On the floor of the ductus cochlearis the important organ of Corti is found. This essentially consists of two sets of cells, ciliated and non-ciliated. The ciliated cells are set in a mucoid substance. This differs from the similar substance in the vestibule in containing no otoliths. The non-ciliated cells are rod-like in form. The inner have been compared to a human ulna; the outer to a swan's

neck and head. The outer fit into the inner, forming a kind of tunnel between them. The ciliated cells are found both outside and inside the rods; they are thus termed the outer and inner hair-cells. Their short stiff cilia are surrounded by a reticular membrane—more distinct over the outer cells, as though a net had been laid down upon them. This membrane is merely a modification of the intercellular protoplasm. The whole of these complicated epithelial structures rest upon the lamina spiralis membranacea, and are covered over by a special secondary membrane, the membrana tectoria. The outer hair-cells are superimposed, and are kept in position by elongated cells (cells of Deiters).

The cochlear branch of the auditory nerve enters the minute canal at the base of the internal auditory passage, and passes up the modiolus of the cochlea, being ganglionic and soft in texture. Leashes of minute filaments pass from it through apertures between the layers of the bony partition, and ultimately probably terminate in the hair-cells. The main artery of the cochlea is from the internal auditory, a branch of the basilar. The main venous radicles pass directly into the internal jugular.

FUNCTIONS OF THE INTERNAL EAR.

Sound is an auditory sensation produced by vibrations, or to-and-fro movements of the molecules of the air; it has been estimated that sound travels at the rate of 1,050 feet in a second.

Wave-length may be defined as the distance between two points of a vibrating body found at the same instant. The wave-length is proportional to the duration of the vibration, and is in *inverse ratio* to the rapidity.

Tone is produced by regular periodic movements of the air. When a number of tones occur at the same time without arrangement, the sensation of noise is produced. A number of simple tones may produce a harmony; rhythmical tones produce musical sound. The least appreciable number of vibrations that can produce a sound is about thirty in a second; the greatest number, about 40,000. Small tuning-forks produce the greatest number of vibrations, and therefore the highest tones. Many people who have useful hearing cannot detect tones above 20,000 vibrations a second. The *pitch* of a tone depends upon the length of time occupied by a single vibration; the intensity or loudness of a tone upon the force or amplitude of the vibration. The quality, or timbre, of a tone is supposed to be dependent upon the form of the wave. According to Helmholtz, the "timbre" of a sound is dependent upon the combination of a secondary with a fundamental or primary sound. Thus "a musical ear" will detect a finer quality in the note of one violin than another, and this may said to be due to the form or composition of the waves of sound produced by it. A musical ear appreciates primary and secondary vibrations and their compounds, and is probably analogous to the cultivated retina of an artist, who appreciates the composite vibrations of light.

The true and exact physiology of the internal ear is still imperfectly understood. It is generally agreed that the posterior labyrinth, the semicircular canals, and utricle are mainly concerned with functions of equilibrium, motion, and sensations of space and directions of sound;* the anterior labyrinth, the cochlea, and

* Space will not permit a description of the theories, statical and dynamical, which have been advanced concerning the functions

saccule with the elaboration and perception of sound, as the pitch and quality of a note. When vibrations are carried to the fenestra ovalis, they are transmitted to the perilymph, and through it to the endolymph and organ of Corti. It is assumed that the rod-like bodies of this structure have the function of vibrating to certain notes and stimulating certain auditory filaments.* When a note is struck before an opened piano, the wires of that particular note in the instrument will vibrate, not only in the clef struck, but in others above it. It is easy to assume that a like action occurs in the organ of Corti. Objections to this theory at once occur. The waves of sound which reach the internal ear are composite, and a certain differential power must be manifested to distinguish them. Some birds, which must have an appreciation of pitch, have no distinct rods in the organ of Corti. It has been assumed that the stretched radial fibres of the membrana basilaris may also vibrate to sounds. Again, the rods of Corti are stiff structures, not likely to vibrate on delicate impulses from the endolymph. The hair-cells seem more likely to vibrate, but it is very probable that audition, like sight, is largely a cerebral function. A blow on the eye gives rise to a sensation of light; an injury to the ear produces a loud sound. A patient who suffered from an accidental wound of the membrana tympani describes his auditory sensations as a loud crash. In the ear, as in the retina, the

of the canals. The reader is especially referred to an article in *Nature* for 1878 by Professor Crum Brown.

* To Helmholtz we owe the hypothesis that vibrations excite similar vibrations in the rods of Corti. Hensens has actually seen the hair-cells on the antennæ of some crustaceans vibrate to loud notes on a horn.

function of the modified epithelial structures seems to be a complicated and ill-understood reception and elaboration of stimuli, which are afterwards differentiated and interpreted by mental processes in the higher cerebral centres. The similarity between the rods and cones of the retina and the epithelial structures of the organ of Corti is striking. When we reflect upon the musical training that can be bestowed upon certain individuals, and on the utter incapacity of others to appreciate one note of music from the other, we are still more impressed with this view. The fine appreciation also of the marvellously complex sounds which fall upon the ear, during the performance of a large orchestra, must largely be due to unconscious cerebration. Imperfect, then, as our exact physiological knowledge may be of these and kindred points, a consideration of what we do know is often very helpful in determining the probable situation of disease in the internal ear. Thus, such symptoms as giddiness and staggering gait usually mean a lesion of the posterior labyrinth ; anomalies of sound, loss of power of hearing certain notes, mischief in the cochlea ; deafness, associated with the power of hearing well through the cranial bones or teeth, an imperfection in the conducting media (as the canal, membrane, or tympanic cavity). The reader will hereafter see the great helpfulness of these simple conclusions.

Auditory centre.—The superficial origin of the auditory nerve is by two roots just behind the pons.

The superficial band of fibres curves round the restiform body, and ends in grey matter on the floor of the fourth ventricle. This is called inner auditory or chief nucleus. As the nerve winds round the

restiform body, some fibres pass transversely through the pons. The deep root passes on the inner side of the restiform body. Some fibres of it pass into the middle lobe of the cerebellum; others pass to a nucleus external to the former auditory nucleus. Others terminate in the anterior auditory nucleus, which lies just behind the restiform body. The deep fibres are supposed to pass to the crista of the semicircular canals, and to be concerned with the functions of equilibrium and space.

A case published by Gowers* would seem to show that the route by which these fibres reach the cerebral hemispheres is through the internal capsule and tegumentum of the crus. A tumour of the corpora quadrigemina thus caused bilateral deafness. Such cases are exceedingly rare, and most cases of bilateral internal ear deafness will be found to depend upon disease of the labyrinth. Tumours of the pons and medulla have not infrequently produced deafness on the same side, so have growths of the trunk of the auditory nerve itself.

* *Lancet*, March 15th, 1879.

CHAPTER II.

THE EXAMINATION OF THE EAR.

The examination of a case of aural disease requires patience, care in observation, and a knowledge of the principles of general medicine and surgery. The surgeon will do well first to form an estimate of the general constitutional condition of his patient. Is he the subject of obvious gout, tuberculosis, or congenital syphilis? In the appearance of the patient there may be something which at once has a direct bearing on the question of aural disease. Thus, he may exhibit the well-known deformity of Bell's paralysis, or present the open mouth and vacuous expression of enlarged tonsils and nasal obstruction. The occupation and habits of the patient must receive notice, and the locality in which he lives. For instance, he may be employed in a trade the pursuit of which exposes him to din and noise, as the firing of great guns, or the hammering of boiler-rivets. He may be in the way of diving, or constantly bathing in cold water, or reside in a locality famous for fog and damp, as the Cambridge fens. A careful consideration of these and like points is always advisable, and often essential, in the diagnosis and treatment of a case of deafness.

The history of the case should next engage attention. As far as possible, the duration of the deafness will be carefully noted, and whether its onset was sudden or gradual. Note the presence or absence of pain or otorrhœa. Investigate the supposed cause, and inquire if any influences, as the weather, materially

alter the deafness for better or worse. Has the deafness ever been associated with pain or discharge? Is it accompanied by tinnitus aurium? Any previous treatment must be inquired into. The family history must not be neglected. Cases of chronic catarrh of the middle ear are frequently hereditary, and marriages of consanguinity are a well-known source of maldevelopment of the internal ear and deaf-mutism. The hearing distance for the watch and conversation may now be noted for either ear. The watch should be gradually approached to the ear under observation, the other ear being closely plugged with wool and the finger of the patient. I instruct the patient to hold up his hand at the moment he hears the watch. This experiment may be repeated several times, and the result expressed in figures. For instance, a watch which should be well heard at forty-eight inches is only heard by the patient at one foot; this will be expressed by the formula H*$=\frac{12}{48}$. The numerator 12 is the number of inches from the ear at which the tick of the watch is heard; the denominator 48, the number of inches at which the sound is heard by a healthy ear.†

Conversation may now be tried at various distances. The observer must be careful to close the ear not under observation, to speak distinctly but in a moderate voice, and to use uncommon sentences. He must so place the patient that the latter cannot see the movement of his lips. The conversation test, though far from being mathematically accurate, is of great importance as furnishing a good practical

* H = horologium.

† Sounds decrease in density according to the square of the distance, not in direct ratio. Hearing distance and hearing power are, therefore, not synonymous.

estimate of a patient's deafness. Whispered speech may be also employed in like manner. It is much to be regretted that no fixed limit can be given to the distance at which ordinary conversation and whispered speech should be heard. The power of hearing varies in different individuals. The conversation of different observers differs in force and distinctness, and a fixed standard of distance for all cases seems hopeless to determine. It is more important to discover if the patient's power of hearing is such that he is able to attend to the ordinary duties of life, and intercourse with others. The watch and conversation, carefully employed, are sufficient for practical use, and other apparatus is seldom employed, except for scientific purposes.

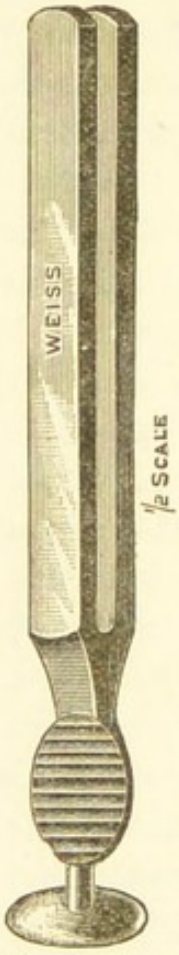

Fig. 11.—Large Tuning-Fork.

The tuning-fork (Fig. 11) may next be used. For general purposes a large fork of the note C of the lower treble clef may be employed. In a case of unilateral deafness, if the fork be placed on the vertex, and be certainly heard better on the deaf side, affections of the conducting apparatus, the external auditory canal or tympanum may be strongly suspected. If the fork is not heard at all, or very feebly, by the deaf ear, even on application to the mastoid, the surgeon may reasonably suspect grave lesion of the auditory nerve itself in some part of its course. It may be noted, in passing, that these latter cases are rare. In estimating the value of tuning-fork tests, the surgeon will do well to take into account the

intelligence of his patient and his tendency to be accurate. It is difficult to be absolutely accurate in anything. Few individuals, especially of the lower class, appreciate this. Accordingly the results obtained by the tuning-fork tests must be acted upon in practice with the greatest caution.

The surgeon next inspects the auricle, the mastoid region, and the orifice of the meatus. Should discharge be evident, he notes its appearance, and the presence or absence of fœtor. The existence of inflammation of the canal itself can generally be appreciated, and the patient saved pain, by mere inspection, without the use of the speculum. This is carried out by pulling the auricle well backwards and upwards, and pressing upon the tragus. It is thus possible to get a view of the greater part of the canal. The parts should be illuminated by a good light. The speculum (Fig. 12) may next be used. Daylight, if good, is best. The author employs a powerful lamp, with a bright concave reflector, but the electric light is preferred by many. The photophore is a convenient form of apparatus, the light and illuminator being fixed on the forehead of the operator. The hand mirror (Fig. 13) is best for inspection. The forehead mirror

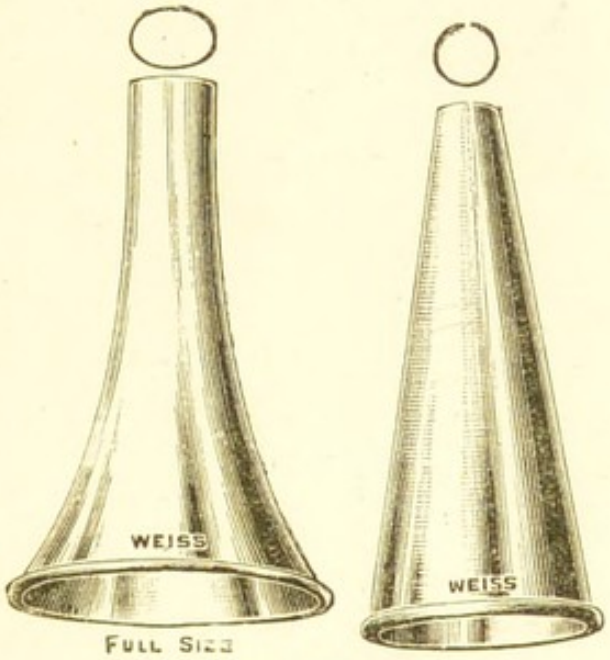

Fig. 12.—Aural Specula.

(Fig. 14) or electric light must be used for any proceeding necessitating the use of instruments. Aural specula are made of various sizes and shapes. Some surgeons prefer one pattern, some another. The essential matter is to get a speculum suited to the size of the canal under observation. The interior should not be too bright, and the instrument should be warmed before use, being afterwards placed in carbolic lotion, and then wiped dry. Brunton's otoscope (Fig. 15) is a most ingenious instrument, and is much used by many practitioners. It is comparatively easy to view the membrane through it, and for diagnosis it is a good instrument when the drum is not obscured. No manipulations in the canal can be effected during its employment, and I therefore never recommend it to practitioners or students. To use the mirror and the speculum, the patient stands or sits in a suitable position to the light, and the surgeon, taking the auricle between the fore- and middle-fingers of the left hand, draws it upwards and backwards, thus straightening the canal; the warmed speculum is inserted with the right hand, and held in position

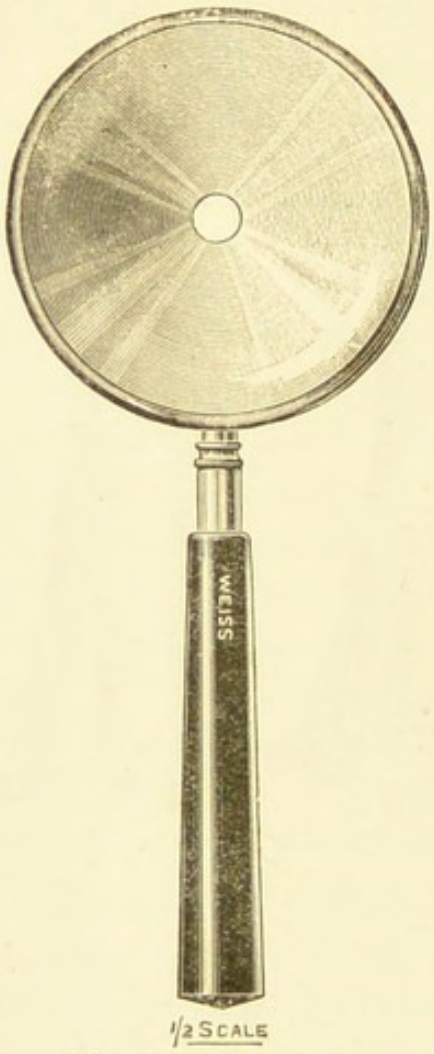

Fig. 13.—Hand Mirror.

between the thumb and fore-finger of the left. The mirror is now taken up by the right hand, and the light cast steadily upon the speculum. This

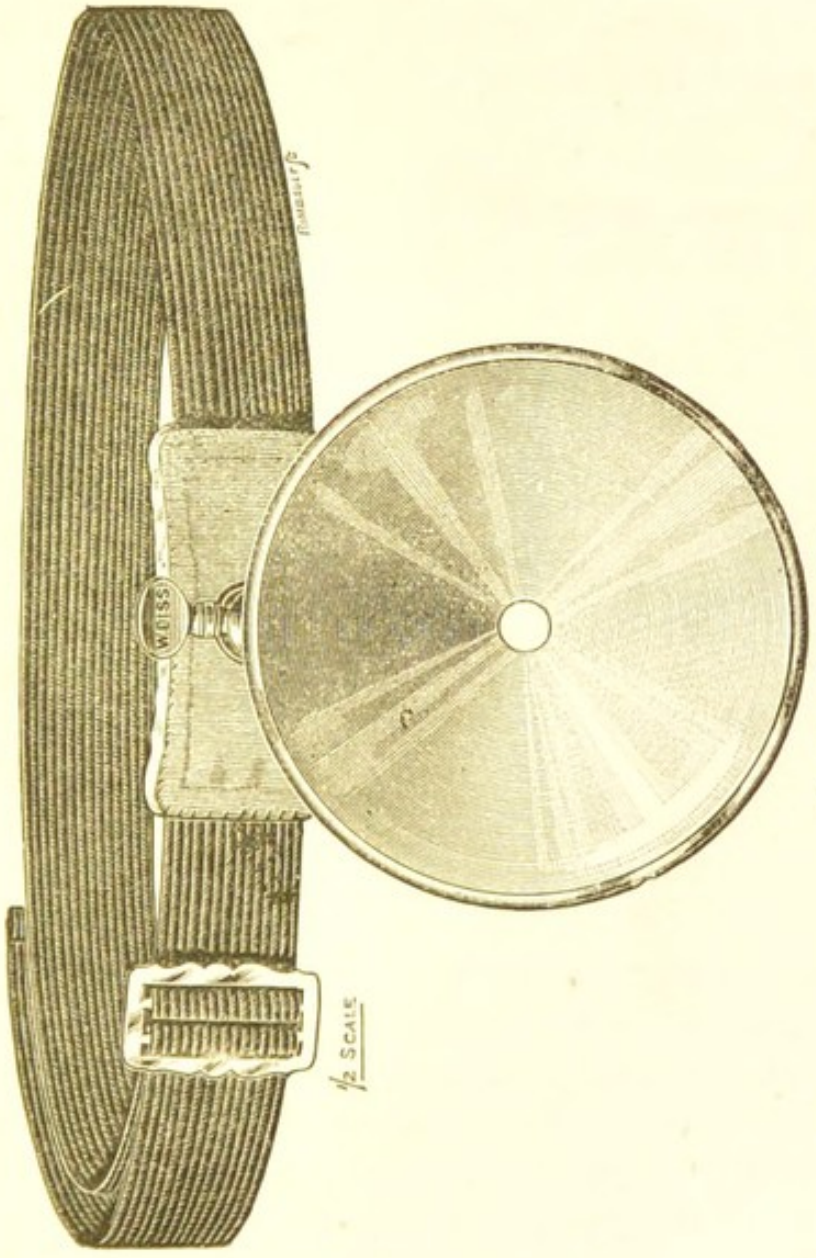

Fig. 14.—Forehead Mirror.

manipulation requires some little practice, and more can be learned by a few lessons than by pages of description. The drum usually comes readily into view.

The ordinary appearance of the membrane (Plate II. Fig. A) is of a light pearly grey. The handle of the malleus, with a blood-vessel upon it, may be discerned descending from above, and a bright shining spot, the "triangular spot of light," is seen below and in front of it. At the base of the long

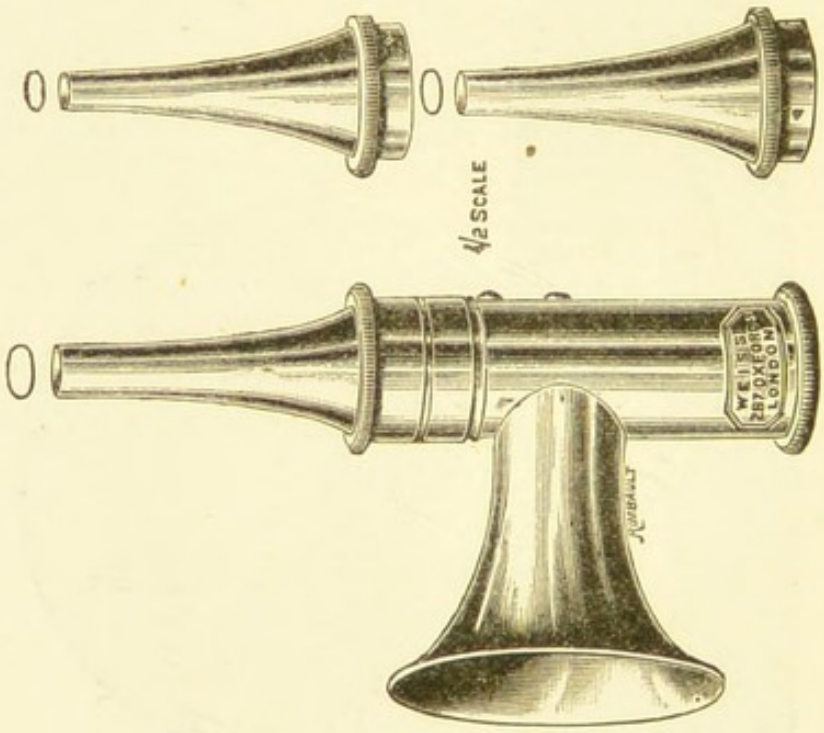

Fig. 15.—Brunton's Otoscope.

process of the malleus is a whitish tubercle, the processus brevis. The termination of the long process is also whitish in appearance, and this part of the drum is termed the "umbo." The triangular spot of light is due to reflected rays from the membrane perpendicular to the field of vision (*Politzer*). When the drum is too concave or irregularly bulged, this light spot shifts its position, form, and size. In cases of great concavity of the drum the malleus is extremely evident, the membrane giving the appearance of being drawn tight upon it from within. There is no

structure that varies so much in appearance as the tympanic membrane, and these varied appearances may all be found with useful hearing. Thus in young children the drum may be milky white in appearance, and yet the hearing be good. In adults it may be dull and lustreless, or even have calcareous-looking spots in its substance, and yet the hearing may not be materially altered. Only constant practice will enable the surgeon to appreciate the changes that take place in the drum as the consequence of disease, and though illustrations may assist description, they are at best a poor substitute for actual inspection of the tissues in nature. The principal changes in the tympanic membrane to be noted by the surgeon are, (1) its colour and texture: are these indicative of inflammation in its substance? Its curvature and the position of the spot of light. Does the drum bulge outwards, indicating fluid in the middle-ear? Is it drawn strongly inwards, indicating Eustachian tube obstruction, or adhesion to the promontory? Is it thrown into irregular puckered folds as the result of chronic inflammation? Are there scars of old ulceration? Should a perforation exist, its size must be noted, and whether it is round or slit-like. A careful examination will also be made for granulation tissue or distinct polypoid formations. The superior part of the tympanic membrane needs the closest inspection, as perforations are overlooked here, in the neighbourhood of the "membrana flaccida." In this situation also, small polypi are apt to project.

The speculum is not to be used so much as a dilator of the canal, as a means whereby light can be thrown upon the drum, and it must be gently moved about until the parts come into view. In cases of otorrhœa,

it is needful gently to syringe the ear, and cleanse it with the aural forceps (Fig. 16) and pledgets of cotton-wool, before a good view of the drum can be obtained. The auditory canal may be blocked by masses of epithelium or inflammatory *débris;* impacted cerumen may at once show itself, or a bony growth. In such cases accurate investigation of the drum is impossible, until the obstructions are removed. In some patients the floor of the bony canal ascends so suddenly that it is most difficult to get a complete view beyond. Hairs growing in the meatus may be placed out of the way, by introducing a plug of wool saturated with glycerine of borax. This being turned round and round in the canal, plasters the hair down out of the field of observation. In any case, no opinion should be given of the condition of the drum, unless it can be thoroughly and accurately viewed.

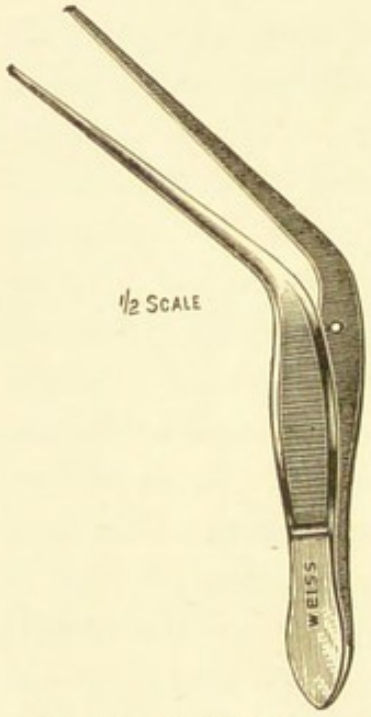

Fig. 16.—Aural Forceps.

In cases of inflammatory swelling of the walls of the canal, especially in young children, it may be impossible to see the membrane at all. In such cases the smallest speculum must be used with care and patience. Self-retaining specula are useful in some operations, as the removal of a foreign body, and in the application of caustics vulcanite specula are invaluable. Considerable experience has taught me that it may be exceedingly difficult accurately to

observe the tympanic membrane, in certain conditions; and in cases where inflammatory swelling or inspissated discharge obscures the view, the surgeon should not be hasty in giving an opinion, until the causes that obstruct his vision are removed.

An examination of the throat and nose should now be made, as a matter of routine, with reflected light, the nasal speculum (Fig. 17) and tongue-depressor being employed. Posterior rhinoscopy may be needful, or the introduction of the finger behind the soft palate. In the case of children a judicious observer will note that any manipulation which is likely to cause pain or alarm should be placed last upon the list. The surgeon will also do well to examine the condition of the dental apparatus, as many cases of pain in the ear are due to caries of the molar teeth. It may in certain cases be needful to investigate the condition of patency of the Eustachian tubes by means of the method of Valsalva, Politzer's bag, or the Eustachian catheter. During the rush of air into the tympanic cavity, the ear of the surgeon and the patient are connected by the diagnostic tube. This is merely a rubber-tube capped with an ear-piece at each end. The black end of the tube is inserted into the auditory meatus of the patient, the white into

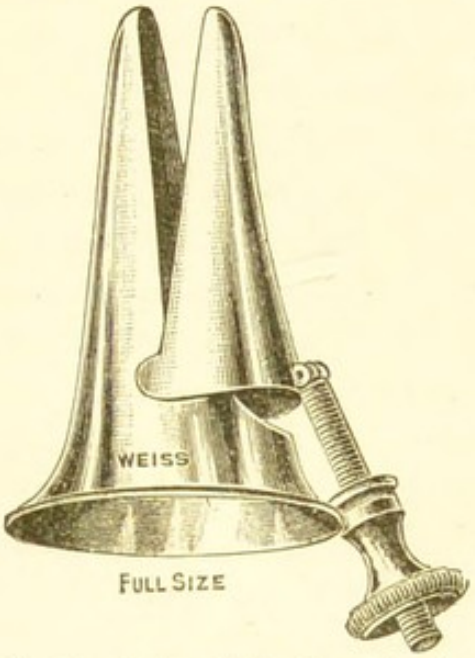

Fig. 17.—Self-retaining Speculum for Nose. (*Duplay.*)

the ear of the surgeon. By the use of this instrument valuable information can be obtained of the condition of the interior of the tympanum. The "rattle" of mucus, the "whistle" of a small perforation, are sounds easily heard and identified. The constant insertion of the same end into the surgeon's ear is advisable on sanitary grounds. I am aware that some surgeons assert, that by the aid of this instrument they are able to appreciate minute morbid changes in the tympanic cavity. The short sharp sound of air entering the cavity, the "creaking" of thick exudation, the "bubbling" of fluid, and the "whistle" or "squeak" of a perforation, are the principal sounds that an observer may expect to recognise. The Valsalvian method of inflation is best practised by instructing the patient to hold his nose, shut his mouth, and to swallow suddenly. Most people are conscious of a sudden slight inflation of the tympanum in adopting this plan. In cases where greater obstruction exists, expiratory efforts must be made, the nose and mouth being closed. I believe that the Valsalvian method, properly adopted, is a more valuable aid to diagnosis and treatment than is usually believed. It has been much abused as a method of treatment, patients constantly adopting it without the advice or permission of the surgeon.

The method of Politzer has probably done more for the prevention and cure of deafness than any single invention. Its use is at the same time diagnostic and curative. It is well to be provided with several bags of different sizes (Fig. 18), children requiring a smaller bag than adults. The nozzle should be soft. I usually cover the ordinary nozzle with a short piece of india-rubber tubing, which can be thrown away after use.

The patient takes a mouthful of water, and at a signal swallows it, the operator at the same moment making a moderate and steady compression of the inflating bag, the nozzle of which is inserted into the nostril.

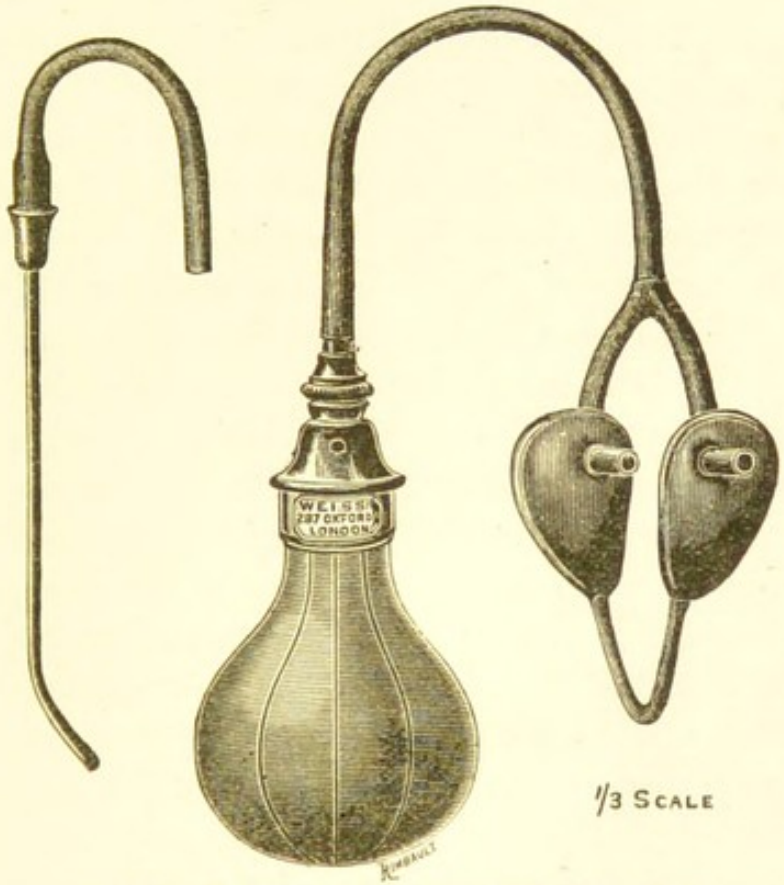

Fig. 18.—Politzer's Bag with Allen's Nasal Pad.

The fore-finger and thumb of the left hand of the operator should close the orifices of the nostrils round the nozzle, by compressing them on each side at the moment of inflation. The process requires some little practice, and is by no means easy to carry out upon nervous and stupid adults. In children, inflation will usually succeed without the swallowing movement, the surgeon taking advantage of a moment when the child has its mouth shut. Of late, I have found that if the patient shuts the mouth and well inflates (puffs

out) the cheeks, politzerisation can be most satisfactorily accomplished. Some surgeons prefer the use of Allen's nasal pad (Fig. 18). During the prolonged pronunciation of such words as "hic," "hoc," the soft palate is approximated to the naso-pharynx. Inflation made at this moment will usually be efficacious in opening the tubes. A sudden restoration of hearing, with a noise like the explosion of a gun in the ear, is usually diagnostic of obstruction of the Eustachian tube by mucus or catarrhal swelling.

The passage of the Eustachian catheter (Fig. 19) need seldom be resorted to as a diagnostic expedient. Principally it is used in those cases where the tubes are impervious to the Politzer method, and to ascertain the presence or absence of complete obstruction. Its use is inadmissible in children, and in nervous adults. The injection into the nostril of a few drops of 5 per cent. solution of cocaine will often greatly facilitate the introduction of the instrument, the cocaine being "snuffed up" by the patient into the naso-pharynx. Several catheters should be on hand, of different sizes and curves.* I prefer them made of vulcanite. The operator, standing on the left of the sitting patient, depresses the upper lip, raises the nose, and passes the catheter (previously warmed) with a rapid and light movement, with its beak downwards, along the floor of the nose until it impinges upon the pharynx. The great secret in this, which may be termed the first movement, is to keep the catheter upon the floor of the nose. The operator will note that, in doing so, the handle must be somewhat raised, as though the beak of the instrument were

* Most catheters are far too large and bulbous at the extremities.

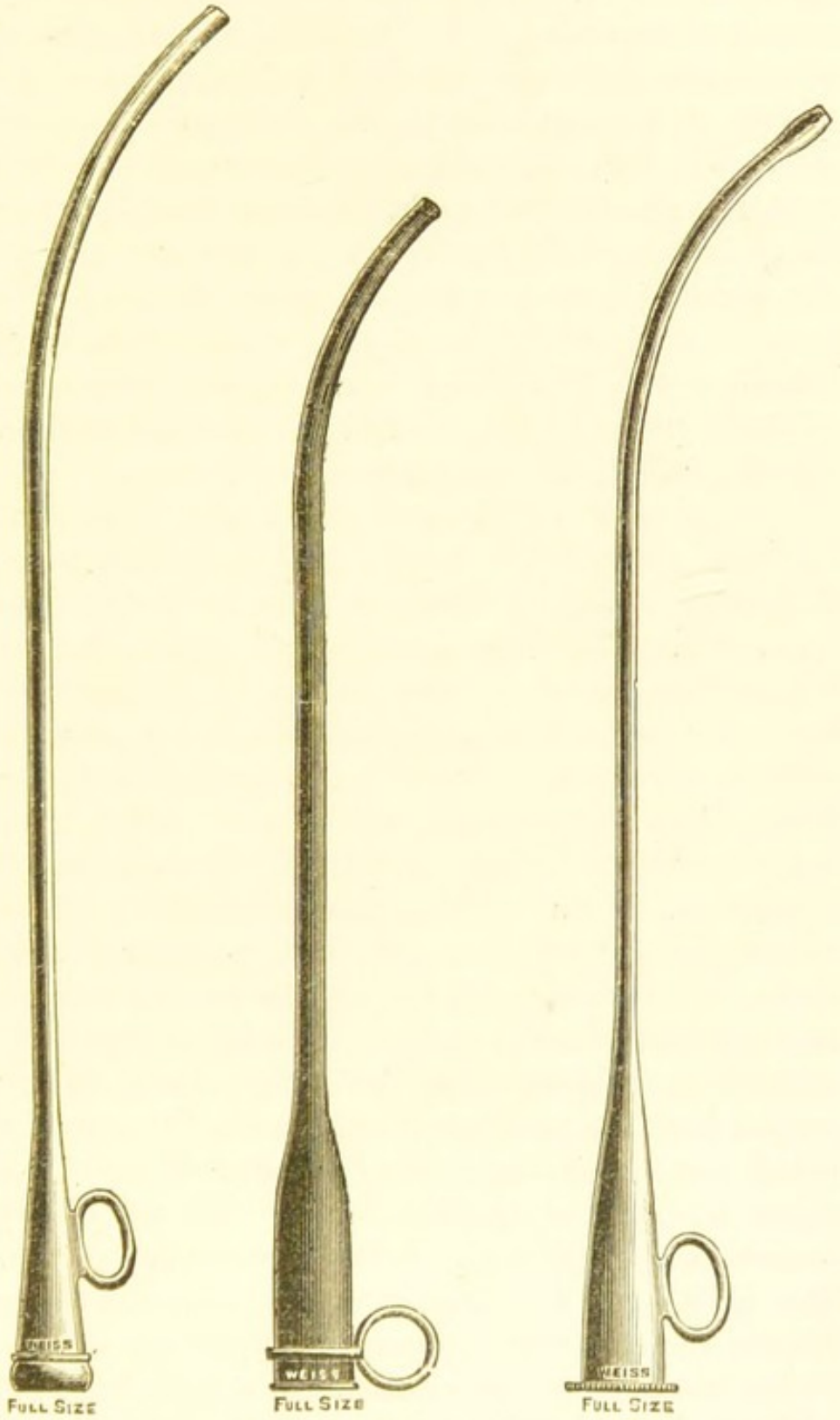

Fig. 19.—Eustachian Catheters.

travelling "down-hill." The second movement consists in withdrawing the instrument, its beak turned downwards and inwards, until it hitches upon the margin of the septum. In the third movement the catheter is again pushed a little backwards, and then turned completely outwards, the beak sweeping from the palate upwards and outwards, until the ring on the handle points upwards and outwards also. The point of the instrument will then almost certainly be lodged in the Eustachian tube. These three movements should not be separated by any interval of time, but be continuously executed.

Many other methods are employed, but this one (method of Lowenburg) is preferable in most cases. Extensive practice will alone make perfect the manœuvre. The surgeon will especially note that the catheter, as indeed all instruments brought into contact with mucous membrane, must be scrupulously cleaned after use, as the risk of syphilitic infection from dirty instruments is not imaginary. The catheter being lodged in the tube, inflation is practised through it. This may be effected by the mouth of the surgeon or by a small elastic bag, preferably the latter. Some surgeons employ nose-pincers (Bonnafont's) to maintain the catheter in position. Should the surgeon be not assisted, the inflating bag may be suspended from the button-hole of his coat. The degree of patency of the tube may thus be estimated, and, if air enter, the connecting tube between the ear of the surgeon and patient will detect any morbid sounds. The passage of the catheter is rendered difficult or impossible by morbid growths, by great hypertrophy of the spongy bone, cicatrisation of ulcers about the pharynx, inflammatory swellings, and the like. If

an ordinary Eustachian catheter be passed in the dissecting-room on a subject where the orifices of the tubes are displayed in the usual manner, by making a section through the basi-sphenoid, it will be found that the instrument passes but a small way into the cartilaginous tube, and scarcely fills it so tightly as certainly to insure the injection of fluids. I have been much impressed by this, and doubts have arisen in my mind as to the possibility of accurately dilating strictures of the Eustachian tubes.

A consideration of the foregoing *résumé* of the ordinary investigations will at once show the practitioner that the diagnosis of a case of deafness requires some deliberation and great pains. In a crowded hospital department it is well-nigh impossible to carry out all the details of a thorough examination. Practice, however, will enable a surgeon to dispense with many of the diagnostic methods explained in certain cases. Indeed, a case of ear disease may be so simple as to be diagnosed correctly by the merest tyro in a few minutes. On the other hand, it may be so complicated and obscure as to elicit but a hypothetical opinion, even after a prolonged examination by a highly-experienced observer.

In cases where it is desirable to investigate the condition of the auditory nerve, a more prolonged and difficult examination becomes needful. If a large tuning-fork be set vibrating, and held close to the auditory meatus, its sound will be audible for a certain number of seconds. If, the instant the sound be lost, the stem of the fork be pressed against the mastoid, no further sound will be manifest in a healthy ear. In the healthy ear it is thus demonstrated that air conduction predominates over bone conduction. The converse of

this experiment is true. Let the vibrating fork be placed on the mastoid; its sound will soon become inaudible. If, as soon as its vibrations cease to be heard on the mastoid, the fork be held close to the meatus, sound will be appreciated for a certain number of seconds more. Air conduction predominating is often for convenience expressed by the symbol + A.

Now let the observer close one canal with wool and repeat the above experiments, and he will find that they are directly reversed. He will demonstrate that the sound of the fork is heard much longer when applied to the mastoid than when held close to the meatus. The more completely the canal is closed, the longer and louder will be the sound conveyed through the mastoid. Bone conduction predominates over air conduction. This is usually expressed by the symbol + B.

The above constitutes the gist of Rinne's experiment, and its use is at once apparent. In any case of deafness, should air conduction markedly predominate over bone conduction, the fault probably lies in the auditory nerve. In the more common cases, where bone conduction is markedly better and more prolonged than aërial, the mischief is probably in the external or middle ear, as impacted cerumen or intratympanic inflammation. In extreme cases of nerve deafness both aërial and bone conduction are lost.

It is well to use a large tuning-fork of medium pitch for these experiments.* Furthermore, the experiment should be repeated many times, and with care and patience. Deaf people are confused and

* Clamps are frequently placed upon the arms of these large forks to lessen the "overtones."

stupid, and members of the lower classes so wanting in accuracy that their observations must be investigated with great caution, or errors will ensue. It is not, of course, generally known that a tuning-fork applied to the forehead will be heard most distinctly by the deaf ear in cases where the outward conduction of sound is impeded.* Consequently, patients will commonly declare that they do not hear the fork in the deaf ear, because they have already made up their minds that they cannot. A few experiments will usually bring them to confess their error.

The above constitutes a sketch of the principal tests for nerve-deafness as commonly applied. In some cases it may be desirable to examine with forks of different pitches, for in certain cases of nerve-deafness some notes are lost and others retained. This is peculiarly the case in the deafness that accompanies locomotor ataxy. Tuning-forks of a very high pitch, or Galton's whistles, are useful to employ when it is needful to decide the capability of the patient to hear very high notes. As a rough rule, in affections of the auditory nerve, very high notes are lost. In affections of the middle or external ear, low notes are lost or indistinct. The principle that the vibrating fork is heard better through the bone in cases of middle and external ear deafness, and that aërial conduction predominates over bone conduction in cases of nerve-deafness, forms the basis for a variety of methods of examination adopted and

* When a tuning-fork is placed on the forehead, and its vibrations are heard markedly louder by the deaf ear, the cause of deafness will be in the external or middle ear. This constitutes Weber's experiment. Weber's and Rinne's experiments should be used to check one another.

eulogised by various authors. A special reference must be made, however, to the method of Gardiner Brown. This is founded on the principle that, if a large fork of medium pitch be placed upon the forehead of a person with normal hearing, the surgeon holding the stem of the fork between his finger and thumb can feel the vibrations as long as the other can hear them. Should the surgeon feel the vibrations longer than the patient can hear them, the nerve apparatus may be suspected to be at fault. Should the patient hear the vibrations longer than the surgeon can feel them, the conducting media are in some way implicated. I need hardly point out that this method requires great delicacy of perception on the part of the surgeon, accuracy on the part of the patient, and care and patience by both parties concerned. It is, however, highly recommended by so good an authority as Urban Pritchard.

Much assistance will be given to the surgeon in these cases by a sound knowledge of the pathological conditions causing, or associated with, nerve-deafness. Such are congenital defects, especially marriages of consanguinity; hæmorrhagic or inflammatory exudations into the labyrinth in syphilis, after mumps, meningitis, and severe attacks of the specific fevers; in pernicious anæmia and other hæmorrhagic affections; grave injuries, as fracture of the base of the skull; violent noises, as the explosion of big guns; repeated concussions leading to congestion of the nerve apparatus in boiler-makers, and riveters. Nerve-deafness may also be associated with cerebral tumours, general nerve disorders, mental shock and worry, and especially the advancing decay of old age. This subject will be again alluded to. For the present its

comparative rarity will be impressed upon the reader. An estimate, rather than an exact dogmatical diagnosis, will be arrived at by the judicious surgeon, who well knows the many sources of inaccuracy that any opinion founded principally upon the statements of patients is apt to entail.

Patients suffering from middle-ear deafness generally hear best in a noise as a railway train (paracusis Willisii). Those who are the subjects of nerve-deafness are often much distressed by noise, and hear best in a quiet room.

The onset of nerve-deafness is frequently sudden, and associated with giddiness, vomiting, or severe cerebral pain. The deafness of middle-ear inflammation is not unusually exceedingly gradual and insidious. Sudden extreme deafness superadded to chronic deafness may mean nerve-mischief added to chronic middle-ear catarrh.

The examination of the ear in children is far more difficult than in adults. The surgeon must be careful not to hurt the child or frighten it, and he will depend more on what he can himself observe than on anything the relatives tell him. The smallest speculum must be used, and warm syringing gently carried out. In cases of great tenderness, where a thorough examination is needful, as in impacted foreign body, an anæsthetic should always be employed. Should there be much swelling it will be impossible to see the membrana tympani properly, and in such instances the surgeon will do well to temporise, by the use of warm applications, until inflammation has subsided. It is especially important to put no instrument, as probes or directors, into the auditory canals of children without full illumination.

CHAPTER III.

AFFECTIONS OF THE AURICLE AND EXTERNAL AUDITORY CANAL.

The affections of the auricle which call for surgical interference are comparatively few and unimportant. When the whole auricle is removed by accident or operation, hearing is little, if at all, impaired. The principal conditions which demand notice due to congenital defect are as follows: (1) Supernumerary auricles. These are not uncommon, and appear as one or more tubercles near the lobule of the ear (Plate I. Fig. A), or the side of the neck, in the position of the first visceral cleft. Occasionally these rudiments are convoluted and lobulated, so as closely to imitate a second pinna. They are to be looked upon as remains of one or more of the six primary tubercles by the coalescence of which the pinna is formed. Removal is indicated, small skin flaps being fashioned. These are afterwards accurately united with fine fishing gut or hair, so that the resulting scar may be imperceptible. In the same category may be placed congenital smallness of one ear, which may be associated with facial paralysis and mal-development of one side of the face and body. Frequently a small fistulous opening (branchial fistula) (Plate I., A) may be noticed in cases of occlusion of the canal and deformity of the auricle. (2) Complete congenital occlusion of the meatus and canal (Plate I., A), with deformed auricle, is also met with. In these cases the deeper parts of the organ of hearing are seldom perfect, so that operations

undertaken to unite a fissured auricle, or to form a meatus, are useful for appearance' sake only. Moreover, it is extremely difficult, often impossible, to keep the newly-formed passage open. In rare cases, the meatus may be closed by a membranous septum, and an operation be attended by the happiest results. It is very important that before any improvement in hearing be promised, the surgeon assure himself that tuning-forks of all pitches are well heard through the cranial bones on the affected side. In connection with this subject it may be mentioned that the canal is sometimes closed by a cicatricial membrane, the result of ulceration. This is excessively rare. The deeper in the canal this condition occurs, the more likely is it to be mistaken for a cicatricial drum-head. Treatment of it by incision and dilatation gives good results.* In the cicatricial contraction from burns all treatment is very unsatisfactory.

Dermoid cysts are sometimes found near the auditory meatus; they probably have their origin in involution and sequestration of epiblastic tissue in connection with the first visceral cleft. These cysts are always congenital, and have the usual contents, epithelial *débris* and cholesterine with short hairs. They lie deep, and may be dissected out; or, if this be difficult, dangerous, or impracticable, a free opening should be made, the contents evacuated, and the interior of the cyst caused to exfoliate by the application of strong solutions of iodine, chromic acid, or nitrate of silver. These cysts, as is the case in the neighbourhood of the orbit, sometimes absorb the bone and lie in contact with the meninges. Should they suppurate, fatal cerebral mischief may thus be induced.

* *Archives of Otology*, vol. xv. p. 75.

Dermoid cysts must not be confused with cholesteatoma, a tumour composed of epithelial cells, and usually found in the mastoid cavities. Great caution should be exercised regarding the treatment of any cyst that seems to lie deep within the bone of the auditory canal.

Serous cysts, containing a clear glairy fluid, are found on the auricle occasionally. They are distinguished from hæmatoma by their very gradual onset, and by the result of puncture. They need incision, evacuation, and drainage.

Case 1.

CYSTIC SWELLING OF AURICLE. REPEATED ASPIRATION AND INJECTION OF IODINE. CURE.

A healthy man, aged 41, presented himself at Charing Cross Hospital, on October 9th, 1890, with a large fluctuating swelling, involving the anterior aspect of the right pinna, and quite obliterating the ordinary concavities of the part. The history was obscure, but he stated that he had noticed a small lump on the ear for twelve years, but this has been larger and more painful for at least six months. No history of an injury. The swelling has all the characters of the ordinary hæmatoma auris. Aspiration, with a fine syringe, obtained nearly three drachms of serous fluid, with a faint trace of albumen, but no chlorides in quantity, and no trace of blood. *Tinct. iodi*, one drachm, was injected, and left in for five minutes, and then again evacuated. Seven days afterwards the cyst had refilled, but there was some puckering of integument indicating shrinkage. Injection had produced but little pain or inflammation. The same treatment was repeated at intervals of a week, four times. Ultimately the cyst shrivelled completely, and all that was left in three months was a chronic thickening of the auricle. The patient promised to report himself if any fresh swelling occurred, but has not since been seen.

Peculiarities in the shape of the ear are matters of the deepest interest to those who study the various types of idiocy and insanity. Curious formations

have been observed in the varieties of mental disease, but the subject is hardly one which comes within the scope of this work.

Morbid growths of the auricle may be innocent or malignant. Among the former may be mentioned pendulous fibromata, the fibrous keloid which occurs in the lobule from the irritation of ear-rings, the common gouty tumour, which is found in the helix, mainly composed of a deposit of urate of soda, and sebaceous cysts. Warts and horny growths are also described; the former are not uncommon round the auditory meatus. The malignant growths are epithelioma and rodent ulcer. One case of melanotic wart has come under my own notice; it was treated by excision, and no recurrence had occurred three years after. A case of melanosis of the auricle was also exhibited at the Dermatological Society of London, by Dr. Stowers, in February, 1893. Malignant growths need free excision, and, if extensive, the surgeon must not hesitate to remove the whole auricle; otherwise the inclusion of the growth by a V-shaped incision will suffice. In several operations of this nature, as well as in accidental wounds, I have found the following a suitable plan of uniting the parts. The thin integument is raised from the cartilage with a small sharp knife. The cartilage is then united by fine catgut sutures, and the skin sewn over it, both behind and in front, with a continuous suture of fine horse-hair. Where large portions of the auricle have to be removed, the surgeon must prepare his patient for resulting deformity, unless a plastic operation can be devised. A keloid growth of the lobule had best be left alone, but, if increasing and unsightly, it may be freely removed. The formation does not, in my

experience, show the same tendency to recur in the scar, as is observed elsewhere. Gouty concretions seldom need treatment. Sometimes they cause ulceration of the skin, when masses of urate of soda will be spontaneously discharged. Should they cause much inconvenience, they may be opened with a sharp lancet, and the contents expressed. A strong lithia lotion is often used in these cases with the ordinary dietetic and medicinal treatment. Sebaceous cysts of the auricle are so intimately adherent to the thin integument, that it is seldom practicable to dissect them out; a free opening should be made into the cyst, the contents evacuated by scooping, and the lining membrane treated with chromic acid or nitrate of silver.

Large sebaceous cysts or "wens," as they are often termed, are apt to grow in the retro-auricular fissure, pushing the auricle away from the head. The integument over them is red and thin, and they may become exceedingly unsightly. If allowed to burst, they fungate, with foul granulations and discharges, simulating epithelial cancer.

The well-known blood-tumour of the auricle is found after injuries, and is common in many varieties of insanity. It has thus received the name of the asylum ear. Its true pathology is still very obscure. Some writers on aural surgery connect it with disease of the brain; but why this should cause mischief in these special vessels is not explained. Considering that in cases of insanity, especially general paralysis, large blood extravasations are common in other parts of the body, and that fractures also readily occur, it is likely that there may be a morbid condition of the blood and tissues, and also of the small vessels, at

present undetermined, but favouring subcutaneous hæmorrhages from slight causes.

The diagnosis and treatment of hæmatoma auris presents no great difficulty. When recent, and the result of injury, such formations are best left alone, when absorption of the blood will occur. Should they rapidly increase, the blood may be drawn off by a fine, clean syringe, and pressure applied; should signs of suppuration occur, the cavity must be laid open and dressed with antiseptic precautions. Vascular tumours, as nævi, are usually obliterated by electrolysis or by passing into them the fine point of a Paquelin's cautery. Repeated small operations are better than extensive ones in these cases. Aneurism by anastomosis, should it occur, may be attacked by excision, preceded by ligature of the principal vessels leading to it. Warts may be treated by snipping them off. When multiple, pure nitric acid is a convenient remedy, applied carefully to the wart itself, the parts around being protected with wool, should the acid transgress its limits. The sores which result should be treated with a simple ointment. Strumous ulceration sometimes occurs round the site of ear-rings, and piercing the lobule has been credited with setting up tuberculous processes in predisposed individuals. Lupus vulgaris rarely attacks the auricle, and its treatment presents nothing special. Acute perichondritis of the auricle is an exceptional affection; I have seen it follow injury, and associated with suppurating hæmatoma. I believe it to be often erysipelatous. All the local and general signs of inflammation are present, and a tense, fluctuating swelling forms, red-hot and excessively painful, which may quite close the meatus. The contents are usually serum or sero-pus. In bad cases,

the perichondrium is stripped from the cartilage, and the latter may necrose. The treatment of this affection is conducted on general principles. A strict investigation into the general health is requisite, with appropriate medicinal and dietetic remedies. Locally, cooling and sedative lotions are useful, but as soon as fluctuation is detected an incision must be made, and the case treated as one of acute abscess. Frequently granulations spring up in these cases from the exposed cartilage, and they are very troublesome to deal with. In such cases, moist dressings are generally inadvisable. The granulations may be removed with the sharp spoon, or touched with such astringents as chromic acid, sulphate of copper, or sulphate of iron; and the cavity lightly packed with iodoform and boracic acid. Under this treatment healing is usually rapid and sound, but, should the cartilage necrose, great deformity will result. Gangrenous inflammation of the auricle and adjacent parts has been observed in ill-nourished children, especially after the specific fevers. Such affections probably originate in thrombosis, and are dangerous to life.

The skin diseases of the auricle are principally eczema, herpes, lupus erythematosus, ichthyosis, and molluscum contagiosum. Erysipelas is common, and syphilides are also found, but both of these affections call for no special treatment.

Morphœa is sometimes met with, as a smooth, ivory-like patch in the course of one of the auricular nerves, and the pinna is lobulated and deformed in tubercular leprosy.

Eczema is the most important, because the most common, of the affections of the auricle. It may be acute or chronic, dry or moist, papular or vesicular.

In weakly, strumous children, pustular eczema is common. In chronic cases the auricle becomes thickened and deformed, with deep fissures and cracks. The meatus is swollen, and in chronic cases is apt to be seriously narrowed, or even occluded. The practitioner should remark that many cases, especially in children, are caused by the local irritation of the pus of an otorrhœa, which is full of organisms and infective. Unless this is treated, the eczema will continue very persistently. I have repeatedly seen general eczema of the face and head thus produced, and the pus has even infected the skin of the neck and chest, producing enlarged glands, and a pustular eruption over the greater part of the body. Eczema of the auricle is often difficult to cure. In addition to local remedies, any manifest constitutional condition, as anæmia, must be treated. In acute eczema, so far as local remedies are concerned, all irritants must be avoided. Calamine lotion, with liquor calcis, is useful as a local application in these cases, and so is the linimentum calcis of the Pharmacopœia. The ear may be occasionally bathed with cold, weak, and alkaline lotions. The patient must be kept on low diet, and all stimulants, especially beer and wine, avoided. The bowels should be acted upon by saline purgatives, with the combination of a few drops of colchicum wine should the patient be plethoric, with a tendency to lithæmia. When the disease begins to decline, arsenic is useful, and the local application of the empyreumatic preparations, given in combination with the bases of lanolin or glycerine. In the anæmic and weakly, and especially where the eczema tends to become pustular, the internal administration of iron is always advisable, the

carbonate being a useful salt. Mercurial applications will often be of great local benefit, especially dilute white "precipitate" ointment. Mercurial ointments are also beneficial in chronic eczema. The red or yellow oxide ointment, always weakened by combination with vaseline or lanolin, will be found to give good results. In still more chronic forms, stimulating applications must be used. When the auricle is much thickened with scales and fissures, no treatment gives such good results as the creation of a smart inflammation in the part. This may be done by the application of a lotion of nitrate of silver, twenty grains to the ounce, or a mild blistering fluid. The application of remedies needs some care in these cases. Hence it is seldom advisable to leave it entirely to the patient. Should the space between the pinna and the mastoid be much affected, the dressings must be laid carefully in this situation, and over the auricle, the whole being retained by a bandage. Treatment will usually be successful if conducted on these lines. At the same time, it must be understood that the selection of local remedies for eczema of the auricle is often difficult, and that to detect and treat the constitutional diathesis which underlies these conditions, calls for good therapeutical and medical knowledge. There is, indeed, nothing peculiar in the treatment of eczema of the auricle, but often perplexities arise in the mind of the medical attendant as to what local remedies are most advisable in any particular case. This, however, is an acknowledged difficulty in the local treatment of eczema wherever it occurs.

Regarding the treatment of herpes of the auricle little need be said. Attention to the general health, and the application of a simple ointment, is all that

is requisite. In old and feeble people, however, the vesicles of herpes may terminate in troublesome ulceration, or be preceded or followed by violent neuralgic pain. The subjects of the affection are usually weak and anæmic. The internal administration of good wine, quinine, and especially carbonate of iron, will prove beneficial.

Lupus erythematosus of the auricle rarely comes especially under the notice of aural surgeons. It is usually associated with the well-known "butterfly" patch on either cheek and across the nose, and the patient will probably be a woman of forty years of age or upwards. The disease forms a patch of a dull red colour, covered with small scales, which differ from those of eczema in adhering closely to the mouths of the sebaceous follicles. Where picked off, bleeding occurs. At the margins slight atrophic healing occurs, leaving white depressed but very superficial scars. The treatment of this disease is eminently unsatisfactory; regarding it works on dermatology may be consulted. To the aural surgeon it is chiefly interesting in a diagnostic sense.

Ichthyosis is said to be associated with a malformation of the lobule of the ear. This is certainly not universal in such cases. Such a deformity has been absent in all the cases I have had the advantage of seeing at the Dermatological Society of London.

Congestions and erythematous inflammations are found in the ears of some individuals whose circulation is defective, who suffer from cold feet and hands, and are severely affected by temperature. In such, chilblains of the hands and feet are common. Protection of the ears from cold is essential in these cases, and the application of

belladonna in the form of liniment or ointment has often seemed to me beneficial. In true Raynaud's disease, the congestion of the auricle passes on to superficial gangrene and to slow intractable ulceration, which may destroy a considerable portion of the auricle (Plate I. Fig. B). The affection is not very painful, is always paroxysmal, worse in cold weather, and is sometimes associated with intermittent hæmaturia. Doubtless many ill-understood local conditions of the vessels of distal parts, associated with congestion, and changes in nutrition, are included under this term. Gangrene of the fingers or toes may also be observed in these cases. Syphilides of all kinds are found on the auricle, and condylomata about the margin of the meatus. These affections must not be confounded with epithelioma, and are to be diagnosed and treated on general principles. Sensations of flushing and heat in the auricles, with severe itching, are sometimes met with in neurotic and dyspeptic females. In persons of plethoric habit, these symptoms are often associated with gout. Dietetic and medicinal treatment is usually of more avail than local, though sedative lotions and ointments may, of course, be useful. Severe neuralgic pains about the auricle may be due to irritation of any of the numerous nerves supplying it. Thus "ear-ache" is found from carious teeth, epithelioma of the tongue, caries of the cervical spine, or tumours of the neck pressing on the ascending branches of the cervical plexus.

Case 2.

SEVERE PAINS OVER AURICLE AND MASTOID REGION WITHOUT OBVIOUS CAUSE. IMMEDIATE RELIEF UNDER TREATMENT FOR GOUT.

A stout florid-looking middle-aged gentleman, seen June 29th, 1891. He has complained for nine weeks of very severe

pain over the right mastoid region about the auricle, and in the canal. At night the tenderness becomes unbearable, and the ear flushes up, and gets hot. When eight years of age he was attended by Toynbee for "abscess of ear." So far as he can recollect has had no otorrhœa since. There is no tinnitus. He is slightly deaf to the watch on the right side, and the fork is referred to the right when placed on the vertex. The drum is a little opaque, and the light spot indistinct. A right inferior molar tooth has been extracted lately, as it was carious and might have caused pain, but no relief followed. Excepting tenderness on pressure, there was nothing abnormal to be externally detected, and there was no history of syphilis. There were many of the signs of gouty diathesis about this patient. He was given hot atropine lotions locally, and doses of blue-pill and colchicum internally. He was ordered not "to dine out," and to take merely a little whisky and lithia water, with an occasional dose of blue-pill. The pain, which had resisted other treatment, rapidly left him, and in a few days he was quite well, and I hear has since remained so.

Case 3.

SEVERE PAIN IN AND ABOUT AURICLE. TUMOUR OF NECK PRESSING UPON AURICULARIS MAGNUS NERVE.

A gentleman, aged 67, for about twelve months has suffered from neuralgia of left ear and side of the head. For the last six months the pain has become unbearable, and is described as flashing, shooting, etc. The most severe pain is referred to the back of the pinna; pain is also occasionally felt over the parotid region. Cold and damp weather makes it worse. He has been a sufferer from rheumatism all his life. A variety of local treatment, including galvanism, has been employed without benefit. There is no deafness, and the auditory canal is normal. On examining the side of the neck, an exquisitely tender "lump" about the size of a large filbert is detected in the substance of the sterno-mastoid muscle, at the junction of the upper and middle thirds. On manipulation of this, pains like "electric shocks" are experienced over the left auricular region and down the left arm, particularly in the ball of the thumb. On inquiry there was a clear history of syphilis in youth; consequently the patient was placed upon an iodide of potassium mixture, and mercurial inunction

applied locally, in the hope that the growth might be a gumma. In three weeks there was distinct improvement, the pains being slight and the growth less tender. Its bulk was in no way diminished, and I advised removal by operation. This, however, the patient declined, and I have since lost sight of his case.

Injuries of the auricle are to be treated on general surgical principles. Fissured lobule is not uncommonly observed in the lower classes, from the earring being forcibly torn out in a fight. The cleft should be pared and sewn together. The auricle heals well, and, should any portions of it be partially detached, they should on no account be removed, but carefully cleansed, replaced, and sutured accurately. I have found fine fishing-gut to answer every purpose in these cases.

Occasionally the ears "stand out" from the side of the head in a very unsightly manner. This may be due to congenital peculiarity, or to the constant pressure of an ill-fitting hat or cap, in the young, between the auricle and the head. These cases, when extreme, are easily remedied by a plastic operation. A piece of integument being freely removed from the back of the auricle and mastoid region, the edges of the wound are accurately united by fine horse-hair, and the parts kept bandaged in new position until firm healing has taken place. As regards the shape and size of the incisions, no fixed rule can be laid down; each case must be studied. It may even be needful, where much deformity exists, to remove a portion of cartilage.

The affections of the external auditory canal are of great importance to the practitioner, and many of them are very amenable to well-directed treatment.

The most common and important condition we have to consider in this connection is accumulation and impaction of cerumen. The true causation of this affection is not easy to explain. It is more common in advanced life than in childhood. Some of the most pronounced and recurrent cases I have met with have been in bathers, and those who are accustomed to submerge the whole head in cold water at the morning bath. It also frequently arises from the general practice of cleansing the ears "by screwing them out" with the end of a wet towel and thus forcing inwards the natural exudation. The healthy auditory canal is perhaps the only part of the body where strict cleanliness is not advisable. A certain amount of moisture mixed with the cerumen seems to prevent accumulations; the secretion, on account of its softness, forming a coating to the canal. In old age the "wax" becomes dry and hard, the natural moisture being deficient. The affection is common among those who work in dust and dirt, as colliers, millers, clothmakers. Great differences may be observed in the amount of secretion from the ceruminous glands in different individuals. Some persons' ears are remarkably dry, without a trace of cerumen, and yet the hearing remains perfect. It must be especially remarked, that impacted cerumen may be combined with other affections, as perforative otorrhœa, nerve-deafness, or chronic catarrhal inflammation of the middle ear, and no prognosis should be given until the wax is removed. Narrowing of the canal, or the growth of an exostosis, often leads to impaction of cerumen by preventing the escape of secretion outwards. In the vast majority of cases no damage is done to the canal or membrane by the plug. In some

instances, inflammation of the lining membrane with desquamation is observed. In others, the tympanic membrane has been found perforated and destroyed.* In most cases, the membrane will be seen forced inwards, and hyperæmic on the removal of the obstruction. The handle of the malleus is especially distinct and pink in appearance. The composition of the wax varies much. In some cases, and usually in children, it is soft and greasy; in the adult and aged, the accumulation is exceedingly dense and firm. The symptoms caused by impacted wax are usually gradual impairment of hearing, with a sensation of stuffiness and fulness in the head, and more or less tinnitus. In many instances the deafness is sudden, from the displacement and impaction of the mass. This is especially apt to occur after bathing, or injudicious syringing; the water causing the substance to swell up.

When much pressure is exercised on the membrane, the symptoms complained of are most curious. They may be readily misunderstood, and the case diagnosed and treated as some chronic cerebral affection. I have several times known of this error being committed. Among other symptoms, roaring noises are complained of, with attacks of giddiness closely simulating the so-called Ménière's disease. Epileptiform attacks are not unknown, and also reflex disturbances of the vagus —as cough and vomiting. In the insane, aggravation of the symptoms and hallucinations are produced

* I mention this in deference to the opinion of authors of repute. I have never seen a case of this nature myself, and believe when a perforation of the drum comes into view after removal of an impacted plug of wax that the lesion is due to pre-existing disease of the membrane and middle ear, and not to the pressure of the plug.

by impacted cerumen, but great improvement follows removal. In all cases of mysterious cerebral symptoms, as giddiness and vertigo, "with noises in the head," an examination of the auditory canals should not be neglected by a careful practitioner. The speculum and mirror will at once reveal the plug, brown, black, or greenish-yellow in colour, usually lightly lustrous on the surface (Plate III. Fig. D, E). The tuning-fork will be more loudly heard by the affected ear, on placing it upon the vertex. It is still too commonly the practice to regard all cases of deafness as due to impacted wax. The syringe is used empirically and indiscriminately. Sometimes it does good; often it fails; not unfrequently it is productive of actual harm.

It is well to observe that before treating a patient for impacted cerumen, we should be sure of its presence. The best treatment for these cases is the removal of the plug by the aural syringe. This is by no means easy to do well. Many of these accumulations are so hard and dense as to resist for a long time the action of a current of warm water. If in such cases violent syringing be resorted to, the plug may be driven inwards, producing pain and faintness, and even actual rupture of the tympanic membrane. In most cases, therefore, and especially in unskilled hands, it is far better to soften the plug before removal. This is done by soaking into the ear a warm alkaline solution. A drachm of bicarbonate of soda, a drachm of glycerine, two grains of carbolic acid, to three ounces of water, is a favourite prescription of mine. A little of this lotion, mixed with enough hot water to warm it, is poured into the ear, the head being inclined towards the opposite side. At bed-time

the application may be advantageously employed, the patient going to sleep upon the unaffected side. On the following day, the syringe should be used. The aural syringe (Fig. 20) should be capable of holding from four to six ounces of warm water, and the nozzle should be thin and elongated. It is well for those much engaged in aural practice to be provided with several sizes of such syringes with nozzles of different length and calibre. The nozzle is laid along the roof of the meatus, and the stream of water continuously and gently injected. This is by no means so simple as a novice may be led to expect. At the same time, the pinna should be well pulled upwards and backwards by the thumb and forefinger of the left hand, so as to straighten the canal. A towel is "tucked" about the neck of the patient, and under the ear he holds a suitable receptacle close to the skin of the neck. The surgeon perseveres with his efforts until masses of cerumen escape. If the wax has been properly softened, one or two applications of the syringe will generally effect the desired end. When a mass of cerumen escapes, the ear should be inspected with the speculum, for the quantity of secretion that comes away in these cases is often quite remarkable, and

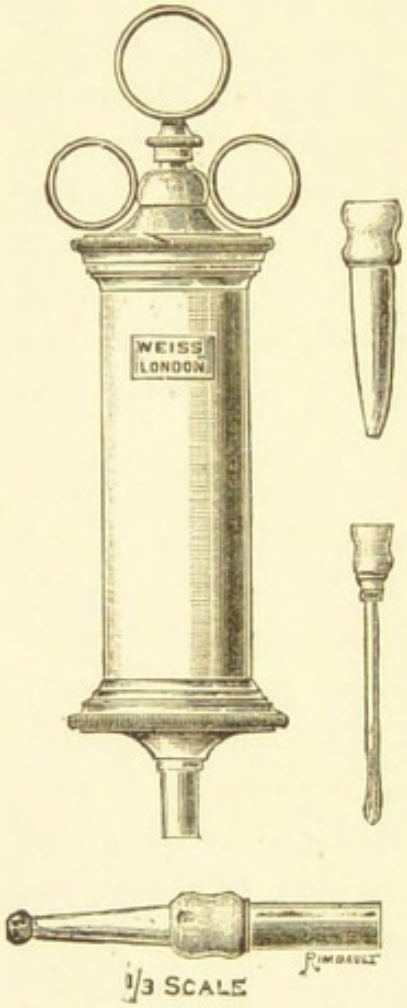

Fig. 20.—Aural Syringe.

the surgeon may imagine that all has escaped, when in reality a considerable portion still remains. On the other hand, he may persevere in his efforts after the offending substance is really removed. The patient is usually sensible of complete and great relief to his deafness and distressing symptoms. The hearing may even seem painfully acute, the sound of the voice being compared to shouting, and the noise of a vehicle to continuous thunder. Should the walls of the canal be inflamed and the membrane hyperæmic, a simple sedative lotion and mild astringent may be used for a few days, and the part carefully protected from cold.

Sometimes much giddiness is produced by syringing in these cases. I have more than once known an attack of syncope to come on, and in epileptics the introduction of the speculum within the ear may lead to an attack of the characteristic seizure. A knowledge of the possibility of the occurrence of such complications, will prevent embarrassment on the part of the surgeon when they happen. A large number of drills, screws, hooks, scoops, and such like instruments, are sold for the extraction of hardened wax from the ear. It is easy to do harm with them, and, in ordinary circumstances, nothing but the syringe should be resorted to. Occasionally it happens, however, that the patient visits his surgeon from a great distance and must return immediately. In these circumstances, should gentle and persevering syringing be of no avail, the mass may be removed "piece-meal" by a small scoop (Fig. 21), a tiny hook, or fine forceps, aided by the syringe. Another plan, which I strongly oppose, is to insert slowly a screw into the mass, which is thus extracted after the fashion of "drawing a charge" from a muzzle-loading

gun with a ramrod. These manipulations, especially the latter, should only be attempted by highly-practised hands, and the parts should be thoroughly

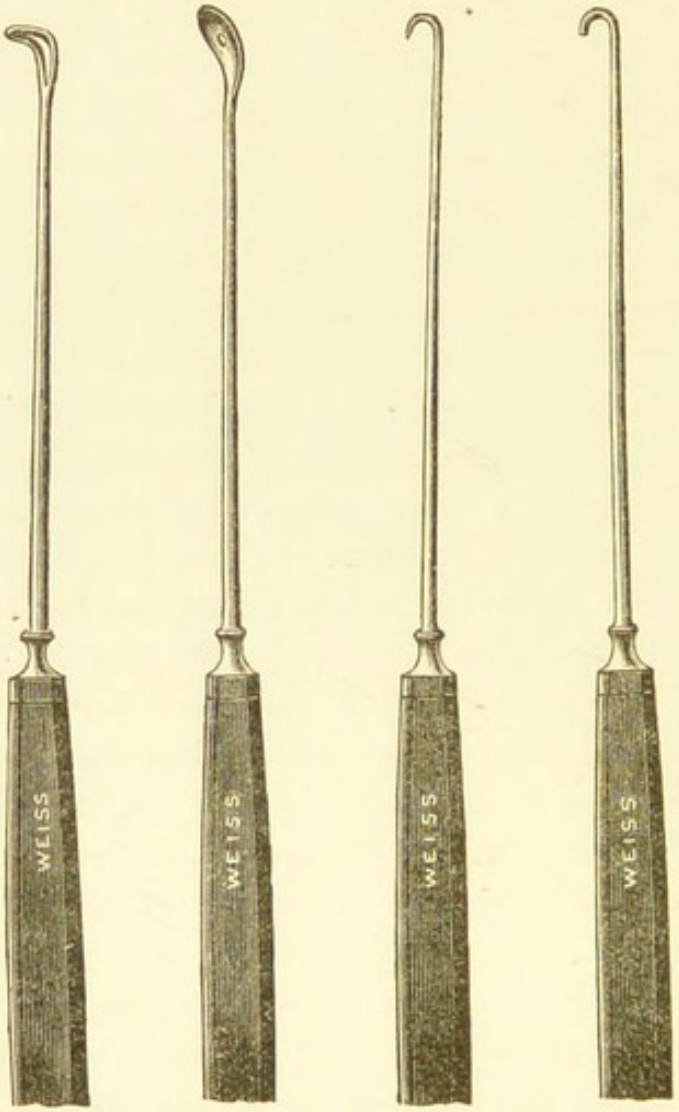

Fig. 21.—Hooks and Scoops for the Removal of Cerumen or Foreign Bodies. Several sizes may be needful.

illuminated through a large speculum. On no account should instruments be inserted, unless the operator can see what he is doing, and where he is applying them.

After complete removal of wax, it may happen that the hearing is but slightly improved; there is then

some affection of the middle ear or labyrinth which needs further investigation. Often attacks of inflammation have caused epithelial desquamation, and the lining membrane of the canal is intimately adherent to the cerumen. These cases are always difficult to deal with, for the plugs are very fixed, and the parts implicated excessively tender. A fine pair of aural forceps (Fig. 16), cautiously used, is best employed; but with prolonged care and patience. Maceration of the epithelial plug with warm and dilute solutions of salicylic or boracic acid is often absolutely necessary. The maceration may be carried out for several days, and then the syringe will usually readily and painlessly remove the substance. Cold is a potent cause of this kind of inflammation of the auditory canal, and, in my experience, an attack of catarrh of the naso-pharynx and middle ear is not infrequently associated with it.

Eczema.—Eczema of the meatus is a troublesome affection to cure. I believe that in many instances applications ordered by the surgeon are improperly employed. Eczema of the canal is usually chronic or sub-acute, and the resulting swelling and induration may seriously contract the calibre of the channel. The surgeon must first assure himself that there is no purulent infective discharge flowing over and excoriating the meatus. Should this be the case, treatment must be energetically directed to it. As in eczema of the auricle, any manifest constitutional condition may need treatment. Local treatment, directed towards the destruction of organisms, is generally beneficial, and will be conducted on the same lines as already indicated in affections of the auricle. Weak alkaline lotions are useful in the acute stages. Mercurial and tar preparations are

often very beneficial, or soaking the canal with a warm carbolic lotion (1 in 40). Bearing in mind the tendency to closure of the meatus in these cases, remedies are best applied on a tampon of lint or linen well impregnated and passed into the canal. The patient should be shown how to do this by the surgeon. The medicinal treatment of eczema of the canal is conducted on general principles. In the pale and anæmic, arsenic or iron is indicated; in the plethoric and gouty, purgation, with moderate doses of alkalies and colchicum. Arsenic, if judiciously managed, seldom fails to be beneficial. In obstinate cases, a course of natural waters is often beneficial, that water being selected which seems most likely to benefit the constitutional defect. In cases where the meatus is certainly or almost completely closed, some operation must be devised. In one such case I have obtained good results from removing elongated wedge-shaped portions of tissue round the orifice of the canal with Gräfe's knife. Subsequently, a small tube of thin sheet-lead was continuously worn for many months.* A carbonate of lead is formed on the surface by the action of the serum, and the continuous pressure and astringent action combined, makes this little apparatus the best I am acquainted with. Partial closure of the meatus is not uncommon in elderly people, especially in women, the cartilaginous walls becoming flaccid and approximated. In such cases a small tubular instrument should be placed in the meatus, for by its use hearing is considerably improved. This may be about half an inch in length, constructed of vulcanite and coloured pink, so as not to be especially remarkable.

* These tubes are made for me by Mr. Hawksley, of Oxford Street.

Case 4.

LONG-CONTINUED ECZEMATOUS INFLAMMATION OF RIGHT AUDITORY CANAL. CLOSURE AND DEAFNESS. DILATATION WITH LEADEN TUBES. RESTORATION OF HEARING.

A stout, puffy woman, aged 49, attended the out-patient department of Charing Cross Hospital on October 14, 1890. She stated that for many years she had suffered from occasional attacks of inflammation of right ear, with occasional discharge. Lately the ear had "quite closed up." On examination, the parts about the meatus were swollen and inflamed, the canal being quite closed, even to the smallest speculum. The watch was heard on contact, and the tuning-fork, long and loud on the mastoid. With some difficulty a thin strand of lint covered with ung. hydrarg. co. was passed into canal with a fine probe. Patient was ordered to soak the ear night and morning for a week with hot carbolised lotion. Beer and excessive meat-eating were interdicted. Salines and small doses of blue-pill were ordered internally. In a week's time the swelling was much reduced; a larger piece of lint, impregnated with blue ointment, was introduced. In fourteen days a small leaden tube, smeared with vaseline, was inserted with some difficulty. After this dilatation progressed well, longer and larger tubes being inserted at weekly intervals. Hot carbolic lotion was regularly applied night and morning. The syringe brought away a quantity of epithelial *débris*, and in five weeks the membrana tympani just became visible through a small speculum. The hearing was now quite restored. The patient was discharged in seven weeks, still wearing a leaden meatus tube, which she was advised to continue for at least six months.

The lining membrane of the outer third of the auditory canal is frequently the seat of troublesome recurrent boils or furuncles. These are intensely painful and annoying from the tension of the parts. Associated with this affection is acute diffuse inflammation. Here the meatus is intensely swollen, of a bright red colour. The pain is acute, and the least touch agonising. There is generally some fever and

constitutional disturbance, with acute pain about the mastoid and joint of the jaw, and in the neighbouring glands, which may be inflamed and swollen. Should the surgeon opine that the lining membrane of the canal and periosteum are involved in the inflammation, he should advise the patient to inhale nitrous oxide gas, and the canal may then be deeply incised with a fine cataract knife. The free bleeding which ensues should be encouraged by continued warm fomentations, the bowels being well acted upon by a mercurial purge. Warm anodyne applications of all kinds are advisable in these cases. Hot spongiopiline may be laid against the auricle, or a small heated sand-bag is often grateful. Morphia may be introduced in these cases in small pellets of gelatine, which can be dropped down the meatus. The local remedies for this affection are too numerous to mention, most households having their peculiar remedy for "ear-ache." The treatment of furunculosis is often difficult. Micro-organisms having been discovered in the pus in large quantities, some observers have been led to consider these affections as entirely local. Whether the little boils are caused by micro-organisms or not, I am convinced that in the majority of these cases some constitutional abnormality usually exists, which needs detection and rectification. These cases are very similar to the common "styes" or suppurations about the follicles of the eyelids. Several typical cases of recurrent boils in the auditory canal have been seen in those who have long been resident in hot climates. The affection is also common in persons who lead sedentary lives, or are the subjects of diabetes or chronic renal mischief. Constipation and want of exercise, with too luxurious living, are, perhaps, the

combination of conditions, which most strongly predisposes towards furunculosis of the canal.

In the general treatment of these affections, therefore, the surgeon will carefully regulate the diet, and, as far as possible, change any faulty habits of life he may detect. The urine should be carefully examined, and any indication it affords observed. As a general rule, the bowels should be kept freely open by mercurials and salines. In many of these cases, calcium sulphide is given in small and frequent doses. The local treatment is of importance. Hot applications are generally most useful, and these are applied by filling the meatus with warm water, to which a liberal allowance of laudanum has been added. Hot, dry spongiopiline, applied over the ear, is often grateful, and a few leeches, placed in front of the tragus, are very beneficial, should general inflammation of the soft parts co-exist. So soon as there is any indication of the pointing of the boil, it should be opened by transfixing it with a fine knife, and the contents evacuated. The meatus should then be constantly soaked with warm and dilute solutions of alcohol, containing in solution carbolic acid, perchloride of mercury, or boracic acid. Once or twice daily the meatus may be carefully dried, and all secretions removed.

The after-application of a dilute mercurial ointment with a brush has seemed to me to prevent recurrence, white precipitate ointment being highly efficacious in this respect.

In connection with this subject must be mentioned an eczematous affection of the canal associated with the formation of numerous flakes and masses of epidermis, which may completely block it. These are curiously

adherent to the walls of the canal, and are with difficulty removed by the syringe. Prolonged maceration with alkaline lotions will usually allow of the withdrawal of them by fine forceps. Hartmann speaks favourably of the instillation of a two per cent. solution of salicylic acid in oil. After the removal, the walls of the canal are left red and tender. Dilute mercurial preparations are now very useful. The vapour of calomel in a state of sublimation is a most excellent application, and can be readily used by subliming the powder in a glass tube, into the end of which a hand-ball and rubber tube are inserted. If the flakes after removal be carefully examined by the microscope, spores and threads of fungus growth will often be detected. A large number of kinds of fungi are described by authors. Doubtless the numerous spores which are floating in the air find in the auditory canal a suitable place to fructify. A knowledge of the existence of these growths will explain the local value of mercurials in such cases. Diphtheritic inflammation of the canal is rare. I have seen but one case, and in that the process had obviously spread from the tympanic cavity, which was raw and suppurating. The dermic covering of the canal, however, is moist and delicate, and doubtless the diphtheritic process may occasionally attack it primarily. Gangrenous inflammation of the external auditory canal is observed in ill-nourished children, after such affections as measles or scarlet fever. The malady is exceptional and dangerous; and, should the child survive, necrosis of the walls of the canal may occur.

Sebaceous cysts sometimes form within the canal, and may become inflamed. In the latter case they

should be treated like an abscess. It is not often easy or possible to dissect them out entirely, and, should they prove troublesome, as much of the cyst-wall as possible may be removed, the contents scooped out, and a caustic applied to the interior. This is conveniently effected by fusing some chromic acid upon the top of a fine probe. Others prefer nitrate of silver in solid stick. Dermoid cysts near the meatus have been already alluded to. Adenomata of the sebaceous glands of the canal are also described, but the treatment by removal presents no difficulties. Molluscum contagiosum may show its pearly-white rounded tubercles near the auditory meatus of children.

Exostosis of canal.—This is one of the most important affections of the auditory canal. Briefly speaking, these growths may be considered as of two kinds, cancellous and ivory. The cancellous exostosis is often associated with irritation in the ear, as suppurative otorrhœa. It is usually pedunculated, and its removal is altogether a more simple proceeding than is the case with the ivory growths. The diagnosis is obvious; the exostosis can be plainly seen, more or less filling the canal, covered with its pale lining membrane. On touching it with a probe, its hard and dense structure is proved. This little bony tumour usually springs from the posterior or superior wall. When associated with otorrhœa, these cases are not without apprehension, as the discharge may be prevented from escaping externally. If there is one case of aural disease more than another demanding immediate surgical interference, it is in that of an exostosis filling the canal, with a suppurative otorrhœa, and acute "head symptoms" supervening. It is noteworthy that in these cases the deafness, pain, giddiness, and such-like serious

symptoms often come on suddenly, the small "chink" between the exostosis and the canal wall, being suddenly occluded by inflammatory swelling or inspissated secretion.

Removal is effected by one or other of the following operations. If the exostosis is pedunculated, a long, narrow-cutting forceps will usually suffice to clip it off.* Or a strong steel wire loop may be insinuated round the stem of the growth, the loop being tightened and the exostosis broken off. This is a difficult proceeding, and must be executed with the greatest care. In some cases of exostosis of the canal, displacement of the auricle by a posterior incision is of the greatest value, as it brings the growth well under the ken of the operator.† Attacking these growths with strong caustics and powerful acids is highly unsatisfactory.

The ivory exostosis or hyper-ostosis may be single or multiple (Plate III. Fig. F). Like other hard growths of the same nature occurring on the skull, their rate of progress is extremely slow. They are found in adults, and appear, according to some observers, to be more frequent among the upper classes. I have seen several instances of this affection in elderly gentlemen of gouty habit, who had been much exposed to cold and wet in sporting, and have observed one case in an old sea-fisherman. It is likely that cold and exposure have something to do with the development of these tumours, for many authors have noticed their occurrence in sea-bathers and divers. When multiple, they seldom completely close the auditory canal, and, if not associated with

* The forceps must be constructed for the case in hand.

† See a paper by myself on the details of this operation in vol. xii. of the Transactions of the Med. Soc. Lond.

otorrhœa, may never call for surgical interference. A small passage suffices for the transmission of the waves of sound. This can be kept patent by occasional careful cleansing. Syringing is generally not advisable in exostosis of the canal, since the water and cerumen may accumulate behind the obstruction. The aural forceps, a small scoop, or a tiny blunt hook, may be employed to remove any obstructing accumulation of cerumen. Patients affected with this disorder should visit an aural surgeon at intervals for inspection and treatment. Should the canal become completely closed, or severe symptoms of deafness and discomfort arise, an operation is needful. This is a proceeding of some danger and difficulty, and patients should never be subjected to it without due deliberation and sufficient reason. If the hearing on one side is good, no amount of mere deafness on the other renders the operation urgent in ordinary circumstances. The ear being illuminated by a good light, through a large speculum, the growth is attacked by an "electro-motor" dental engine and a small burr. The bleeding is free, and constantly obscures the site of operation. A number of small fragments of sponge should be at hand, fixed upon wooden splinters, and steeped in a hot alcoholic solution of tannin. These are useful to press firmly upon the bleeding parts during the intervals of operation. Operators who have had exceptional experience in operating upon these cases, advise the insertion of a guard beyond the exostosis; this should be adopted when practicable. A convenient position for the patient is upon a high couch, with the head well raised, before the light of a window. An assistant should draw back the ear, and assist with the speculum or guard. Another assistant should aid

with sponging. The electric light may be useful, but good daylight, if it can be obtained, is superior to any artificial illumination. In this respect, London operators are at an inevitable disadvantage during the winter. The anæsthetist must be prepared to

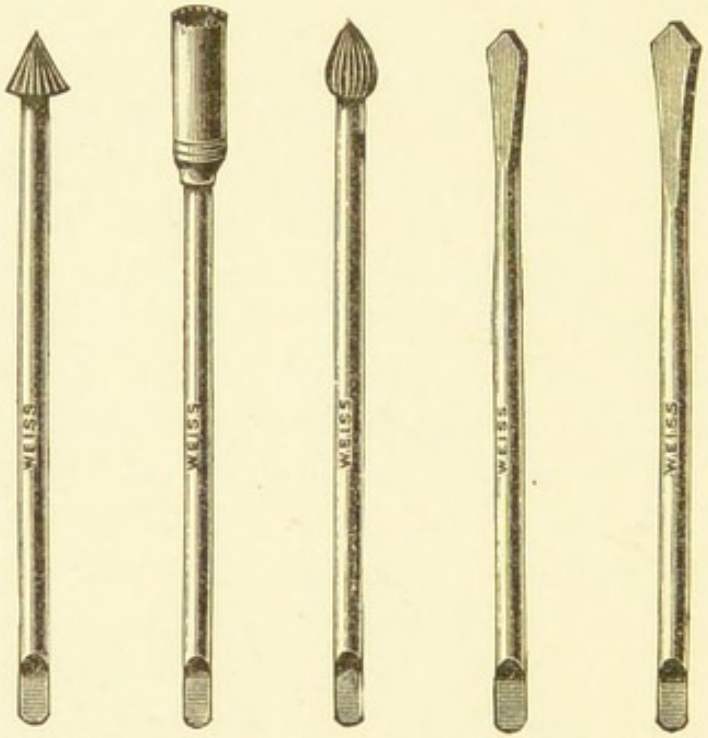

Fig. 22.—Drills, Trephine, and Burrs. These should be adapted in size to the case in hand.

keep his patient insensible for an hour, and the utmost patience and perseverance must be exhibited by all persons concerned. The electro-motor has much simplified these operations. It is well to work this instrument at reduced speed, and to exert very light pressure on the drill, which cuts away the most dense tissues with extraordinary rapidity. An operation which formerly would have taken an hour can now be effected in thirty minutes. If there be several growths, the larger one alone need be attacked. If the exostosis be well "hollowed out," the remainder

of it will usually necrose and come away. The density of these growths may blunt many drills and burrs (Fig. 22); hence it is well to have a store of these terminals at hand.* After the operation severe inflammatory reaction not uncommonly sets in, with much pain, and the formation of granulation tissue over the inflamed bone. This is to be met by hot ear-baths, containing carbolic acid and laudanum in solution, and by the application of leeches to the front of the tragus. Any attempt to apply caustics to the granulations is to be deprecated. In time matters improve, and when the acute symptoms have subsided, the remaining granulations can be destroyed with chromic acid or the galvano-cautery. The usual result is in the end highly satisfactory. Aural exostoses vary exceedingly in density, and, consequently, operations vary in difficulty. In a more soft growth, a hole having been drilled into it, this may be rapidly enlarged, or one blade of a forceps may be passed into the opening and the exostosis wrenched off. In the most difficult cases, a small drill is laboriously passed into the growth, and the opening thus made gradually enlarged. Such a proceeding may take several sittings. The position of the growth also, as to depth or superficiality, will influence the confidence with which the operator can work. A very narrow and curved canal, and a deeply-seated ivory exostosis close to the drum, afford a combination of difficulties of no small moment, and in such cases the indications for an operation should be very clear before it is undertaken. No fixed rule can be laid down as to the exact spot on the exostosis where the drill is to be

* Some operators, as Pritchard, prefer the terminals to end in a small trephine head.

applied. In certain cases, the detachment of the auricle posteriorly affords a ready access to the growth, which then comes immediately under the eye and finger of the operator; the exostosis may thus, if cancellous, be readily removed with a chisel.

It is especially important in the diagnosis, that a true bony growth should not be confounded with localised bony enlargements, the result of chronic inflammation. These latter are usually found in late syphilis, and are, in fact, calcified periosteal nodes of the canal. The administration of mercury and iodide, and persevering local application of strong solutions of iodine and preparation of mercury, may cause considerable diminution in these swellings. I cannot doubt that some of the cases related of the disappearance of "exostosis" under such local remedies as iodine were really diagnostic errors.

Foreign bodies in auditory canal. — Foreign substances are not infrequently introduced into the ears by children and those of weak intellect (Plate III. Fig. G). There is a curious tendency to introduce various materials into the orifices of the body in children and "hysterical" girls. The foreign bodies found in the auditory canal may be classified as: (1) smooth soft bodies, as peas, pellets of bread, pledgets of cotton-wool; (2) hard or pointed bodies, beads, fruit-stones, gravel, pieces of wood or slate-pencil, tin-tacks, a tooth, and the like; (3) insects of various kinds, and maggots in some neglected cases of suppurative otorrhœa.

All writers on this subject have dwelt with force and emphasis on the dangers and difficulties associated with these cases. Various are the aphorisms that have been composed, and the cautions expressed,

regarding them. To relate fresh instances of the results of rash and unskilful treatment in these cases, would be merely useless repetition. It is only needful to make certain statements, which are founded upon facts supplied by all authors, and common knowledge.

(1) A foreign body lodged in the auditory canal seldom gives rise to dangerous consequences, either to life or hearing, if it is left alone.

(2) Unskilful attempts to remove a hard foreign body from the ear, are fraught with the greatest danger to hearing, and even to life.

Such attempts are certain to fail, and the foreign body is left, with the knowledge that an acute inflammation of the damaged parts will supervene. The practitioner or surgeon may look upon a case of impacted foreign body in the ear of a child as one of great difficulty even in the most skilled hands ; and he will, bearing this in mind, on no account undertake the care of such a case without due deliberation.

(3) The treatment of insects or larvæ in the ear may be shortly dismissed. The former, by scrambling against the membrana tympani, give rise to acute and disagreeable sensations. The ear should be filled with warm water, to which some carbolic acid is added, and the creature will speedily make its exit, or may be removed by the syringe. A small piece of wool moistened with a solution of cyanide of potassium, or with chloroform, will also prove speedily fatal to flies, "earwigs," etc., and they can then be removed with the syringe. In those disgusting cases of neglected otorrhœa where maggots form, the ear should be filled with warm carbolic lotion, and continuously soaked. The creatures are afterwards to be expelled with the syringe. The subsequent treatment

of the otorrhœa must, of course, be energetically entered upon.

In cases of foreign body in the ear, the patient and continuous use of the syringe is the one method which will recommend itself to the notice of most surgeons, and this alone is to be advised to those unskilled in aural manipulations. With regard to peas, beans, grains of corn, and the like, it must be remembered that they swell considerably in water, and hence, if they are not expelled by the syringe they become the more firmly impacted. In these cases it is best to syringe with clear olive-oil, which can always be easily procured. If the pea or bean is not expelled, instillations of warm glycerine should be used in the intervals between the syringing. It has been shown by actual experiment that this causes such substances to shrink. Should syringing in the ordinary position fail, the child must be placed upon a couch, with its head a little "hanging over," and the affected ear downwards. The head should be supported by a relative or assistant. The surgeon, pulling the pinna well backwards, should introduce the nozzle of a syringe bent at an obtuse angle, into the ear, and direct a stream of warm water well along the upper wall of the canal, the water falling into a basin placed upon the floor below. The syringing should be continued for at least half an hour before relinquishing the attempt, and it may be repeated on the following day. The stream should be injected with regular force, and not in "jerks;" and the operator will, in a great number of cases, be rewarded by finding the offending substance either expelled altogether or shifted into such an external position, as to render its extraction comparatively easy. I would repeat, that the proper use of the

syringe will serve to expel most foreign substances from the canal. A caution must here be expressed, that on no account must the syringe be used, unless the surgeon can himself see the foreign body said to be introduced; and should there be inflammatory swelling and discharge, this must first be removed by appropriate treatment, such as the continuous instillation of sedative and antiseptic lotions, and the application of leeches to the tragus. In the case of fractious children an anæsthetic is generally needful for due examination, or even for syringing.

Should the proper and persevering use of the syringe fail, the case at once resolves itself into one of great difficulty and some danger. The difficulty and risk will be in proportion to the hardness and degree of impaction of the foreign body, and to the amount and nature of the unskilled attempts that have previously been made to extract it. Unfortunately, even in these days, such cases are brought to the surgeon after blind attempts have been made by the relatives, with hair-pins, etc., to remove the offending substance; and within the last twelve months I am cognisant of a case where a surgeon attempted to remove a foreign body from the ear with forceps and hooks without illumination under an anæsthetic! Should there be much inflammatory swelling and discharge, this must first be subdued, and granulations may be removed by astringents. In the course of time the patient will be able to bear the introduction of a speculum; and then, happily, the foreign body may come into view and its exact nature and position be carefully studied. Should it appear to be only moderately fixed, the agglutinative method may be applied in the following way. A small

camel-hair brush is cut fairly short, dipped into the strongest glue, and then passed rapidly against the foreign body. By a little pressure the hairs are expanded so as partially to embrace the offending substance. The quill handle is to be cut on a level with the meatus, and cotton wool packed round and over it, so as to keep it in position. The brush is left *in situ* for twenty-four hours. At the expiration of that time the wool is removed, the pinna pulled backwards, so as to straighten the canal, and moderate traction on the quill may bring out the foreign body firmly attached to the hair of the brush. This method is useful for such substances, as beads, which are not firmly impacted. I have several times known this method fail, but it is commendable from its simplicity and harmlessness. Foreign bodies, unsuspected in the ear, may give rise, like impacted cerumen, to curious symptoms of cerebral irritation.

Forceps are seldom useful in these cases, unless the offending substance be of such a shape as to favour their grasp, or soft and yielding, as paper, wool, tobacco, or a piece of fruit. Round bodies of all kinds persistently and provokingly slip from the jaws of a forceps inwards towards the membrane. One of the most useful and harmless instruments that can be used in these most perplexing and troublesome cases is the simple wire loop. I prefer a small loop of steel wire fixed in a handle, something like a cataract vectis. The loop must be made of a size suitable to the foreign body, and can often be passed beyond it, and the body thus brought out. The fine steel-wire loop of a delicate polypus snare may be applied in the same way, and is especially useful for angular or

elongated foreign bodies. For such substances as peas, seeds, and fruit-stones, I have found nothing answer so well as a minute sharp hook. This may be self-made by taking a fine "hare-lip" pin, heating it in the spirit-lamp, and pressing its point upon a block of wood. The less the pressure, the smaller the hook formed. This instrument can be insinuated between the foreign body and the superior wall of the canal, and, by pressure, it will take a remarkably firm hold of the former. A sharp screw drill has also been employed. It should be very sharp, and be driven well into the offending substance. I regard this instrument as too dangerous for recommendation. Unless the foreign body is moderately impacted, or the surgeon can insinuate a "guard" beyond it, it is difficult to work a sharp drill without its slipping, or pushing the body dangerously against the membrane. Small blunt hooks are also useful; they should be flattened, bent at an obtuse angle, and very delicately made out of some malleable metal. Most of the instruments sold in the shops are far too coarse for the purpose intended. They are used on the principle of the lever, and may be modified in size, shape, and strength, according to the particular case under treatment. Some authors have recommended the destruction of the substance by the galvano-cautery, but I have had no practical experience of the use of this instrument for such a purpose. In desperate and obstinate cases, where the symptoms are very distressing, and especially where symptoms of cerebral irritation threaten, the operation of detachment of the auricle posteriorly may be adopted. The posterior wall of the bony canal may then be removed to a sufficient extent with chisel and gouge to extract the

substance. The necessity for this operation is very rare.*

It is also most essential that the ear should be well illuminated and a large speculum employed, no manipulations being attempted unless the substance to be removed is well under observation. The exercise of patience and gentleness is most important, and, should the surgeon fail at one attempt, he must repeat it at another. But these cases are among the most difficult in surgery; and the parents of the child become urgent and importunate, for they can ill understand the delay and difficulty that are experienced over what seems to them a very ordinary matter.

Most of the bad, or even fatal, consequences witnessed in these cases are the combined results of panic and unskilled treatment. It has more than once happened that foreign bodies have been found in the ear in adult life, which had remained there unsuspected since childhood. Moreover, the substances that children introduce are rarely pointed or rough, since these would cause pain on introduction. Smooth, round substances the most readily slip into the canal, and these may even lie in contact with the drum without any very serious consequences. I would recommend these remarks seriously to those who are about to undertake "heroic" operations for such cases. †

* A remarkable case of molten lead, or rather solder, in the auditory canal and tympanum was published by me in the *Lancet* for April 30th, 1892. In this instance I employed metallic mercury, which seemed to form an amalgam with the processes of the solder-mass in the tympanum. The specimen is in the museum of the Royal College of Surgeons. The case is well worthy of perusal, as also a criticism upon it and the reply in the *Lancet* for October 14th and October 22nd, 1892.

† In the *Clinical Journal* (No. xx.) will be found a reference

Necrosis and caries of the cartilage or bony walls of the canal may occur as the result of operations, as the sequel of acute periosteal inflammation, or in delicate tubercular children after the specific fevers. Disease of the temporo-maxillary articulation has secondarily involved the auditory canal. In caries and necrosis of the mastoid, the canal may also become secondarily involved, and fistulous openings leading into the mastoid are not uncommon. The symptoms are those of caries and necrosis in other parts. There is profuse fœtid discharge, with abundant granulation tissue, and the probe will usually detect rough and carious bone. One of the most troublesome associations of necrosis of the canal is the formation of deep-seated abscess and fistulous openings in the neck, and about the parotid region and jaw. The temporo-maxillary articulation may be destroyed. In the treatment of these cases strict cleanliness must be enforced by the frequent use of the antiseptic ear-douche, and the surgeon must carefully consider whether it is not possible to remove the offending bone. If a loose sequestrum form, its prompt removal is urgently called for. Bare spots of bone may be repeatedly touched with a powerful acid, or removed with a sharp curette. I am certainly of opinion that in many of these cases more bold surgery is advisable than is usually now adopted. The auricle and soft parts can be turned down from the side of the skull, and will readily reunite. In many cases the mastoid cells are also implicated; and, if this is the case, a very

by myself to the case of a pebble in the ear of a girl of fourteen. It was thought to be an exostosis, and had probably existed in the canal for about ten years, doing no harm of consequence.

free opening should be made into them, that the pus and *débris* may freely escape thereby.

Case 5.

PROFUSE OTORRHŒA FOLLOWING SCARLATINOUS OTITIS MEDIA. REMOVAL OF POLYPOID GROWTHS ON TWO OCCASIONS. DETECTION OF A SEQUESTRUM WITH THE PROBE, PROBABLY EXTERNAL TO THE DRUM. REMOVAL PER VIAS NATURALES. EXCELLENT RESULT.

On June 14th, 1893, I saw a child, aged 18 months, by the recommendation of Mr. Scatliff of Forest Hill. There was a history of left otorrhœa for about twelve months. This was profuse, and of very foul odour. There was a suppurating gland in the neck below the ear, and the child was pale and ill, with poor appetite, with constant pain in the ear, and excessively irritable and restless. On cleansing the ear, a soft vascular polypus, the size of a buckshot, was seen deep in the canal, apparently coming through a perforation in the drum. Slight left facial paralysis could be observed.

A few days afterwards I removed this little growth with a fine snare, and freely applied pure chromic acid to the base of the growth. The suppurating gland was evacuated by scooping, and carefully drained.

By September the symptoms had returned. The child was much improved for some months after the removal of the first growth, which seemed to check the exit of discharge. On examination in September, a fresh growth of the polypus was evident, and I again removed it in the same manner. At this time I made an elaborate examination with a fine probe, and detected a considerable area of rough bone, which was fixed and deeply seated.

During the latter months of the year 1893 I saw this case at intervals. The child was well cared for, and the ear syringed daily with a warm solution of chloride of zinc. In November, the sequestrum—black, hard, and rugged—came into sight. Owing to the restlessness of a small child, and the narrow canal, it was impossible to obtain an estimate of its exact size, or its connections, but it remained fixed, and, so long as this was the case, I determined to wait, as I was uncertain

regarding the structures implicated in it, or the damage I might inflict if violence were employed.

Late in 1893 I was able to ascertain, on firm pressure with a probe, that the bone slightly moved, and on the 4th January, 1894, I extracted it in the following way. Dr. Hewitt gave the A.C.E. mixture, and Mr. Scatliff assisted. Through a speculum, and with a good light, I fixed a small strong hook in the dead bone and tried to shift its position, but this I failed to do. With a small sharp curette, however, I was easily able to penetrate into the mass, which was soft and carious, and thus a considerable portion of dead bone was removed as amorphous *débris*. Finally, the main sequestrum was broken up, and then, with the forceps, I was able by traction and rotation to draw the remaining portions of necrosed bone away piecemeal. The whole mass must have been of considerable size, and, so far as I could judge, involved the posterior wall of the canal far down about the level of the drum. Absolutely no symptoms followed the removal of the sequestrum. The ear has remained quite dry since; all discharge has ceased.

Epithelioma and rodent ulcer may both attack the auditory canal, being then usually secondary to some local irritation. These affections are rare. If the disease spreads from the auricle inwards, it should be energetically attacked in its early stage. Even in late cases, I have seen considerable benefit from free operating. Should the auricle be involved, the whole parts should be removed by cutting circularly with a strong scalpel. Furious bleeding will occur from the divided branches of the external carotid; but, if the wound be large enough, no difficulty will be experienced in securing them.* The involved bone may then be cautiously chipped away with mallet and gouge, and Paquelin's cautery, or chloride of zinc

* I have lately (August, 1894) removed a very formidable growth of these parts, the external carotid being first ligatured. The hæmorrhage was readily controlled.

paste, applied to the surface. Afterwards, when the wound granulates, skin-grafting can be advantageously employed. When the disease has extended very deeply into the temporal bone, all operative interference is out of the question, so that it is important to attack these affections early and thoroughly eradicate them. Facial paralysis is an important symptom of deep extension.

The external canal may be the seat of several kinds of parasitic affections. The more common is the mould fungus *aspergillus niger*. This appears as black or brownish flakes, filling the canal, adhering to its walls, and covered with minute black spots, as though the membranous flakes of epidermis had been dusted with gunpowder or soot. It gives rise to much the same symptoms as impacted cerumen. Considerable pain and inflammation with discharge are often present in these cases in addition to the symptoms of obstruction of the canal. After removal, the microscope will establish a diagnosis, numerous mycelial elements, with conidia, being visible. This affection is much more rare in England than is usually supposed. The treatment consists in the removal of the fungus, which is much aided by previous maceration with warm solutions of salicylic or boracic acids. The walls of the canal are usually left "raw" and tender. Soaking with warm dilute alcoholic solutions of perchloride of mercury or carbolic acid is strongly to be recommended, and the after-insufflation of boracic acid or salicylic acid mixed with prepared chalk will often give good results, should early recurrence be detected.

In secondary syphilis, moist papules or actual condylomatous growths are sometimes found at the

meatus auditorius. In late syphilis, ulcerations about the auricle and meatus will need to be carefully distinguished from rodent ulcer or epithelioma. The treatment of these affections presents nothing special.

The subject of polypoid growths from the walls of the canal will be deferred to another chapter.

CHAPTER IV.

A BRIEF PRELIMINARY CONSIDERATION OF THE INFLAMMATORY AFFECTIONS OF THE TYMPANUM, TYMPANIC MEMBRANE, AND EUSTACHIAN TUBES.

A RATIONAL clinical classification of the inflammatory affections of the middle ear is not easy to formulate. Although certain types of inflammation readily suggest themselves, yet in practice many cases are met with, which do not exactly conform to preconceived descriptions. An attempt will be made in this chapter to show that the pathological considerations of the changes that occur in middle-ear diseases present nothing peculiar. As it is on a correct appreciation of pathological changes that judicious treatment can alone be founded, we would insist upon the importance of looking at the subject from this point of view, rather than from the standpoint of an extensive classification of varieties and sub-varieties of the inflammatory process, which it is impossible accurately to differentiate clinically. The membrana tympani is anatomically continuous with the lining membrane of the canal, externally, and the lining membrane of the tympanic cavity internally. Accordingly, most inflammatory affections of these parts, especially of the mucous membrane of the tympanum, are apt to spread to the tympanic membrane, and the latter participates in the pathological changes of the former. There can be no doubt that inflammatory affections, even leading to suppuration, may commence primarily in the tympanic membrane

itself. There can be equally no doubt that such cases are exceptional; and, for practical purposes, the inflammatory affections of the tympanic membrane may be considered with like disorders of the lining membrane of the tympanic cavity.

The mucous membrane of the tympanum is very intimately connected with the bones, of which, indeed, it may, for clinical purposes, be considered the periosteum. Accordingly, inflammatory and ulcerative affections of the tympanic membrane may easily be associated with osteitis and caries superficialis. The significance of this fact, when considered in connection with the serious intracranial complications of ear disease, is well known. Besides mucous membrane, the tympanic cavity contains ossicles, ligaments, minute articulations, with synovial membranes, and upon its inner wall are the two secondary membranes covering the fenestra ovalis and fenestra rotunda. There is an extensive supply of nerve-filaments, with widespread connections, and many blood-vessels, one of which has immediate origin from the large trunk of the internal carotid artery. The effects of the inflammatory process upon these structures are not difficult to imagine. Acute inflammatory attacks, provided they are energetically treated, may subside or terminate in acute suppuration. Provided the process is not sufficiently acute to destroy the structures implicated, good restoration of hearing may take place. In the more chronic varieties of inflammation, the usual results are exemplified—infiltration of cellular products with subsequent organisation and fibrosis; and, in individuals advanced in life, of the rheumatic and gouty type, calcification. Thus are found sclerosis of the mucous membrane, adhesions

between the ossicles and mucous membrane, thickening and infiltration of the ligaments, and anchylosis of the ossicular joints, or of the base of the stapes in the fenestra ovalis. The tympanic membrane and the secondary membranes share in these unfavourable processes, being thickened, deformed, thrown into puckers, or folds of diverse shape, and sometimes infiltrated with calcareous deposits. All the above changes have been found and proved by pathological investigation. The greater the amount of cellular infiltration of the mucous membrane in any given case of chronic inflammation of the middle ear, the more marked is the subsequent process of organisation of tissue. To such cases the term of proliferous chronic catarrhal inflammation is often applied. In the most chronic cases of all, the process is very gradual, and, doubtless, every gradation can be traced between chronic insidious inflammation and that process of stiffening and calcification, which is such a common association of advancing age, in the arteries, ligaments of joints, crystalline lens, and other fibrous structures.

Again, so far as exudation into the tympanum is concerned, we have every degree between formation of the most virulent and destructive pus, swarming with organisms, as in scarlatinous otitis, to simple exudation of mucus. In like manner, the consistence of a non-purulent exudation may be thin and watery or thick and offensive, stringy and adhesive. In a word, the varieties of inflammation of the tympanic cavity are those of mucous membrane generally, and the results are to be interpreted by a reflection of the effects of these processes in a small confined cavity containing delicate and diverse structures.

It will be convenient, however, for clinical purposes to consider certain marked types of middle-ear inflammation, for a knowledge of these serves as a useful guide in practice. Thus we may describe :—

(1) Acute and sub-acute suppurative inflammation of the tympanic cavity.

(2) Inflammation associated with the exudation of mucus of varying amount and consistency.

(3) Chronic inflammation associated with varying degree of organisation of inflammatory tissue.

A consideration of the symptoms, consequences, and treatment of these types of inflammation will suffice to give a useful idea of a subject which, complicated in itself, has been made more so by laborious classification and cumbrous nomenclature.

The vast majority of cases of middle-ear inflammation have their origin in like affections of the mucous membrane of the naso-pharyngeal tract, the inflammation spreading by direct continuity of tissue. This will be found to be a matter of great importance in the prevention of tympanic inflammations and in the concomitant treatment of them.

The more important disorders of the Eustachian tubes are associated with tympanic conditions, with which they are associated in diagnosis and treatment. Thus, in catarrhal conditions of the middle ear and throat, the tube is likely to be closed by inflammatory swelling. In chronic inflammatory disorders of the middle ear the Eustachian tube may be narrowed, or even entirely closed. The orifices of the tubes may be obstructed by inflammatory swelling, adenoid growths, or large nasal polypi. Exostosis may occur in the bony Eustachian canal. Foreign bodies may find their entrance into these tubes, as a piece of

broken bougie or an "awn" of grass. The orifices of the tubes may be puckered and obstructed by the cicatrisation of ulcers of syphilis, or in the after-healing processes of extensive operations in the naso-pharynx. In congenital deafness the result of imperfect formation of the internal ear, or in cases of imperforate auditory canal, the Eustachian tube has been found imperfect or wanting. The treatment of the affections of the Eustachian tubes is merged in that of the conditions it is associated with or complicates. In all affections of the middle ear the tube, and especially its orifice, needs consideration and treatment. This will be from time to time alluded to. In cases of old chronic inflammation of the middle ear, when the surgeon has reason to believe that the tube is obstructed by chronic inflammatory processes, the treatment and prognosis are highly unfavourable. In these instances the catheter will not pass, and no air can be made to enter the middle ear. The drum is shrunken and lustreless, and there is a long-continued history of advancing deafness. Much ingenuity has been expended in these cases on the passage of bougies, incising strictures, and the like. Any surgeon who has had to deal with true fibrous strictures of mucous canals easily exposed to his operations and manipulations, and who knows the transitory improvement too often effected by dilatation, will long hesitate before he adopts painful and doubtful treatment upon parts so difficult of access as the Eustachian tubes. It is often exceedingly difficult to pass instruments in these cases, and I have seen emphysema of the pharynx and painful inflammations result from pumping air through stiff and fine instruments apparently passed into the tubes.

A careful exploration of the naso-pharynx in cases of chronic deafness should never be neglected. This may be done by the finger or posterior rhinoscopy. Growths, hypertrophy of the spongy bones, or cicatricial contractions about the orifices may thus be detected, and perhaps remedied.

CHAPTER V.

ACUTE AND SUB-ACUTE INFLAMMATIONS OF THE TYMPANUM.

Acute intra-tympanic inflammation is always attended with intense suffering, and sometimes with great danger. It is usually unilateral. The principal causes predisposing and exciting may thus be considered. Predisposing causes are, a low condition of the general health (as after one of the acute specific fevers), defective hygienic surroundings leading to septic inflammations of the naso-pharynx, the tuberculous diathesis, and previous existence of perforative otorrhœa. The exciting causes are numerous. Most commonly this malady is brought about by the direct extension of severe inflammation from the throat and naso-pharynx. Thus it is common as a sequel or concomitant of bad scarlet fever, measles, and typhoid. I have seen several cases associated with the severe septic sore throat of "drain-poisoning." It may also follow operations upon the naso-pharynx, especially "plugging" for epistaxis, when the tampon is soaked in some strong iron solution, and allowed to become "septic" and "foul," or the removal of growths, or the injections of fluids into the tympanum. Some of the worst cases of acute middle-ear inflammation seen in adults, have been from direct exposure to cold, and from the entrance of sea-water into the tympanum through an old, but quiescent, perforation of the drum. During the epidemic of influenza in 1891 I attended several cases of suppuration of the middle ear, with

destruction of the membrane following this affection. There can be no doubt but that many of the most disastrous cases of acute intra-tympanic inflammation are caused by the invasion of the mucous coat of the tympanum by crowds of micro-organisms of a peculiarly virulent type. A variety of these are described by bacteriologists. The streptococcus pyogenes and the staphylococcus albus are among the organisms commonly found in middle-ear suppuration, and the pneumo-bacillus is also described as sometimes occurring here.

The space at disposal forbids a prolonged description of this subject, which is fully dealt with in works on bacteriology. The practitioner should always have the probable explanation of these acute suppurative inflammations before his mind ; for then he will appreciate the importance of cleanliness of the naso-pharynx in cases likely to be complicated by acute otitis media.

The symptoms in a typically severe case usually set in with vehemence. Agonising pain in the ear and over the side of the head is experienced of a throbbing or "hammering" nature. The patient, even if a strong man, may keep his hands to his head, shrieking out in agony, and the terrible pain may often be associated with mental confusion or delirium. There is high fever and a coated tongue, with a quick, hard pulse. The intolerable agony of these cases can only be appreciated by those who have seen them, and this constitutes the most important symptom of the affection. On examination, the meatus and canal will be observed red, hot, swollen, inflamed, and very tender. In children it is often impossible, on account of the tenderness and swelling, to get a satisfactory view of the

membrane. When this is effected, the latter is seen to be intensely hyperæmic, of a dull-red colour, or yellow and sodden-looking; bulging is said to be usually observed, but the strong fibrous layer of the membrana tympani may resist the pressure from within. Thus perceptible bulging of the drum may not be observed, and yet pus have formed in the tympanum. Deafness, more or less complete, is, of course, present, but this, in the presence of the other symptoms, is little noticed. Sooner or later the membrane yields, in part or in whole, and a copious discharge of yellow pus exudes for many hours, or days, in a continuous stream. The perforation of the drum may vary in size, from a small aperture to entire destruction. In the acute otitis media of scarlet fever, the latter result is, unfortunately, far from uncommon. All the ossicles may at the same time become destroyed and discharged, incurable deafness resulting.

It may here be remarked that all cases of acute inflammation of the ear are not necessarily associated with suppuration. Instances will occur in practice, especially in children, when the symptoms are most acute, local pain and high fever being marked. Such may subside, even spontaneously, without any evidence of suppuration. It has been said in these cases that the matter finds its way down the Eustachian tube, but this is doubtful. I have on several occasions incised the membrane, and found no pus, though, from the severity of the symptoms, I was led to believe that suppuration must have occurred.

The pain in the head, vertigo, delirium, and fever, may lead an unwary practitioner to regard these cases, when occurring in children, as due to meningitis. The first evidence of this erroneous opinion is often

the copious discharge of pus from one ear, and the rapid subsidence of the symptoms. This diagnostic error is especially apt to be committed in very young children, who are unable to describe their sensations accurately. Regarding this point, it may be remarked that meningitis rarely sets in with absolute suddenness, with acute pain, high fever, and delirium. The pulse also does not exhibit the characteristics of meningitis, and "cerebral" vomiting is not marked. The respiration, pupils, and oculo-motor nerves are not affected. Optic neuritis is not usually present. At the same time, it must ever be recollected that acute otitis media may produce meningitis, and then some of the characteristic symptoms of this disorder will become manifest.

Acute suppurative inflammation of the middle ear is insidious in its symptoms in bad cases of scarlet fever or typhoid, and is often merely marked by increase of delirium, with a tendency to coma. An observant physician will usually notice that the semi-unconscious patient exhibits some symptoms of aural discomfort, as clutching at the ear or burying the head in the pillow. In such cases an examination of the ear is of vital importance, and, if pus be evacuated, the delirium and drowsiness may at once disappear.

It is especially important to remark that the initial stage of acute otitis media is really acute catarrhal inflammation, and hence it is at this stage that treatment should be energetically directed towards subduing the inflammatory action, and so obviating a termination in suppuration. In the worst instances of suppurative otitis media occurring in bad cases of scarlet fever, no treatment seems to check the virulence of the inflammation, or much modify the general

havoc wrought by it. On the other hand, many cases are found in practice, of catarrhal inflammation terminating in suppuration, where the symptoms are by no means so definite and acute as above described. Such cases usually commence as "sore throat." There is deafness, with vague pain and discomfort; in a few days a discharge of pus takes place, and the drum is found to be perforated. Such cases are especially common in weakly, strumous, and ill-nourished children. We may here remark upon the exact similarity between the behaviour of the tympanic mucous membrane and other mucous tracts, as the urethra, in inflammation in different persons. An acute case of tympanic suppuration in a healthy man may, if well treated, end in cicatrisation of the membrane and a good recovery. A sub-acute case of insidious suppuration and perforation, occurring in a weakly or tuberculous individual, usually needs great patience and perseverance on the part of the patient and his medical attendant to ameliorate, improve, or finally cure it.

The treatment of acute otitis media should be thus conducted. Supposing the case is seen and recognised early, local abstractions of blood should be at once carried out, and, if needful, repeated. This is done by means of leeches, and the marvellous relief to the pain and inflammation effected by their use can only be fully believed by those who have witnessed it. Timidity in local blood-letting is one of the characteristics of modern practice. Two or three leeches in these cases are useless. Eight to twelve for an adult, two to four for a child, is my ordinary rule of practice. The leeches should be applied in a row, close in front of the tragus, not over the mastoid, unless there should

be pain and tenderness in this locality also. Should there not be room, the leeches may be applied in relays. The bleeding should afterwards be encouraged by warm fomentations. In weakly individuals the judicious practitioner will modify these measures, and will not leave his patient until the hæmorrhage from the leech-bites is checked. The skin about the ear should be well cleansed before the leeches are put on, or glandular inflammation may result.

Heat is usually grateful. The patient lying upon the opposite side, the meatus is constantly filled with warm water mixed with equal parts of laudanum. Another application often most agreeable is a piece of spongiopiline or folded flannel, wrung out of boiling water, sprinkled with laudanum and applied to the region of the ear as hot as can be borne. A bag of heated sand or moist meal is a well-known application. The bowels should be at once freely acted upon by a mercurial and saline purge, and the diet reduced to "slops." I have found great benefit from the early administration of wine of antimony in 20-minim doses every hour in these cases, supposing the patient is strong and plethoric. As in acute inflammations of other important organs, early treatment must be prompt and energetic if any great good is to be effected. Too often the case does not come under notice until later, when the tympanum is full of pus or actual perforation has occurred. The relief afforded by the above treatment is generally very marked, and any recurrence of pain may be at once met by free mercurial purgation and by leeches, which seldom fail to give relief. The question of puncture of the membrane is often an anxious one in this class of cases. It is impossible to lay down any hard-and-fast

rule for its performance. Remembering that it can do no harm, and may do great good, I always adopt it in cases of doubt as an exploratory proceeding. Speaking from practical experience, it is not always possible to be sure whether or no there be pus within the tympanum; for the membrane, as before stated, does not always become convex outwards. When the drum is deep-red in colour, sodden, and definitely bulging, the operation of paracentesis should not be delayed. When the ears are affected in bad cases of scarlet fever, puncture should be performed very early. These cases always terminate in suppuration, and the timely making of an incision may prevent destruction of the entire drum. There is occasionally the greatest difficulty in getting a view of the membrane, especially in children, from the tenderness of the parts and the excessive swelling of the walls of the canal. In such cases, it is infinitely better to persevere with hot fomentations and gentle warm syringing than to make any "wild stabs" in the dark at the membrane. I have seen several unfortunate instances of the latter practice, and must condemn it strongly.

A bright silver speculum and a good light being employed, the drum must be accurately defined, and the operator, with a light and careful hand, passes the paracentesis needle (Fig. 24) through the drum below and behind the handle of the malleus, cutting downwards as he withdraws the instrument. An anæsthetic is always necessary in children and nervous patients. It is especially important that the edge of the perforating instrument should be exceedingly sharp, so that no undue pressure may have to be exerted upon the membrane before penetration is effected. Professor

William Anderson has drawn my attention to the fact that the internal carotid artery is sometimes found on the anterior aspect of the inner tympanic wall, being merely covered by a fine shell of bone. An incautious operator, perforating the anterior part of the drum, might therefore prick this vessel. Pus will usually at once escape, but it sometimes happens that the exudation is too viscid to escape through the incision. A moderate application of Politzer's bag will then suffice to force the exudation outwards. Another plan is to pass a tympanic tube through the incision and, by suction or syringe, to withdraw the exudation. This is seldom needful.

With the escape of pus, the symptoms usually at once improve, the pain and fever rapidly abating and the worn-out patient sinking into sleep. It will now be very essential to keep the parts constantly clean by methodical and repeated syringing with some warm and dilute antiseptic; for ordinary purposes of practice, nothing is better than carbolic acid lotion of the strength of one in forty. After the syringing, the ear may be filled with the same lotion, and the patient, lying upon the opposite side, allows it to soak into the tympanum for ten minutes. Then, turning back again, he gently practises the Valsalvian method of inflation, and the lotion, mixed with discharge and bubbles of air, is expelled from the meatus. At least once a day the ear should be carefully cleansed by the surgeon, with mirror and speculum, the discharge being thoroughly wiped away with pledgets of wool upon a probe or the aural forceps. The condition of the naso-pharynx must receive close attention. The nares may be syringed once or twice daily with a warm, very dilute alkaline and antiseptic lotion, and

Politzer's inflation employed with moderate force. In adults and tolerant children, the pharynx and nares may be "swabbed" out daily with antiseptics, and a chlorine spray used with a curved nozzle which can be passed behind the soft palate is most beneficial. I have also a high opinion, personally, of the value of peroxide of hydrogen solution as an application in these cases if the suppuration be intense and persistent. Cleanliness is the great essential. To carry this out requires much care, gentleness, and perseverance. Hence in many cases, especially among the lower orders, the treatment is neglected or imperfectly performed, and, in consequence, the discharge grows chronic. The perforation, from being a narrow slit-like aperture, becomes converted into a round hole, with callous edges, and the condition of common perforative otorrhœa is established. I have no hesitation in saying that the vast majority of cases of recent perforations of the drum in children would certainly heal if only cleansing of the canal were properly adopted from the commencement of the case, with attention to the naso-pharynx, and gentle inflation by the method of Politzer.

Among rarer terminations of acute suppuration of the middle ear must be mentioned retro-pharyngeal abscess, abscess of the neck and parotid, destruction of the temporo-maxillary joint, purulent phlebitis of the lateral sinus or jugular vein, and general pyæmia, with pleurisy and pneumonia. These serious maladies are only to be feared in severe cases, and generally in those where old disease has before existed; but in children abscess may readily burrow unsuspectedly about the pharynx or palate. The inflammation may also extend to the mastoid cells, causing severe pain

and tenderness over the mastoid, with perhaps some local redness and tenderness. In these circumstances perforation of the mastoid antrum should not be delayed. So far as I have seen, acute cases occurring in healthy people from cold or bathing are usually prompt in healing, supposing, of course, that the whole drum, with the ossicles, has not been destroyed. Cerebral complications, as meningitis, are especially to be feared when acute inflammation comes on in an old diseased ear.

Case 6.

ACUTE INFLAMMATION OF THE RIGHT EAR AFTER DIVING INTO A SWIMMING-BATH. THREATENING CEREBRAL SYMPTOMS. IMPROVEMENT UNDER LEECHES AND MERCURY. SUBSEQUENT CURE.

On August 24th, 1893, I saw, with Dr. O'Connor, of Piccadilly, a young man, aged 21, who was dangerously ill. A week before he had dived frequently in a swimming bath, but there was no history of previous ear disease. He recognised that he had hurt his right ear, and was attacked with the most violent pain, causing sleeplessness and delirium and such agony in the head "as no one could have endured." The day I saw him some thick viscid pus had escaped from the canal, but without relief. I found the patient emaciated, with a dry, brown tongue, and sordes on the teeth. On cleansing the right ear from inspissated discharge, a large reniform perforation could be seen anteriorly. The parts were obscured by swelling, and exquisitely tender. His manner was strange, and at times he was quite incoherent. The pulse was 120, very weak, but not irregular; the respirations were but little above normal; the temperature was 103°. He had not vomited; there was no induration or tenderness in the neck, and the optic discs were natural. In these circumstances, I gave it as an opinion that there was probably intense hyperæmia of the meninges, but that, as yet, there was no actual meningitis or pyæmic infection. As the bowels were confined, five grains of calomel, followed by a copious senna draught, were at once administered, and eight leeches were ordered over the front of the tragus. The mastoid region was

tender on deep pressure, but there were no marked indications of inflammation there.

August 25th.—The pain had at first abated, but returned in the night as bad as ever. Morphia had to be employed. The face was a little dusky, but there was no pneumonia. The bowels had only imperfectly moved. The other conditions remained much the same. He had no rigors, and the discs were still normal. A copious enema was ordered, with a scruple of the compound jalap powder, and six more leeches over the tragus. The canal was well syringed with warm carbolic lotion. The vessels of the tympanum were enlarged and pulsating violently, communicating their movement to the bubbles of fluid over them.

In the afternoon he was much better, and had some sleep after the bowels acted, and on the night of the 26th he was much relieved, though some of his old pain returned on the 28th and 29th. From this date he began steadily to improve, but was long deaf and very "dizzy and dazed." The ear was kept scrupulously clean, and was daily soaked with a 10-vol. solution of peroxide of hydrogen, while the naso-pharynx was well swabbed with astringents.

By September 15th the drum had healed, and he heard conversation well, but the tick of a watch only at 3 inches. He has since completely recovered hearing power.

Comment.—This is a fair type of a case not uncommonly met with in practice. It is difficult in the present day to avoid using the trephine in cases with such threatening symptoms. The mastoid should always be opened if there is the least sign of mischief spreading in that locality. The condition of the optic discs, the absence of rigors, vomiting, and oculo-motor symptoms, all made one incline to the belief that no meningitis or pyæmia had set in. The marked efficacy of very free purgation in this case was at once notable.

Sub-acute inflammation in delicate persons furnishes the majority of cases of chronic perforative otorrhœa; the symptoms are insidious, and the discharge from the ear often occurs unsuspectedly and quietly. There is no doubt that a considerable proportion of quiet suppurations of the middle ear

are tuberculous. Such cases are met with in persons of marked phthisical diathesis, and the characteristic bacillus has been found in the discharge on examination. It is very exceptional, however, for cases of sub-acute middle-ear inflammation to be brought for treatment until the deafness of the patient, or the fœtor and nuisance of the subsequent discharge, cause discomfort and alarm.

The preventive treatment of acute and sub-acute otitis media is of vast importance. By this is meant careful attention to the condition of the naso-pharynx in cases likely to be complicated by extension of the inflammation to the ear. A large amount of unhealthy inspissated mucus not uncommonly hangs about the back of the nose in cases of fever. In adults or tolerant children the nose should be gently syringed through night and morning with alkaline and antiseptic washes, and the back of the throat and nares brushed with weak astringents and antiseptics. In syringing the nose, the nozzle of the instrument should never fit tightly so as to force fluids towards the Eustachian tubes. A full-sized glass syringe, carrying a piece of soft tubing about two inches long, and small enough to lie easily along the floor of the nose, will answer the purpose well, and has the advantage of being obtained in any remote country village. The mechanical removal of inspissated and unhealthy discharges is, in my estimation, most important. In young children suffering from "scarlatinal throat" much difficulty is often experienced in carrying out these measures. They will, however, bear gentle syringing of the nose, and a hand-spray with a long curved nozzle is most useful in conveying antiseptic remedies to the back of the naso-pharynx. Boracic

acid, chlorate of potash, chlorine, benzoin, and iodine may all be used in this way.

In the worst instances of swollen and ulcerated throat after measles or scarlet fever, the ears are exceedingly likely to be permanently damaged despite all efforts to the contrary. When there is nasal obstruction to start with, especially from the growth of adenoids, the case becomes much more serious and more difficult to deal with.

In speaking hereafter of the complications of otorrhœa, it will be pointed out that occasionally acute inflammation may be superadded to the chronic local condition of perforation and discharge. This undesirable result may be brought about by cold or injudicious treatment, as syringing cold water into the ear or applying caustics. Such cases are peculiarly dangerous, and the more serious terminations of acute otitis media are generally found in instances where inflammation is engrafted upon a previously diseased ear, by injudicious behaviour of the patient.

Attacks of a milder form of intra-tympanic inflammation, with or without exudation of mucus, are among the very common affections of the middle ear. In the large majority of cases the affection has its origin in a catarrhal affection of the tonsils, throat, or naso-pharynx. The "stuffiness" of the ear or actual deafness which accompanies a severe "cold in the head" is familiar to most of us. Many of such affections are transient and slight, and get well spontaneously. No case is, however, too trivial for careful treatment for this malady is apt to lay the foundation of more chronic inflammatory changes, which may permanently damage the hearing. A previously existing unhealthy condition of the throat, tonsils,

and naso-pharynx is undoubtedly a strong predisposing cause of this affection. Accordingly, we find many cases in delicate individuals who are constantly suffering from "sore throat," "colds in the head," and the like. Such patients will usually be found to present enlarged tonsils, swollen mucous membranes, and naso-pharyngeal obstruction from adenoid growths or polypi. The mucous membrane over the turbinals is, in such individuals, often swollen and hypertrophied. The back of the pharynx is usually "granular" from enlargement of the lymphoid follicles in that situation.

The symptoms of this affection in a typical case will be as follows. During an attack of catarrh from exposure to cold, a patient will become deaf on one or both sides, with an annoying sensation of "dulness" or "stuffiness" in the ear. Some tinnitus is commonly experienced, and a sensation of a rattling or bubbling movement in the ear of the affected side. Not uncommonly changes in the position of the head will temporarily improve the hearing. Sometimes anomalies of audition are complained of, as the hearing of double notes or of high notes only. The patient's own voice sounds painfully loud, cavernous or shrill, while the voices of other people are muffled and inaudible. Not infrequently the symptoms are so disagreeable that the sufferer becomes peculiarly taciturn and morose, and, if he be a business man or highly-educated, his alarm at his condition will be marked. On examination, the tympanic membrane will be seen to present very varied appearances. Should there be much exudation, portions of it may bulge on either side of the handle of the malleus, which may be almost entirely concealed. At other

times the fluid may appear through the drum, making its lower portions to seem of a yellowish or greenish tint, like hypopion in the anterior chamber of the eye. If, however, the membrane should be thick or opaque, these changes are much obscured. By auscultation with the diagnostic tube, especially when inflation is employed, distinct bubbling sounds can be heard which are characteristic. If one ear only is affected, the tuning-fork placed on the vertex is heard very plainly and long on the affected side, and the tick of a watch is generally only recognised on contact. Loud "cracking" sounds, audible to the patient and surgeon, are very diagnostic of the bursting of air-bubbles in thick, viscid mucus. It is not in every case that a considerable quantity of fluid is poured out. The exudation differs very widely, as to quantity and nature; in one case being thick and gummy, in another serous and watery. Mild attacks of inflammation of the middle ear in children are only marked by transient deafness, which may readily leave behind some slight permanent mischief. The attacks, recurring, cause in time serious loss of hearing. It is difficult, if not impossible, to impress upon parents the importance of immediate attention to slight deafness in children. Too often this is entirely neglected, and when the child goes to school he is unjustly condemned for stupidity or inattention, and ultimately chronic deafness is established.

In the treatment of exudation of mucus, the question of removal of the fluid by paracentesis must first arise. Here the widest diversity of opinion is expressed among aural surgeons. The quantity of the exudation is my own principal guide, and the discomfort caused by its presence; and also the

resistance of the case to milder measures. When the membrane appears to bulge, there can be no doubt but that an incision made with the usual precautions in the posterior quadrant is the best practice. The fluid will at once escape, or, if viscid, may be expelled by the air-douche. A most gratifying improvement in the hearing is instantly experienced by the patient. When the exudation is very viscid, it is recommended to wash it outwards by injecting the tympanum through the Eustachian catheter; or the tympanum can be cleansed through the perforation with an intra-tympanic syringe.

Case 7.

EUSTACHIAN OBSTRUCTION FROM PHARYNGEAL INFLAMMATION. ACCUMULATION OF FLUID IN TYMPANUM. RAPID CURE UNDER TREATMENT.

A gentleman, aged about fifty, strong and florid, not gouty or alcoholic, a patient of Mr. White, of Surbiton, was seen by me on December 22nd, 1892. He stated that his left ear had become occasionally deaf, and that his symptoms had been previously relieved by the removal of cerumen. Three months ago he became quite deaf suddenly, with severe buzzing tinnitus. The watch could be heard only on contact, and conversation on shouting. Hearing of the right ear was good. A large tuning-fork, applied to the vertex, was heard entirely on the left side. The membrana tympani was somewhat congested. Politzer's bag had no effect in inflating. A small soft Eustachian catheter was passed with some difficulty. Afterwards Politzer's bag succeeded, and, on listening through the diagnostic tube, bubbling sounds were heard in the tympanum. Inflation was ordered daily, and the throat and naso-pharynx were to be swabbed with a solution of nitrate of silver, three grains to the ounce. Chloride of ammonium vapour to be inhaled thrice daily; iodide of sodium and small doses of mercury to be taken internally. Under the faithful observance of this treatment, the hearing rapidly improved, and in eight days became practically normal.

A perusal of this abstract will indicate the line of treatment to be generally adopted, one which will usually prove efficacious. This is (1) The methodical inflation by the method of Politzer; (2) the application of astringents to the naso-pharynx and mouths of the tubes; (3) the application of vapours, especially that of chloride of ammonium, to the naso-pharynx.

The condition of the throat and nares invariably calls for attention in these cases, which are often well termed "throat deafness." The nose should be gently syringed through daily with very dilute alkaline and astringent solutions, while the throat must be treated with astringents. Enlarged tonsils, and especially nasal adenoids, must be removed so soon as the acute symptoms of ear-mischief have subsided. A careful examination of the nose must be made as a matter of routine, for polypi or hypertrophy and swelling of the mucous membrane over the turbinated bones. The surgeon will seldom meet with a case of aural catarrh with a perfectly healthy throat and nose. In most instances of mucous catarrh, vaporisation of the tympanic cavity is generally strikingly beneficial. The vapour of chloride of ammonium inhaled from the ordinary apparatus sold by chemists is frequently prescribed with benefit.* The vapour of iodine and of oil of pine-wood mingled with chloroform are often advantageous. The patient fills the throat and naso-pharynx with vapour, and then, by gently using the Politzer bag, inflation and application of the vapour to the opened tubes is simultaneously executed. This

* The ingenious inhaler of Messrs. Godfrey and Cooke is the one I usually advise, and a description of the methods of using the apparatus is sold with it.

may be done thrice daily. In children the Politzer's bag may be filled with vapour before inflation. This method is exceedingly useful. Thus chloroform vapour, mixed with iodine or the vapour of the essential oils, may be passed into the tympanum.*

The Eustachian tubes in many of these cases may be presumed to be in the same condition as the neighbouring pharynx and tympanum. The mucous membrane, swollen and covered with sticky exudation, completely closes them. Accordingly the regular performance of politzerisation is important. Frequently, on the first performance of inflation, the patient experiences the sensation of a loud "bang" or explosion, and his hearing is temporarily restored. In a few hours, however, it becomes again obscured. The Eustachian catheter may be needful in obstinate cases. It is advisable to attend carefully to the condition of the general health. In anæmic individuals iron, cod-liver oil, and general tonics are indicated. I also am in the habit of prescribing in these cases moderate doses of mercury and iodide of potassium, and have reason to believe that absorption is hastened thereby.

Lastly, we have to consider the question of climate in recurrent cases of this affection. Individuals are not seldom met with, especially in our large cities, who are peculiarly liable to naso-pharyngeal catarrh from exposure to cold, dust, or, indeed, from no obvious cause. In such cases, if the lining membrane of the Eustachian tubes and tympanic cavity are also constantly affected, serious damage to the hearing will

* Inflating bags are now conveniently made by Messrs. Hawksley with a chamber which unscrews, and the preparations prescribed are dropped upon wool in the chamber and there volatilise.

in time certainly ensue. There can be no doubt that residence in pure, dry air will do more for the prevention of catarrhal inflammation than any amount of treatment; and, when the circumstances of the patient permit of it, this should always receive due consideration. Residence in the damp and fog of an English winter in one of the large cities, is to court recurrence of catarrhal affections and incurable deafness.

A severe attack of mucous catarrh, even if well treated, may leave behind it some slight impairment of hearing. Cases that are ignored or neglected certainly lay the foundation for organisation of inflammatory products and subsequent incurable deafness. It is especially the slighter and recurrent attacks that are important from this point of view. In cases where the exudation approximates to the sero-purulent type, perforation of the drum may occur spontaneously, and the condition of perforative otorrhœa may in consequence be established. As an instance of the curious symptoms sometimes found in the young, in connection with confined discharge within the tympanic cavity, the following case, related by Dr. Day may be quoted.

Case 8.

PERSISTENT HIGH TEMPERATURE IN A BOY DEPENDENT UPON SUPPURATION WITHIN THE TYMPANUM. BY W. H. DAY, M.D., "LANCET," DECEMBER 10TH, 1887.

A boy, aged nine, was said to have fallen and struck his head three weeks ago. From that time he has been drowsy, with headache and giddiness; he has been "sick and ill" from time to time. There is also a vague history of a blow in the abdomen from another boy. The boy is drowsy, and lies curled up and disposed to hide his head beneath the clothes. He complained of pain over the left hip, leading to a suspicion of

incipient hip mischief. He would answer questions intelligently on being roused. The abdomen was natural and the tongue clean, but the bowels were very costive. There was no marked complaint of any kind, excepting head-ache and drowsiness. The remarkable feature of this case was, however, the persistently high temperature. From March 23rd, the date of admission, to April 1st the temperature varied in an extraordinary manner, not falling below 100°, and frequently rising to 103° and 104°. Cold sponging was resorted to, with doses of antipyrin. No possible explanation of this temperature could be advanced. The boy had wasted considerably, and on 31st March complained of severe pain about the sacrum and hip. He seemed terror-stricken at the idea of local examination. On April 1st I saw him in consultation with Dr. Day, and made a careful examination of the hip and spine, but failed to detect any symptoms of disease. His symptoms, indeed, were those of neuro-mimesis, and with a little encouragement he was persuaded to get up and run about the ward. The possibility of ear-mischief never then entered our minds. On the 4th and 5th there was a sudden and copious discharge of mucus, mixed with pus, from the right ear, and on examination deafness was noted, with a posterior perforation of small size. The temperature still vacillated, but at the beginning of May became normal. On an average he slept seventeen hours out of the twenty-four. By May 10th the temperature had become normal, and he gained flesh and strength, and his drowsy condition disappeared. He was seven months afterwards reported to be in good health. In his remarks Dr. Day discusses the possible explanations of this case, and concludes as follows:—"A blow on the head, some suppuration about the tympanic cavity, possibly old mischief lighted up into fresh activity, and a curious train of febrile and head symptoms supervened. In an older person, or a lad of more stolid temperament, the symptoms would probably have been less complicated. The progressive improvement which followed the discharge from the ear in this case goes far to prove that the pyrexia was due to muco-pus within the tympanum irritating an abnormally sensitive nerve-system, and hence inducing curious pyrexia. This case affords a remarkable instance of the anomalous symptoms which may be observed."

No apology is needed for the length of this abstract. The subject is one which engages the attention of every practitioner, and is of the highest interest and general importance, on account of the great benefit that can be bestowed upon this class of cases by prompt and judicious treatment.

CHAPTER VI.

CHRONIC INFLAMMATION OF THE TYMPANUM.

CHRONIC inflammation of the mucous membrane of the middle ear, of the secondary membranes and joints of the ossicular chain, is responsible for many cases of incurable deafness. The classification of varieties of chronic aural catarrh, as it is termed, is very varied, and perhaps serves little useful purpose. A considerable number of these cases owe their origin to frequent attacks of naso-pharyngeal catarrh in early life. Repeated slight manifestations of deafness finally result in progressive loss of hearing. This form of deafness is, therefore, found in those who have suffered from enlarged tonsils, adenoid growths, nasal obstruction from polypi or bad deviation of the septum and hypertrophic rhinitis. Such individuals are prone to suffer from constant attacks of catarrh. The nose and head feel "stuffy;" the ears have a sensation as though something "stopped them up;" pain is usually absent, and there is no suppuration; the back of the pharynx is congested and granular, and covered with stringy mucus. Exposure to causes likely to produce catarrh, aggravates and emphasises the symptoms; and we find them exemplified in their more typical forms among the delicate inhabitants of large cities, who are exposed to fog, draughts, and dust. Many sufferers from what is loosely termed "hay-fever" become deaf, and well-marked instances of chronic aural catarrh will be seen in fishermen, sailors, and

the inhabitants of the fen counties.* Examples of chronic middle-ear inflammation were in former times generally thought to be due to nerve-deafness. The use of the tuning-fork usually at once shows that the mischief is in the middle ear; for its sound is heard long and loud through the mastoid, faintly (if at all) at the meatus. The canals are dry, and the most diverse appearances are presented by the membrane. Of these, the more striking and more constant are absence of lustre, the membrane being opaque and dull-white, with loss of the light-spot (Plate II. Fig. II). The drum is drawn inwards, often showing manifest concavity outwards. The handle of the malleus and its short process are very distinct, standing out white and prominent. If inflation be practised, after the method of Politzer, some parts of the drum may bulge outwards, like little cysts or bladders. In many cases, however, but little alteration occurs. Tinnitus of varying intensity is commonly complained of, and constitutes the chief misery of bad cases of chronic aural catarrh. One sufferer likens his tinnitus to the rushing of water; another to the boiling of a kettle; a third to the roar of machinery. Most diverse sounds are complained of, and cause the unhappy victims such mental discomfort that they become morose, melancholic, and even suicidal. In all these cases one factor strongly predominates,—the surgeon is able to make out clearly the catarrhal origin of the affection. For purposes of treatment this is immensely important; for, if the disease has not gone on too far, removal of the cause and judicious treatment is often beneficial. Some of the worst cases of this affection

* The frequency of cases of chronic deafness of varied degree, among the out-patients at the Cambridge Hospital, is very striking.

will be found in congenital syphilis, especially about the time that keratitis appears in the eyes—the catarrh and the swelling of the naso-pharynx and the unhealthy condition of the nose causing constant attacks of tympanic inflammation, with intractable deafness. In the majority of cases of the deafness of congenital syphilis, nerve-lesion is also superadded, so that they are hopeless as regards remedial treatment. In secondary acquired syphilis, aural catarrh is frequently present, when the throat and naso-pharynx are affected, and this is very important as regards treatment. Syphilis, it must be recollected, is an important cause of naso-pharyngeal catarrh in young adults, and treatment directed accordingly will influence associated deafness in a remarkable manner.

It is generally held that most cases of chronic aural catarrh originate in inflammatory affections of the naso-pharynx. The more strongly the evidences of catarrh and naso-pharyngeal obstructions are marked, the more certainly will the tympanic mischief depend upon and be caused by such conditions.

The second group of cases, which stand out in broad distinction to the last, are, in my experience, somewhat more rare. In these deafness comes on slowly and insidiously, and advances despite all treatment. Careful inquiry fails to elicit a history of attacks of catarrh or of nasal trouble. The sufferer will hardly be able to date the onset of his symptoms. Many of these cases show hereditary tendency to chronic deafness, several members of a family being affected. Exposure to cold, especially injudicious immersion of the head in bathing, gout and rheumatism, and bad hygienic surroundings, have all been advanced as predisposing causes of this affection. Personally,

I have been struck with the frequency of it among comparatively young women, and the symptoms in them are always aggravated when they are worried, or exhausted by pregnancies and suckling. I have seen many cases of this very intractable form of deafness in the subjects of chronic uterine disease. Such women are markedly anæmic, often intensely low-spirited, and, in addition to their deafness, they are haunted by tinnitus, and wear a fixed look of misery and hebetude.

The symptoms of this form of chronic aural catarrh are tolerably definite:—Insidiously-advancing deafness; tinnitus of a hissing or roaring nature—the fork is heard better through the bones than through the air; the auditory canal is dry and devoid of cerumen; the membranes are lustreless, and concave; the "light-spot" is either absent or has shifted its shape and position; frequently air can be made to enter the tympanic cavity, and the membrane may even move outwards, but with little or no relief to the symptoms. Pathologically, sclerosis of the mucous membranes and other incurable lesions have been demonstrated in this disease. So marked is the formation of connective tissue, that the term proliferous catarrh has often been applied to these cases; and one cannot but think that the process must have originated in some forgotten attack of intra-tympanic exudation. It is most important, when such symptoms are exhibited, to examine the condition of the auditory nerve by the tuning-fork, for in many cases, especially in anæmic women, nerve-dulness or loss of nerve-power is undoubtedly also present, which adds to the unfavourable prognosis.

The mucous membrane of the tympanum is thickened and hyperplastic. Bands of connective

tissue tie together the ossicles, and the minute joints are anchylosed. Peculiarly often is the stapes anchylosed into the fenestra ovalis, or tied to the wall of the tympanum by fine bands of tissue. Stiffening and calcification are marked, especially in the aged, the sufferer from chronic gout or rheumatism. Indeed, clinically, it is difficult to differentiate some cases of chronic aural catarrh from the slowly-growing deafness of old age, where impaired nerve-power and fibrosis of many parts, besides the middle ear, advance hand in hand. So far as I have seen, the phenomenon of hearing better in a noise is often exemplified in these cases; and confusion of sounds, as in the conversation at a dinner-table, is often an early and distressing symptom. Sudden and great loss of hearing in chronic aural catarrh generally means impairment of nerve-power, and in such cases the fork will no longer be heard distinctly through the cranial bones. So far as I know, no certain account has yet been advanced of the phenomenon of hearing better in a noise (paracusis Willisii), but the confusion of sounds in conversation admits of a rational explanation. The ossicular chain being altered or disarranged, vibrations are imperfectly conducted through it, and some probably reach the perceptive apparatus, through the bones or air of the tympanum, irregularly and at various times.

In dealing with the treatment of cases of chronic aural catarrh, it is well to consider the latter variety first. I here give the result of my own experience, which, as it is contrary to the statements of many, is advanced with all diffidence. I believe chronic aural inflammation not associated with naso-pharyngeal catarrh to be absolutely incurable; and I know of

nothing that tends to stay its progress, unless it be attending to the condition of the general health and hygienic surroundings. In anæmic women exhausted by suckling, improvement may follow the weaning of the child and the administration of iron and strychnia. Amelioration of the symptoms will also occur from residence in dry pure mountain air. Whatever tends to improve the general health of the individual, directly or indirectly, will tend to stay the progress of this malady. Hence the aid of the physician is often invoked. Residence in dry, bracing air and the avoidance of cold and damp are all-important. Women should be cautioned against washing their hair, and against exposing themselves to draughts or cold after being heated at parties or dances. Should there be any tendency to naso-pharyngeal catarrh, this must receive due attention; but then the case resolves itself into the treatment of that variety of chronic aural catarrh associated with, and caused by, naso-pharyngeal mischiefs, which we will next shortly deal with.

Cases of chronic tympanic inflammation dependent upon unhealthy conditions of the throat and nose are much more favourable in their prognosis and treatment than chronic proliferous catarrh. At the same time, much will depend upon the time when the case comes under observation. When the deafness and attacks of inflammation have gone on for years, and disease of the nose or pharynx has been allowed to remain indefinitely, the prognosis is extremely bad. Should the Eustachian tubes in addition be thickened or impervious, such cases are so hopeless that it is questionable whether they are capable of real improvement, and I never do more in them than advise

palliative measures. Prevention is better than cure. When we reflect that these cases have their foundation in slight attacks of deafness due to such causes as enlarged tonsils, adenoid growths, nasal stenosis, or catarrh of the naso-pharynx, that could easily be removed in the young by appropriate treatment, operative or otherwise, the responsibility of the parents or practitioners is great who allow such cases to become chronic, and to drift into hopelessness.

The indications of treatment for chronic aural catarrh that has not existed for many years, and where deafness is not extreme, may be summarised as follows :—

(1) Attend carefully to the condition of the nose and naso-pharynx. Enlarged tonsils must be removed, and so must adenoid vegetations. An extremely deviated septum, or enlarged spongy bones and polypi, will need detection and treatment. A granular pharynx may need the light application of the galvano-cautery. Astringents and antiseptics, as nose-washes, gargles, and topical applications, are very useful. In this way zinc, nitrate of silver, iron, copper, tannin, iodine, and alum, may all be used in varying strengths. The actual application is of far less importance than the thoroughness with which it is applied. The naso-pharynx needs most attention. Here large stringy masses of mucus are apt to accumulate, acting most injuriously upon the tubal orifices. These are best dislodged by a naso-pharyngeal syringe, or a curved brush carried well upwards and forwards behind the palate.

(2) The inflation at regular intervals of the tympanic cavity and intra-tympanic medication. So far as I have seen, the method of Politzer is the best

for inflation, and it should not be carried out too often or too violently. When injudiciously employed, it may do absolute harm by causing the drum to become relaxed and flaccid. Politzerisation twice or thrice weekly for many months is more beneficial than daily application. The nozzle of the Politzer's bag should unscrew in the middle, and the vapours of chloroform, iodine, or oil of pine-wood, may be introduced into the middle ear by placing a few drops of these agents on the wool in the chamber of the bag. The method of Valsalva is usually much condemned because patients use it too often and too violently, causing constant congestion; but, when they are properly taught and cautioned, it is a valuable adjunct. In the worst cases of chronic catarrh the tubes are impervious to air by Politzer's process, and then the Eustachian catheter must be employed, a small inflating bag being attached by a tube to its extremity. It is in these cases that real difficulties are met with. When the introduction of air with the catheter is very difficult or impossible, I have never seen any good from persevering in treatment. Cases of chronic aural catarrh that are only to be inflated by the catheter are generally very unsatisfactory, and patients will seldom submit to the prolonged discomforts of a treatment which can only, at best, produce a temporary alleviation of their symptoms.

Opinions vary considerably among aural surgeons as to the value of intra-tympanic medication. Some strongly condemn this treatment, others laud it. The truth is probably midway between extremes. In many cases it is powerless for good or evil; in a few benefit seems to accrue; in a minority distinctly evil

consequences ensue. Personally, I have never introduced strong solutions of chemicals, such as nitrate of silver, into the tympanic cavity. I am aware that some surgeons claim brilliant results for this treatment, but it is hazardous ; and the possibility of making the patient worse, must always be present to the mind of a judicious practitioner. Warm and very dilute solutions of iodide of potassium, carbonate of soda, and silver nitrate, may be employed in obstinate cases. The method of injection is as follows : The catheter being introduced is filled by a syringe with the fluid to be injected. A small inflating bag is attached, and injection gently carried out. The patient is usually conscious of a sensation of fulness and "stuffiness" of the ear, and the hearing is often temporarily made worse. Vapours are more readily introduced by the simple expedient of filling the Politzer's bag with them before inflating. The empty bag is compressed and expanded over steam, and then over the vapours of chloroform, ether, iodine, or the essential oils of pine-wood, eucalyptus, and the like ; or the expedient of placing these substances on wool in a chamber of the nozzle can be tried. Probably only a small percentage of the drug reaches the tympanum, but I have traced distinct improvement to the employment of vapours in this manner, and there can be little risk of creating active mischief. Vapours may be introduced through the catheter, either by filling the inflating bag with them or by connecting the catheter by means of a long tube, with a receptacle generating the vapour, to which an inflating apparatus is likewise applied. For instance, a glass jar, capable of containing about ten ounces of fluid, may be partly filled with tincture of iodine, to which a couple of drachms of gum may be added.

Through the cork of the jar pass two tubes—one connected with an injection apparatus, the other with an Eustachian catheter. The vapour of iodine and gum is thus readily passed towards the tympanic cavity. But the most useful appliance I have ever employed is that designed by St. John Roosa, and figured by him on p. 75 of his well-known treatise. This simple and ingenious apparatus is nothing more than a bulb placed in the tube of Politzer's apparatus. Into this bulb is introduced a sponge containing a small quantity of the agent to be vaporised and injected, and, on the action of the bag, the vapours are readily introduced into the tympanic cavity. The patient and surgeon will do well to recollect the long period of time over which treatment, to be useful, must be extended in these cases. Before leaving the subject of vaporisation of the middle ear, it is needful to draw attention to the misuse that has been made of the vapour of chloride of ammonium in these affections. This remedy, invaluable in cases of moist and recent catarrh, is worse than useless in the class of cases we are discussing. It is frequently prescribed, however, either by ignorance or design, and indeed is looked upon by many as a kind of panacea for all cases of middle-ear deafness. I have experienced the abuse of this remedy so often that I think it only right to enter a protest against its employment in these circumstances.

(3) Careful attention to the general health and hygienic surroundings.

Any obvious defect of health will need treatment. Tonics are useful. Quinine should never be given. Iodide of potassium administered occasionally may be beneficial. Residence in pure dry air, as the

Switzerland mountains or the Cape, is nearly always useful in cases of advancing chronic catarrh. I have a high opinion of climatic treatment in these cases, and believe that it often affords a better chance of arrest or amelioration of the symptoms than any local measure. Exposure to cold and wet, especially washing the head and bathing and diving, are exceedingly prejudicial. The patient should be warmly clad, and should avoid all chances of "catching cold" as much as possible. In practice, it will soon be found how difficult it is to carry out these indications, and the necessary continuance of the patient in climates and occupations that have caused or aggravated his malady will often defy and negative the best efforts of the surgeon for his relief. It is advised by many to employ rarefaction of air in the external auditory canal by means of a syringe attached to a rubber speculum. This may be used with judicious force, as an adjunct to Politzer's method. Siegle's speculum (Fig. 23) may also be used, and during the alternate rarefactions of the air in the canal by the mouth of the operator, applied to the tube, movements of the drum may be studied. Many of these patients feel relieved when the meatus and canal are firmly plugged with wool. I often advise this simple remedy.

(4) Electricity. As regards this treatment, I have at present little to say. I have certainly known improvement to the distressing tinnitus found in these cases, from the use of the galvanic current; and when tinnitus is very violent I often advise it. I cannot see, however, how chronic inflammatory products can be altered by feeble currents of electricity, and, as regards the hearing power, I have never known material improvement excited either by galvanism or

faradism employed by highly-skilled medical electricians. The mystery and attraction that now pervade the mind of the public in regard to matters electrical, open up a fertile field for the charlatan in all incurable affections, especially of the nervous

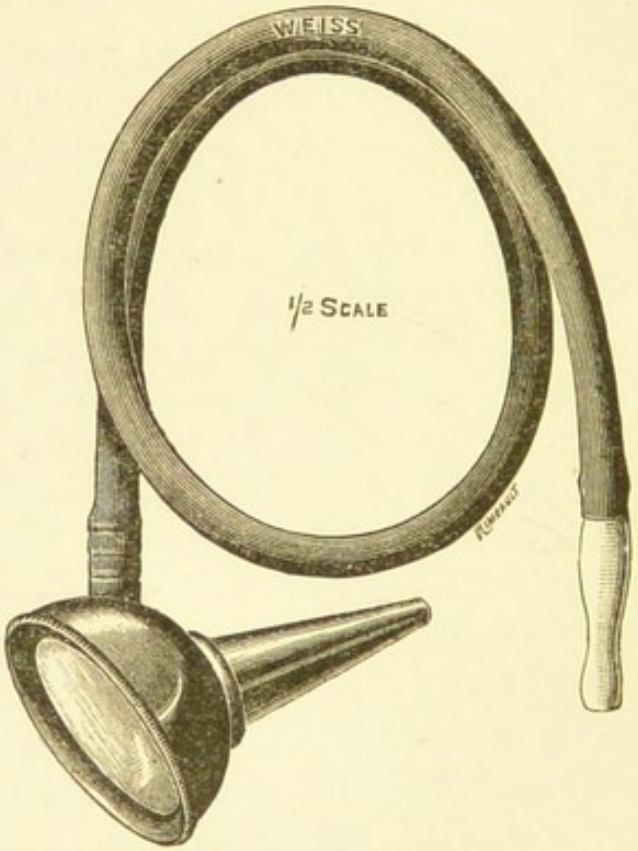

Fig. 23.—Siegle's Speculum.

system or the special senses, and honourable practitioners will do well to raise their protest against it.*

(5) Operations upon the membrana tympani and ossicles. Most surgeons practising aural surgery in England have had little experience of these

* For an excellent account of the reactions of the healthy auditory nerve to galvanism, and of the application of this remedy in deafness and tinnitus, the reader is referred to the well-known treatise on Medical Electricity by Stevenson and Lewis Jones.

methods of treatment. They have been largely performed and brought forward by some American surgeons, who claim for them brilliant results. The principal operations that have been advocated and performed are as follows:—The making of an opening through the tympanic membrane; the excision of the drum in whole or in part; the removal of the malleus and incus; disarticulation of the stapes; division of the tensor tympani muscle, or of intra-tympanic adhesions; perforations of the mastoid.

The making of an opening through the drum usually improves the hearing in a remarkable manner in cases of chronic catarrh and Eustachian obstruction. Tinnitus, if due to inward pressure of the stapes, is also relieved. Unfortunately, the opening persistently closes, and the symptoms recur. The best method I am acquainted with of making a permanent opening in the drum is by means of the galvano-cautery. Under anæsthesia and good illumination, a pointed cautery is placed against the posterior quadrant of the drum and contact made. A considerable opening is then effected. I have performed this operation in two cases. In one, great benefit was given to the tinnitus; the hearing was hardly, if at all, improved. In the other, the tinnitus was rendered distinctly worse, and severe pain was experienced, with some subsequent suppuration. A good and safe preliminary, in cases where the surgeon is doubtful as to whether an opening in the drum will or will not improve the hearing, is to perforate with an ordinary paracentesis needle. The opening soon closes, but remains open long enough to enable the surgeon to estimate its value. In both the cases above mentioned, the openings remained patent, like

those of a chronic perforative otorrhœa, for certainly some months. Excision of the membrane and removal of the malleus may be performed under illumination and anæsthesia. Any surgeon who

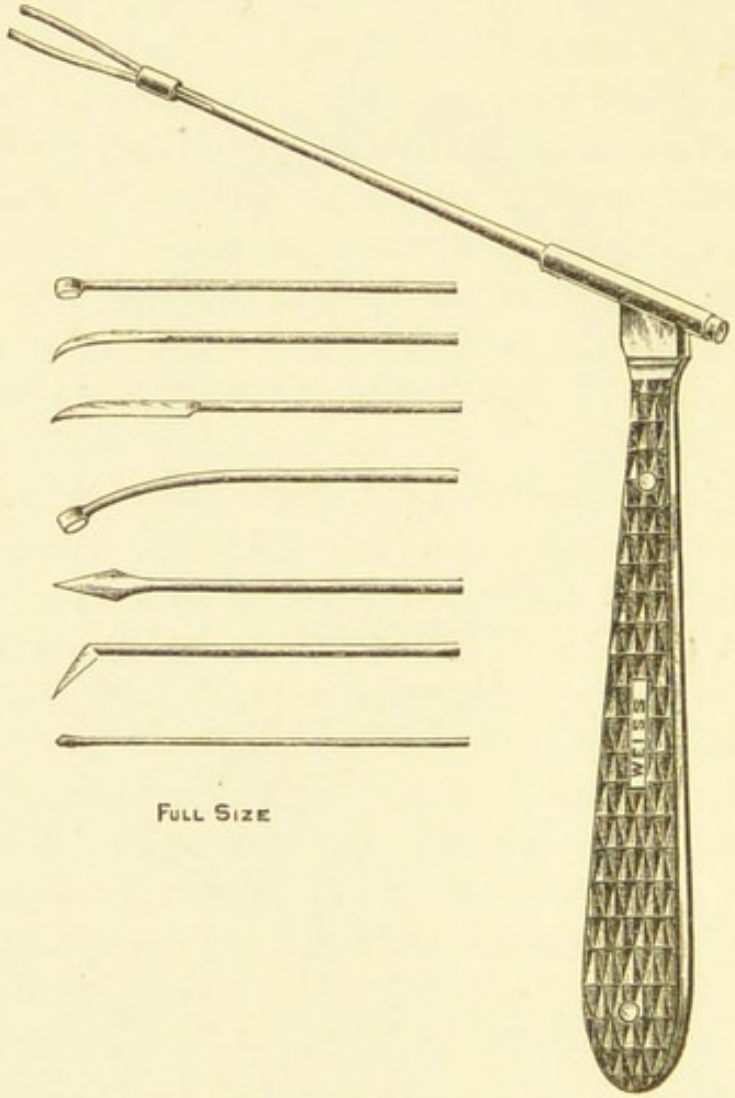

Fig. 24.—Minute Curettes, Knives, Probe, Paracentesis Needle, and Caustic-holder, fitting into one handle.

proposes performing such an operation had better study Dr. Sexton's description, and employ the instruments devised by him. Messrs. Weiss have made an excellent set of instruments for me for operations on the drum and tympanum, all fitting

into one handle. The minute knives are especially useful to divide a definite band, or fold in the membrane (Fig. 24). As regards such operations as division of intra-tympanic adhesions, or of the tensor tympani muscle, many surgeons of sound education will confess their inability to perform them to their own satisfaction, or clearly to understand their benefit. The greatest diversity of opinion is expressed regarding the advisability of performing intra-tympanic operations; they are in some quarters opposed most strenuously. It behoves us to consider the question with an open mind, for it is quite possible that increased experience in diagnosis may enable us to lay down more definite rules for their performance. At present one cannot but be struck with the experimental nature of them, and, were a fatality to occur, any right-minded man would blame himself. On the other hand, it must be allowed that few conditions are more distressing than total deafness and intolerable tinnitus. The conditions, in my judgment, which may necessitate the establishment of a large opening in the drum are, (1) Bilateral extreme deafness; (2) tinnitus, probably due to a retracted membrane pressing the stapes inwards; (3) the absence of nerve-deafness. Finally, the patient should be told of the dubious result, and the sole responsibility for the undertaking of the operation should rest on his shoulders. In the after-treatment of any operation upon the tympanic membrane no syringing of the ear is advisable. Some finely-powdered boric acid and zinc oxide may be blown upon the part, and the meatus firmly closed by cotton-wool, and "left alone" for three or four days. The total or partial removal of the drum exposes the tympanum to cold and dust, and must render

suppuration, with its attendant evils, liable to occur. The opening into the mastoid for the equalisation of pressure, in cases of chronic inflammatory mischief in the middle ear when the Eustachian tube is impermeable, was at one time rather freely adopted. A surgeon of eminence submitted to this proceeding and lost his life, after which it fell into disuse! Generally speaking, of all operations upon the drum and ossicles in cases of chronic aural catarrh, it may truly be said that they are experimental. It is possible to do harm by them, and make a patient worse. The difficulty of such an operation as disarticulation of the stapes, is such as to put it outside the pale and power of those operators who like to operate with that certainty and precision which sound surgery demands. All such operations have hitherto found but little favour in England; and, of the numerous successful cases quoted in other countries, only the immediate results of the operations are related. That these operations are not entirely free from risk, the following case will show.

Case 9.

OPERATION FOR CATARRHAL DEAFNESS.

Dr. B. Alexander Randall, of Philadelphia, reported a case of excision of the drum, membrane, and malleus for catarrhal deafness, followed by suppuration, mastoid empyema, and burrowing abscess of the neck. No reaction followed till the fifth day, when high fever began, with severe pain and profuse muco-purulent discharge. This gradually lessened under treatment, but in about four weeks pain and swelling of the occiput, of the mastoid, and at the angle of the jaw, gave evidence of mastoid empyema breaking into the digastric fossa. The usual incision was made over the mastoid; pus was evacuated from the digastric fossa; the neck abscess beyond the bone sinus was scraped, and the outer surface of the mastoid was trephined in

the usual manner, the antrum being freely opened. On irrigation, the fluid passed into the canal at first, then found its way into the pharynx by some lower opening. The temperature fluctuated greatly during the following fortnight, and there was oculo-motor paresis, diplopia, and some mental aberration suggestive of intra-cranial abscess. A good recovery was ultimately made, but at no time was there any improvement of the hearing to compensate in the least for the suffering. While the severe symptoms might possibly be ascribed to an attack of influenza, it is much more probable that the incus, which had been displaced upwards, clogged the exit of the antrum and induced the empyema. This would furnish a strong indication for the removal of the incus in any such operation, which even then may be followed by negative or unfortunate results. (*Medical Record*, August 6, 1892.)

CHAPTER VII.

A GENERAL CONSIDERATION OF PERFORATIONS OF THE MEMBRANA TYMPANI AND THEIR MANAGEMENT.

In treating of this important subject, it will be well first to mention some perforations of the membrane that are the result of accidental lesions. Among these may be enumerated injuries from scalding or corrosive fluids and molten metals; wounds with thorns, pins, scissors, and other pointed instruments, accidentally or designedly thrust into the ear; the lodgment of a pointed foreign body or, more commonly, the injudicious attempts made to remove it; rupture from loud concussions, as the explosion of a cannon or gun close to the ear; rupture from violent efforts at coughing, as in whooping-cough; and, lastly, the rending of the membrane associated with fracture of the base of the skull (Plate II. Fig. c). In the latter instance it is well to remark that lesion of the auditory nerve, and consequent irremediable deafness, is not uncommonly observed. "Boxing the ears" and diving from a height are responsible for a certain number of cases of rupture of the membrane.

Wounds of the tympanic membrane heal with extreme readiness, if only strict cleanliness and antiseptic precautions are employed. In most cases the best treatment is to close the meatus with boracic wool, and leave the case absolutely alone. Should there be much hæmorrhage or purulent discharge, the ear should be gently syringed with warm and diluted antiseptic lotions. Any symptoms of an acute

inflammatory nature will be met by the *régime* and treatment already indicated in dealing with acute aural inflammation, and where much pain and hyperæsthesia are present, the insufflation of a powder composed of morphia, boric acid, and tragacanth, so as to form a protective coating over the perforated membrane, is efficacious. In such cases, free leeching is advisable. Incisions made by the surgeon into the membrane usually heal rapidly without any special treatment.

Perforations of the drum of the ear from disease constitute a large majority of aural cases which come under notice. This affection is remarkably common. Many patients who suffer from otorrhœa entirely disregard it; and, despite the warnings of generations of pathologists and surgeons, some members of the medical profession completely ignore the gravity and terrible consequences of this affection. The parents of a child with otorrhœa are still assured that "it will grow out of it," and even hospital physicians have been known to recommend a course of sea-bathing to sufferers from this perilous affection. These cases usually have their origin in intra-tympanic suppuration. By a combination of pressure, softening, and ulceration, the pus bursts through the drum. The resulting discharge, being neglected or imperfectly treated, continues indefinitely. The opening thus becomes permanent. Not all cases of perforative otorrhœa originate in acute tympanic inflammation and suppuration. A considerable number have their source in those insidious and sub-acute attacks so common in the weakly and debilitated, where, after more or less discomfort about the ear, a discharge of pus ensues, giving temporary ease. Such instances are peculiarly common in delicate children of large

cities, and are usually combined with such unhealthy conditions of the naso-pharynx as adenoids, obstructed nares, granular naso-pharyngitis, and enlarged tonsils. The more severe examples are the result of acute otitis media occurring in scarlet fever or measles. In these very bad cases the whole drum may be destroyed, the ossicles may necrose and be discharged, and irremediable deafness result. Special mention must be made of the association of perforative otorrhœa with tuberculosis. In the tuberculous, otorrhœa is common, and is peculiarly intractable. A remarkable feature of these cases is their quiet onset, without much pain or constitutional disturbance, and the co-existence of most extensive destruction of the drum with extreme deafness. The characteristic bacillus may be detected in the discharge. Conversely, otorrhœa and its associated foci of caseating material in the mastoid cells and tympanum, may cause constitutional tubercular infection, and this serious consideration must never be lost sight of. In diabetes and bad constitutional syphilis otorrhœa sometimes assumes very grave characteristics. Extensive caries of the mastoid with caseation of inflammatory products may be found associated with otorrhœa in such constitutional states.

It would serve little useful purpose to attempt to describe the various positions of perforations, and their nature and extent. They vary within the widest limits, from complete destruction of the whole membrane, as observed after acute scarlatinous otitis (Plate III. Fig. H), to minute apertures hardly to be recognised, or detected only by the presence of tiny bubbles of air and fluid passing through the membrane (Plate II. Fig. F). Special mention must be made

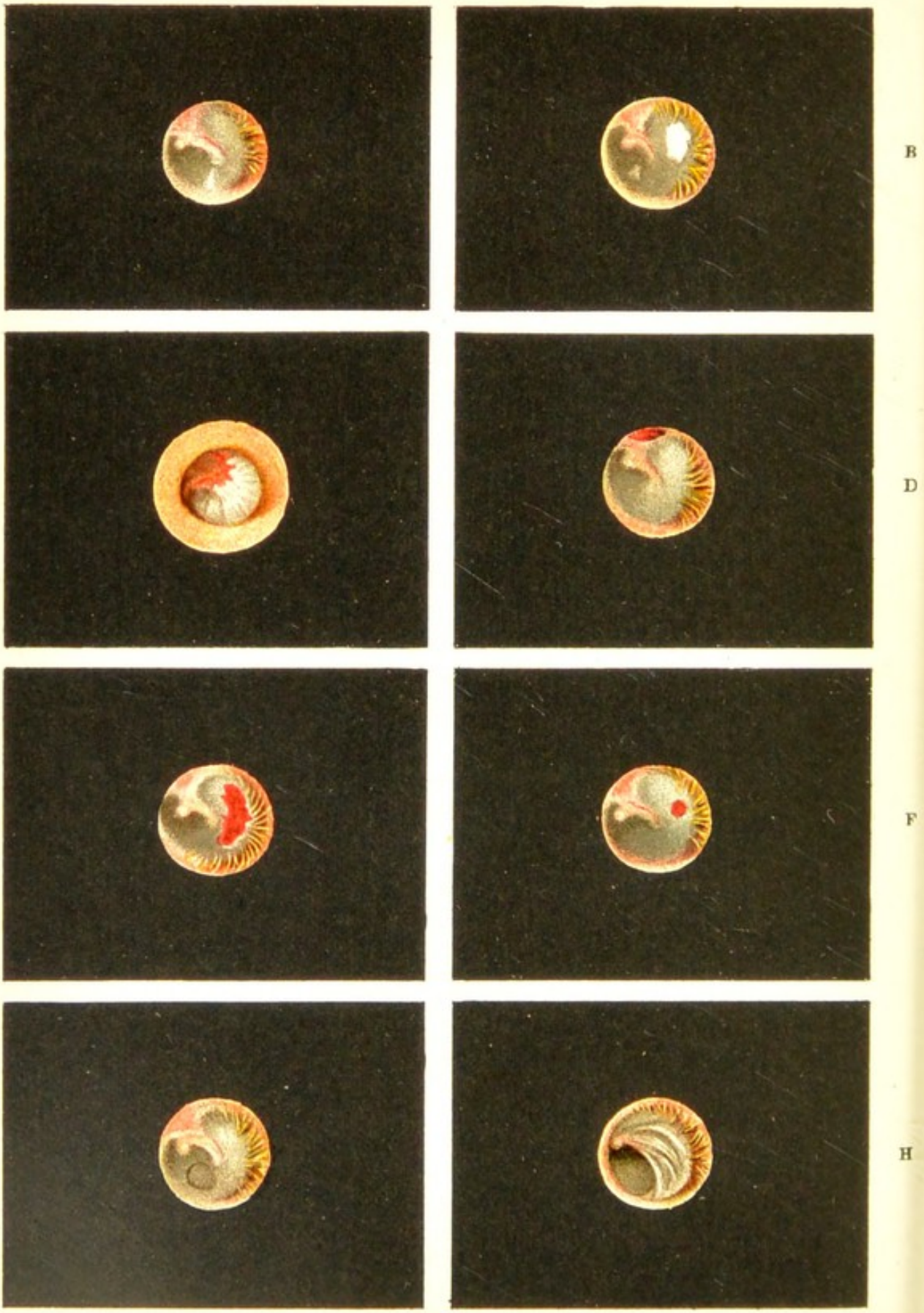

PLATE II.

PLATE II.

A.—Normal membrane showing the light spot and a vessel in the handle of the malleus.

B.—Drum of a gouty man, with white calcareous deposits in its substance.

C.—Extensive rent in the drum, from an old case of fractured base of the skull. associated with nerve-deafness.

D.—Perforation in the membrana flaccida.

E.—Large reniform perforation after suppuration in the middle ear, following influenza.

F.—Small circular perforation situated anteriorly.

G.—Healed scar of old perforation.

H.—Deep retraction of part of drum in Eustachian obstruction; prominent folds of fibrous tissue radiating from handle of malleus.

also of perforations in the superior quadrant of the drum (Shrapnell's membrane). In these cases discharge escapes with difficulty, and accumulations of caseous material within the tympanum are comparatively common. Perforations in this region are often associated with intra-cranial mischief, and are liable to be overlooked (Plate II. Fig. D). In shape, perforations may be slit-like, reniform (Plate II. Fig. E), or circular, in direction transverse or vertical. Recent perforations are usually slit-like, old ones circular. The margins of recent perforations show nothing noticeable. The margins of old perforations are thickened and callous from long irritation, and the constant passage of discharge. The more circular a perforation and the more defined its margins, the greater difficulty there is in bringing about the healing process.

The canal in cases of old otorrhœa is usually filled with pus and *débris* of discharge, which may hide the membrane from view. On syringing, the discharge escapes as flakes of "stringy" lymph and pus, which float about in the water. Stringy masses of muco-pus can only originate from a mucous surface. If in syringing the ear these escape, the surgeon may conclude with certainty that the drum is perforated. On using the diagnostic tube, and employing the method Valsalva or Politzer, air will usually issue from the perforation with an audible squeak or whistle.

Conversely, fluids poured into the ear may pass into the throat, and discharge may percolate also down the Eustachian tubes. The pus varies much in quantity and quality, being sometimes copious, and not infrequently associated with a disgusting odour, which, among the poorer classes, is often the one

symptom that leads them to seek relief.* The canal itself is often irritable, inflamed, and tender, and the neighbourhood of the meatus covered with a pustular eczematous eruption, which may spread over the entire head and face of a child. The cervical glands, especially in young children, are frequently enlarged and tender. Deafness is a constant symptom, but is most variable in degree, and it is especially important to note that this symptom bears no proportion to the size of the perforation. In some cases, when only a shred of the drum is left, the hearing is surprisingly acute; in others, with a tiny perforation, grave deafness is present. Tinnitus, pains in the head, vertigo, and giddiness are often complained of. These symptoms are exceedingly common when the general health is depressed, or when the sufferers from otorrhœa experience mental worry, or have to be engaged in harassing work, as reading for an examination or casting up complicated accounts. The general health of these patients may be gravely affected, the continuous drain of albuminoid material telling severely on the system, even causing marked anæmia, and inducing amyloid disease of the viscera.

Before attempting to inspect a supposed perforation, the canal must be carefully cleansed by gentle syringing with warm water, and afterwards by small pledgets of wool held in the aural forceps or twisted upon a suitable probe. The parts being then well illuminated through a speculum, there is usually no difficulty in accurately observing the position and

* Pulsation is frequently observed in the fluid covering or filling a perforation. This is caused by contact of the fluid with the engorged vessels of an inflamed mucous membrane.

nature of the lesion.* In young children, especially if the meatus be swollen and tender, it may be impossible to get a proper view of the drum, and in such cases we must be satisfied with an inferential diagnosis until a more exact examination can be made. Besides inspecting the position and extent of the perforation, the surgeon will especially note the presence or absence of a polypus or of granulations, for these conditions will keep up an otorrhœa *ad infinitum* unless properly treated. The intra-tympanic conditions associated with a long-standing otorrhœa, are usually an unhealthy condition of the lining membrane, which practically, in extreme cases, is converted into granulation tissue. Caries and necrosis of the ossicles may exist to a varying degree, and small foci of bone disease on the walls of the tympanum are common. The tympanic cavity is also filled with cheesy masses of accumulated discharge, and the mastoid cells are often implicated, their walls being thickened and sclerosed, and their cavities filled with inflammatory products. As a general rule, offensive discharge and the presence of granulations denote carious bone. It may be needful to examine with a probe. This instrument should be scrupulously clean, and used with a light hand. Spots of carious bone may thus with certainty be detected; but, personally, I seldom, if ever, have recourse to this method of examination.

The prognosis of any given perforation will largely depend upon a full and careful consideration of all the bearings of the case, and especially upon the thorough performance of the various methods of treatment laid

* Small perforations appear as round dark apertures. When larger, the inner bare wall of the tympanum can generally plainly be seen, through the opening of the drum, of a pink or red colour.

down by the surgeon. Recent cases will almost certainly get well under appropriate treatment. Broadly speaking, no case of otorrhœa is so severe as not to be susceptible of immense improvement to bodily health, comfort, and hearing power by well-directed treatment. Desperate cases will sometimes recover in a manner which pleases and surprises the patient and his surgeon. Neglected cases of very long standing are unfavourable. Necrosis, facial paralysis, and threatening cerebral disturbance, also render the prognosis grave; but it must ever be remembered that, though cure is impossible in many such cases, well-directed treatment and hygienic precautions may prevent some of the terrible complications which perpetually hang over the heads of sufferers from chronic otorrhœa. The practitioner will ever keep before his mind that chronic otorrhœa is a dangerous affection. So long as a patient has a perforation and discharge, so long is he in peril of his life, and at any moment—perhaps in the most unexpected manner—one of the serious complications of otorrhœa arises, which speedily hurries him to destruction.*

Special attention must be drawn to cases to which the term "quiescent perforation" may well be applied. These are almost invariably found in adults who have suffered from otorrhœa in youth, or in those who have received a long course of well-directed treatment by cleanliness and astringents. Not infrequently there is some slight fœtor about the meatus, but all discharge has ceased.

* It may here be pointed out that, in cases of chronic discharge from the ear, the mastoid cells or walls of the canal may be at fault, the pus issuing from a fistulous sinus external to the drum. Such cases are often not properly understood.

In these cases most aural surgeons agree that masterly inactivity as regards local treatment is very advisable. Such cases are readily excited to serious inflammation. Syringing is, in them, generally injurious. Operations upon the nose or naso-pharynx are also not devoid of risk. The inspissated secretions are laden with micro-organisms, and the septic materials produced or associated seem to be especially virulent if they gain access to the general circulation. Meningitis, pyæmia, and sepsis may thus result. Such cases are also peculiarly susceptible to cold, the entrance of sea-water, or accidental injuries.

The subjects of "dry perforations" should be carefully warned, and taught how to cleanse the ear with "pledgets" of cotton-wool, and to insufflate some antiseptic. For this purpose nothing is better than finely-powdered boric acid, blown into the ear twice or thrice weekly.

The observant surgeon will be struck at the number of his adult deaf patients who have suffered from otorrhœa, and now present quiescent perforations or cicatricial drums. As many members of the medical profession ignore and despise the grave nature of otorrhœa, so a directly contrary opinion is prevalent, that every sufferer from otorrhœa must inevitably succumb to one of the well-known complications of the disease. The truth is that, considering the number of sufferers from otorrhœa, probably only a minority die of meningitis, abscess of the brain, or sinus pyæmia. This consideration must be taken into account when advising any operative treatment for otorrhœa cases, designed to prevent such complications. The practitioner will do well to remember, that so completely do many parents ignore otorrhœa that

child-patients will often be brought to him suffering from such symptoms as giddiness, anæmia, loss of appetite, flesh, and strength, which are really dependent upon a profuse discharge from the ear and concomitant cerebral congestion. In these cases "tonics" are often advised, the true source of the symptoms remaining undetected and unrelieved.

We may now proceed to consider from a general point of view the complications of these cases, upon which, indeed, their main importance depends. Excluding the grave affection of the general health and the relationship to tuberculosis, most of the complications of otorrhœa follow naturally upon a consideration of the anatomical surroundings of the tympanic cavity.

Facial paralysis is found in a considerable proportion of severe cases, and usually indicates necrosis of the inner wall of the tympanum and pressure upon the nerve by inflammatory products. The nerve itself may undergo inflammatory infiltration and subsequent degeneration. When facial paralysis occurs in acute inflammation of the middle ear, or in syphilis, recovery may ensue; but those cases associated with bone disease are, in my experience, peculiarly unfavourable for prognosis and treatment. In bad cases of scarlatinous otitis media, the drum may be entirely destroyed and the ossicles extruded. If the stapes remain, considerable improvement may be evoked by the aid of the artificial membrane. Occasionally the necrosis is far more extensive, and sequestra may be gradually extruded and removed. In this way portions of the labyrinth have escaped, and, indeed, large pieces of the petrous bone itself. The constant irritation of discharge and

the presence of one or more spots of carious bone tend to the excessive production of granulation tissue, and when this grows externally and is moulded by the configuration of the canal, the tumour is dignified by the name of aural polypus. In rare instances, true sarcoma or epithelioma is developed, and is characterised by the usual clinical characteristics of inveterate increase, agonising pain, rapid infiltration of the bones, a tendency to fungation, and profound and rapid deterioration of the general health of the sufferer. The discharge is watery and very offensive.

Meningitis, and cerebral abscess are among the more dreaded complications of otorrhœa. We shall probably never know certainly the number of individuals who die from these affections. The symptoms are often exceedingly obscure, and the ear affection is frequently overlooked. The meningitis is usually rapid and acute. The exudation spreads over the base of the brain, the subarachnoid space being filled with greenish-yellow pus and lymph. The lining membrane of the ventricular cavities is also generally implicated. When cerebral abscess occurs, in the vast majority of cases it is found in the temporo-sphenoidal lobe, more rarely in the cerebellum; but abscess has also been known to occur in a part of the brain quite remote from the origin of the mischief. The proximity of the jugular veins, the lateral sinus, and their numerous emissary veins, explains the frequent occurrence of purulent phlebitis, thrombosis of the cerebral sinuses, and pyæmia, in cases of chronic otorrhœa dependent upon caries. The spreading of inflammation to the mastoid cells leads to necrosis of the cellular laminæ, accumulation of discharge and of caseating products. These, mingled with epithelial *débris*, may form a

distinct tumour hollowing out the mastoid cells (Cholesteatoma). Finally, an abscess may point and evacuate itself behind the auricle, leaving a fistulous opening leading to carious bone. In many cases, however, the implication of the mastoid is only to be suspected by the pain behind the ear on deep pressure, by localised heat, redness, or slight superficial œdema. Exostosis of the canal, as already mentioned, is an awkward and dangerous complication of otorrhœa, leading, in extreme cases, to retention of discharge and cerebral disturbance. In such cases, prompt removal of the growth is indicated. The last complication of these cases which needs mention is both rare in occurrence and fatal in its consequences. I allude to hæmorrhage from the canal in consequence of ulceration of the coats of the carotid artery, or its branches, or from one of the smaller tympanic arteries. The hæmorrhage is characterised by its arterial character, its profuseness and its inveterate persistence. Plugging the canal is usually first resorted to, and subsequent ligature of the common carotid in the neck. Should the bleeding continue furiously, the latter procedure is occasionally successful. Hæmorrhage from the canal, even to a considerable extent, may also occur from congestion of granulations. Patients will not infrequently come to the surgeon alarmed by bleeding from the ears, following coughing or violent vomiting. They will usually give the history that they are the subjects of otorrhœa, and congested granulations will be found on examination. Good results follow in these cases from free watery purgation, and the application of astringents to the granulations.

The complications of otorrhœa will be again especially treated of; but, for a full appreciation of

them and their far-reaching character, works on general medicine and surgery must be consulted. The cerebral complications of otorrhœa give this affection its dreadful significance, in the minds of those who are acquainted with morbid anatomy in hospital post-mortem rooms. The practitioner will do well to recollect that these cases are dangerous to life in the first, to hearing in the second place only. Thus he may view with satisfaction a case placed by his efforts in a comparatively clean and aseptic state, though the hearing be quite lost.

At the risk of repetition, I would urge the importance of treating cases of otorrhœa at their outset, especially in children. The affection is peculiarly amenable to early and well-directed curative efforts. Long-continued suppuration renders the margins of the perforation thickened, and the parts become disinclined to heal. Pathological changes take place within the tympanum, and seriously damage the function of hearing. The first duty of the surgeon is to urge upon the patient, or friends, the gravity of the affection and the importance of carrying out with care the treatment prescribed. In the majority of hospital cases, the poverty and carelessness of the patients or his friends render the best advice of the surgeon of little avail. The result among this class of the community, must on no account be taken as a criterion of treatment, which is far more satisfactory among the educated and wealthy. The scope of this work will not permit of even a *résumé* of the various applications and methods which surgeons have employed from time to time in cases of otorrhœa. The principles of general surgery will be found applicable to these cases, and the care and thoroughness

with which treatment is carried out are of far greater importance than the actual composition of any given lotion or other application. The indications to be observed in any given case of otorrhœa are as follow :—

(1) Strict cleanliness of the parts must be carried out, and persevered in.

(2) The nose, throat, and naso-pharynx require inspection and treatment.

(3) Attend carefully to the general health. Treat any obvious constitutional defect, and observe general hygienic precautions.

The first indication is all-important in cases of chronic otorrhœa. By the use of strict cleanliness alone many cases of perforations in children will be brought to heal readily. There are two main methods of cleansing the ear, which may be called the moist and the dry. I believe it to be a great error to adopt either of these systems universally. The essentials of the moist treatment of cases of otorrhœa are the frequent use of the syringe, and the soaking into the affected ear of antiseptic and astringent lotions. The essentials of the dry treatment are the avoidance of the syringe and all lotions, the cleansing of the parts with cotton-wool, and the application of remedies in the dry and powdered state. It is impossible to lay down more than general rules as to when to adopt either of these systems. Profuse and fœtid discharge generally needs the use of the syringe. This method is also useful in young children, and by the persevering use of warm water alone, many perforations in the young may be brought to heal. Syringing or moist applications are usually very harmful in the "dry" perforations already alluded to. These commonly

occur in adults, and the act of syringing such cases may induce bad inflammation, with increase of discharge, or even worse mischiefs. I believe that the indiscriminate use of the syringe has induced an unfair estimate of its value in many cases of perforative otorrhœa. When there is profuse discharge, I always advise gentle syringing with warm water alone at frequent intervals. The syringe should contain about three ounces, and should have a narrow nozzle capable of being laid well along the upper wall of the auditory canal. The jet should not be forcible enough to cause pain. The surgeon must instruct the nurse or parent, and not be satisfied until the proceeding is easily carried out by them. A second person is always needful to syringe an ear properly. When this is impossible, the surgeon must instruct the patient to syringe his own ear to the best of his ability. A small rubber douche syringe with a narrow nozzle—or, better, a small modification of the common Higginson's syringe—will suffice, if due care and perseverance be insisted upon. Many cases, especially in hospital practice, come to the surgeon when cleansing has been imperfectly carried out, and the astringent or antiseptic is soaked into a cavity filled with foul *débris*. While the ear is filled with warm water, inflation should always be practised. In adults the Valsalvian method may be gently employed. In children a small Politzer bag with a soft nozzle may be used once or twice daily. By the use of inflation, pus and *débris* are washed about and out of the tympanum; and, should the inflation be impossible from such causes as adenoid growths, these will need removal before permanent improvement can ensue. It is surprising what good results will be obtained by

these simple means. In young children perforations will heal, and discharge cease, with little further treatment. It is customary and advisable to combine cleanliness of the ear with the "soaking in" of antiseptic and astringent lotions. These are almost too numerous to mention. They should be used warm, and always very dilute. The patient lying upon the opposite side, the ear should be well filled with the application, which should be allowed to soak into the parts for at least fifteen minutes. Boric acid, carbolic acid, zinc, lead, and other antiseptics and astringents may be thus used.

The lessening of discharge and improvement of hearing is usually a signal to diminish wet applications and employ dry ones. The ear may now be cleansed by a long, twisted "wick" of cotton-wool passed well down the canal by means of a small pair of forceps. Afterwards such antiseptic powders as iodoform and boric acid may be blown down the canal. These may be combined with oxide of zinc, calamine, starch, carbonate of lead or tannin. All powders must be in a fine state of subdivision, devoid of gritty particles, and carefully introduced. Furthermore, the astringent element had better be at first small in quantity. Should the patient be under the constant care of the surgeon, the canal may be packed with the powder, this substance being introduced through the speculum and gently pressed down upon the drum. When the discharge is still abundant, I make it a rule never to pack the canal with powders. A convenient way of introducing antiseptic or astringent remedies in these cases, is by combining them with gelatine in small oval pellets, which can be dropped down the meatus.

Cases of old and quiescent perforations in adults should always be treated on the dry plan, if they are treated at all. Such patients should be instructed how to cleanse the canal with cotton-wool, and should blow a small quantity of some finely-powdered antiseptic down the canal, say, thrice a week. If they avoid cold bathing, head injuries, and especially injudicious treatment, nothing more will be required.

Should the surgeon be able to ascertain that the discharge passes from a fistulous opening in the bone in the direction of the mastoid, the case will assume a different aspect. In such conditions it is most unwise to attempt to check the flow of pus. All discharge should be encouraged to escape by syringing, and, if the orifice of the sinus can be reached, it must be enlarged by a sharp curette, and any "cheesy" material should be evacuated with small curved spoons. When in a case of otorrhœa I see marks of old sinuses about the mastoid, I always search for a like condition on the walls of the canal. The mastoid may be washed out, too, in these cases by introducing a fine curved cannula into the sinus and connecting this with a syringe. In this way peroxide of hydrogen in 10-vol. solution may be used with very good results. This agent is especially valuable in cases where pus is abundant and profuse. Regarding the shapes and sizes of the instruments to be used in such cases, no constant guide can be given. Each individual case must be well studied on its own merits, and that surgeon will be most successful who best appreciates the special features before him, and exercises his own ingenuity.

In cases of otorrhœa associated with evident

gross affections of the pharynx or nose, as enlarged tonsils, adenoids, and great nasal obstruction from polypi, or hypertrophied spongy bones, treatment of these conditions needs careful consideration. I believe it is safe practice never to operate for naso-pharyngeal affections until the otorrhœa is lessened by previous treatment and cleanliness ensured. So soon as this is effected, operations should not be delayed, though the risk is always slightly increased. Operations upon the nose or throat of adults who have unsuspected perforations and septic stinking tympanic cavities, are peculiarly hazardous. A judicious surgeon will make it a rule never to operate upon the naso-pharynx until he has assured himself of the absence of these conditions. In minor cases of throat mischief, the surgeon may be satisfied with the regular application of Politzer's bag, and the methodical use of a simple nasal wash.

Strict attention to the general health and certain hygienic considerations are of the first importance in cases of perforative otorrhœa. It is astonishing to meet constantly with cases where every local measure has vainly been exhausted on the subject of an otorrhœa, who may be suffering from obvious syphilis, or is the champion diver of a sea-side resort! Tonics and iron with cod-liver oil are generally useful. Quinine should be avoided. Good diet is essential. Dry mountain air, in my experience, suits these cases best. Sea air is not so advantageous, and bathing must be strictly avoided. Damp, fog, residence in a river-valley, and especially defective sanitation, are always prejudicial. Cold fresh or sea-water should never be allowed to enter the ears or naso-pharynx of sufferers from perforative otorrhœa. Blows on the head

are also peculiarly dangerous, and this is always to be mentioned to those pedagogues who still indulge in the reprehensible practice of "boxing the ears" of their deaf and, therefore, stupid pupils. Syphilis, congenital and acquired, should always be examined for and treated. In cases of tubercle the ordinary climatic and medicinal treatment should be thoroughly carried out.

Should otorrhœa be associated with a polypus or the excessive growth of granulation tissue, these conditions will need especial treatment, to be again considered. Should obvious symptoms of inflammation and accumulation of pus in the mastoid cells arise, the opening of these cavities must not be delayed. Such symptoms are especially agonising pain, with local tenderness and œdema, fever, and rigors. Cleansing of the tympanum can by no means always be carried out effectually by the means previously described. This is especially the case when the perforation is seated superiorly in the membrana flaccida, or when the aperture is too small to allow the inspissated pus to escape. In these cases a patient will have "disagreeable head symptoms," as giddiness and a sense of fulness in the head, irritability, inability to work, fever or drowsiness, and these symptoms are relieved by a flow of pus from the ear, to be again renewed. Such instances as these are difficult to deal with. The use of the intra-tympanic syringe is to be recommended in these cases; the tube to be curved and modified for the case under treatment. I have used with success in these cases a fine suction curette similar to that in use by oculists for soft cataract (Fig. 25). The glass barrel is filled with warm solutions of carbonate of soda, or iodide of potassium, or very

dilute carbolic acid, combined with cocaine. Introducing the curette gently through the perforation, the cavity is filled with the solution, drawing it in and out by means of regulated pressure with the lips. This proceeding is always disagreeable, and sometimes very painful. Professor Politzer showed in London in 1892 some minute soft rubber tubes which are peculiarly applicable to these cases and might readily be fixed on any apparatus. The question will often arise whether it would be advantageous freely to incise the membrane, evacuate *débris* with fine scoops, and remove the necrosed ossicles. This operation is by no means easy. Indications for its performance are the presence of loose sequestra. The more one sees of operations upon old middle-ear disease, the more impressed one becomes with the infinite caution that must be exercised. The severity of the symptoms will be one guide, the presence of necrosed ossicles the other. If, by introducing a fine curved probe through the opening, the malleus can be felt rough and loose, it may be cautiously removed by fine ring forceps, the perforation being enlarged for the purpose. In the year 1892 I experienced a peculiarly favourable case of this nature.

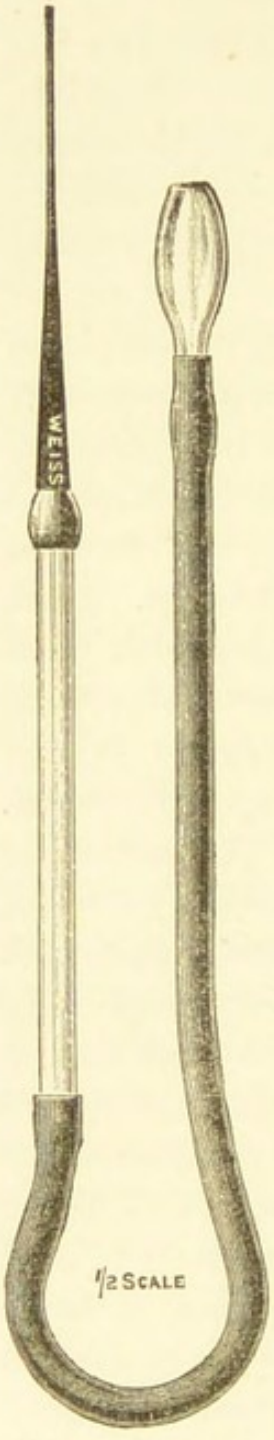

Fig. 25.—Suction Tube, with soft nozzle.

Case 10.

OTORRHŒA AFTER SCARLET-FEVER. EXTRACTION OF CARIOUS MALLEUS AND INCUS. SUBSIDENCE OF SYMPTOMS.

A little girl, aged eight, sent by Mr. Charles Tuke, of Chiswick, in November, 1891, had very bad scarlet fever in April, 1891, "especially attacking the nose and ears." Right ear ceased discharging about two months ago. Left ear discharges profusely, with pain and discomfort. Child hears tick of watch ten inches on the right; only on contact on the left. There is a dry central perforation in the right side. Membrana tympani nearly destroyed on the left; and ear blocked with foul discharge and *débris*. Instructed nurse and mother how to cleanse ear with wool and syringe. Lotion of chlorinated soda to be used, and inhalation of chloride of ammonium vapour. Great improvement, locally and constitutionally, followed.

November 18*th*.—Examined gently and carefully with a fine bulbous probe, and distinctly felt carious bone. As case was improving, advised continuance of "cleanliness" treatment.

March, 1892.—With strong illumination could just see fragment of bone, and under cocaine removed two carious fragments, being part of the malleus and incus.

August, 1892.—The ear is quite dry, and the drum in part reformed. Child hears a watch at three inches, and conversation fairly well.

I mention this case to show how the general principles of surgery are applicable to aural disease. On several other occasions I have removed necrosed ossicles, and always with excellent results.

In recent cases of perforation, should healing be sluggish, stimulation of the margins of the perforation, by means of nitrate of silver or lead, may be easily carried out. A fine brush is dipped into a solution of nitrate of silver (twenty grains to the ounce) and lightly passed through the perforation. This should be done at infrequent intervals, and never if active inflammatory symptoms are present.

The final management of cases of perforation will always include the question of wearing some sort of

artificial support. The scope of this work forbids historical discussion. I would only point out that the principle that, "if the stapes remains fixed in the fenestra ovalis, and light pressure be brought to bear upon it, the hearing is thereby greatly improved," was in the main due to Yearsley.

The principle has long been known, and much abused. Its discoverer deserves infinite credit. Unfortunately, as so commonly occurs in matters of this kind, a sound principle has been seized upon by quacks, who sell "ear-drums" made of metals, at fabulous prices, to the credulous deaf. These inventions improve the hearing of a few, and this is a sufficient advertisement to ensure their use by the many. All metallic and rigid contrivances are most injurious to apply in the neighbourhood of the middle-ear. I doubt if any real improvement has been made upon the cotton-wool pellet of Yearsley. I have given a patient trial to other forms of "artificial drum," and have finally rejected them. Any wire or metal is irritating, and a fall or blow may drive it forcibly inwards. Indiarubber discs, though recommended by some high authorities, become foul and stinking, and may be broken off from the stem, and remain within the ear. The surgeon will do well to advise the use of the cotton-wool pellet in all cases of bilateral perforations with deafness, in patients willing and intelligent enough to employ them. Trial must always be experimental, and we never can tell the amount of improvement to the hearing that may ensue. This is often astonishing, even though the whole membrane is destroyed. Soft iodoform or boracic wool is twisted into a "wick" terminating in a small pellet a little smaller than the "drum" in the case under observation.

The little pellet is moistened, flattened, dipped in finely-powdered boric acid, and passed lightly down upon the remains of the drum. It is then placed in position by pressure in various directions with the aural forceps (Fig. 26). Should the hearing be improved, the patient is encouraged to adopt the plan himself. In children, nervous and stupid adults, much trouble is necessary in instruction. Once, however, they acquire the method, they will place the plug in position with remarkable ease and certainty, and will moreover make modifications in size, shape, and pressure which by experience they find best suited to their individual conditions. It must be confessed that the proper application of the cotton-wool pellet requires some little skill, and can only be acquired by experience. The results are, however, so striking in many cases, that much patience will be worthily bestowed. The pellet not only acts by improving hearing; it also protects the drum and tympanum from the external air, soaks up and disinfects discharge, which by its withdrawal is removed, and promotes healing. This contrivance is useful in many cases of otorrhœa, though the hearing may not be markedly improved by it.

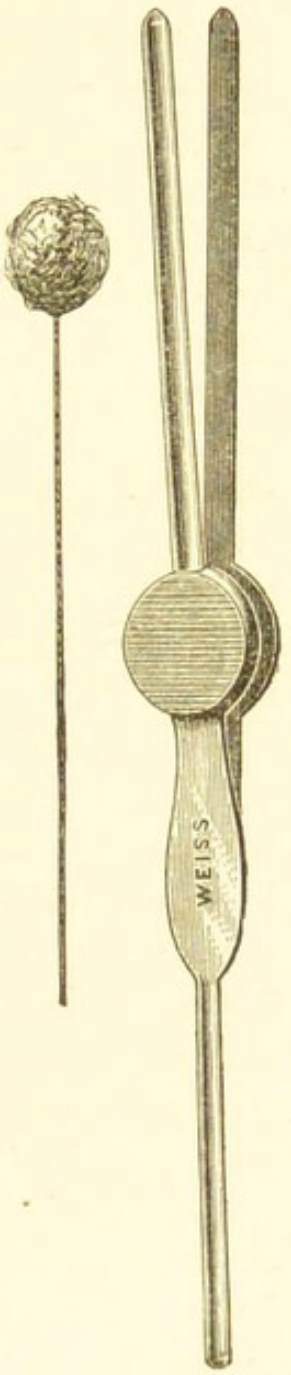

Fig. 26.—Wool Pellet, and Aural Forceps for its application.

The surgeon will find that a number of cases of otorrhœa will come under his notice which are absolutely incurable. In these instances suppurative processes have been allowed to progress unchecked for many years, and extensive necrosis of the petrous bone, with facial paralysis, co-exists. In these distressing cases cleanliness and asepticism should at least be arrived at, and all the efforts of the surgeon should be directed to warding off the fatal complications that are apt to ensue. Daily cleansing and careful hygienic precautions concerning the ear should be the patient's chief care, and so he may live to a good age. We will here only call especial attention to the condition of the mastoid in bad old cases of otorrhœa. If the surgeon has reason to believe that the mastoid cells are implicated and stuffed with inflammatory products, and especially if there be a sinus, or fluctuation behind the ear, a very free opening should at once be made, necrosed bone freely removed, and the tympanum washed out through the meatus. The improvement which follows such a proceeding is little short of marvellous.

Case 11.

SEVERE DOUBLE MASTOID DISEASE WITH OTORRHŒA. SEVERAL OPERATIONS. PROLONGED DRAINAGE. ULTIMATE CURE.

A delicate girl, aged 10, first seen on November 11th, 1889, with Mr. Burton, of Blackheath. She had post-scarlatinal otorrhœa, with large ragged perforations on both sides. There was profuse fœtid discharge. The child was emaciated, pale, quite deaf, with an expression of much suffering. Behind the right mastoid was a sinus discharging fœtid pus. She had been under the care of various aural surgeons, and had got sometimes better, but always relapsed. Mouth chronically open; expression stupid and vacuous; adenoids in pharynx. The first operation was performed in November, 1889. A free

incision was made over the right mastoid, and the parts were freely raised from the bone. The orifice of the sinus was enlarged with gouges until a small spoon could be introduced. A large quantity of offensive *débris* and cheesy pus was thus evacuated. A syringe, applied to the sinus, forced through the meatus a quantity of the same material. There was free venous hæmorrhage, checked by hot syringing. A leaden tube was inserted, and iodoform plentifully introduced. Strict cleanliness and carbolised syringing daily carried out.

July 3rd, 1890.—Surprising improvement. The child has gained flesh and weight and also some hearing power. The treatment for otorrhœa is daily carried out; the sinus has quite closed.

November, 1890.—Fresh trouble about the right mastoid; the sinus is again discharging; under ether, fixed in sinus a fresh leaden tube, and operated upon adenoids in the usual way.

January 18th, 1891.—Removed a large granulation tissue polypus from left ear, and made a free opening into the left mastoid, evacuating much cheesy *débris*. Fixed in a leaden tube on this side also. The tube was kept in the right sinus for about six months; in the left sinus for about three months. Both canals and leaden tubes were daily syringed through with solution of peroxide of hydrogen for about three months. This had a marked effect in diminishing discharge. Tubes were gradually shortened and finally removed.

November, 1892.—Girl has grown, and looks well and healthy. Both sinuses soundly healed, but there is a deep depression behind right auricle. Ears dry and healthy, cicatricial tissue has formed about the situations of the membranes. With cotton-wool pellet hears conversation quite well, but is worse in the damp or fog of the vicinity of London than at the seaside, when "she can hear as well as any of the family."

In 1894 the same satisfactory condition continued.

This is a good instance of the severity of these cases, and the prolonged treatment required, with the ultimate good results that may be looked for from free drainage and good care.

CHAPTER VIII.

THE DIAGNOSIS AND TREATMENT OF THE CEREBRAL COMPLICATIONS OF PERFORATIVE OTORRHŒA.

The cerebral complications of perforative otorrhœa are so important, and so much has lately been written upon them, that it is impossible to do the subject full justice in a treatise of limited dimensions. What is here set forth will, it is hoped, serve as a useful guide towards the diagnosis of these most difficult cases. Reference must be made to the works and published cases of Macewen, Horsley, Ballance, Ferrier, and especially to the excellent Hunterian Lectures of Mr. Barker. It must ever be remembered, also, that to antiseptics must be attributed many of the principles upon which modern cerebral surgery, and the treatment of abscess in the brain particularly, are founded.

The subjects of old perforative otorrhœa occasionally suffer from what are vaguely termed "head-symptoms." These vary from a general sense of cerebral pain and discomfort, to such alarming manifestations as giddiness and vertigo, intense headache, confusion of thought and ideas, and even mental hallucinations. I am unable to supply accurately the pathological explanation of these phenomena. Most probably they depend upon congestion and irritation of the meninges and cerebrum adjacent to the affected petrous bone. In post-mortem examinations in old cases of ear disease, I have several times seen a patch of pachymeningitis over the petrous bone. When such

symptoms are present, a blaze of actual acute inflammation of the septic type is always to be feared. The significance of cerebral congestion in ear disease is frequently misunderstood in practice. In cases of peculiar and mysterious head affections, the first duty of the practitioner should be to examine the ears by the speculum and mirror, and also by the sense of smell. A fœtid odour is often a most important sign of old-standing perforation and intra-tympanic disease. Symptoms, such as I have enumerated, are often excited in the subjects of old-standing otorrhœa by blows on the head, cold, syringing, sea-bathing, or undue mental worry and exertion.

In these circumstances, the energetic employment of the ordinary rules of treatment for inflammation of the middle ear are indicated. Free abstraction of blood by leeches and mercurial purgation will often cause rapid subsidence of pain and discomfort. At the same time such symptoms, in cases of old disease, must be viewed with the utmost apprehension, and watched with extreme care. Cerebral abscess in connection with disease of the tympanum is sometimes so insidious in formation, and the symptoms attending it are so vague, that it is unfortunately impossible always to diagnose it with any degree of certainty. A man the subject of old otorrhœa may have a little pain and discomfort about his ear, may feel "out of sorts," have headache and sickness, or be "queer" in manner or unsteady in gait. Such symptoms may be absolutely disregarded or referred to the wrong cause, as "a bilious attack," by the medical attendant. One day the patient becomes delirious, convulsed, and drowsy, and finally dies in a condition of deep coma. Only those who have witnessed these sad cases can

testify to the mystery that often surrounds them, and to their vast importance in practice. In girls, the curious mental phenomena that accompany cerebral abscess or meningitis are only too often referred to "hysteria." The author has seen at least one instance of this serious and fatal error, which would have been avoided had the ears and optic discs been examined.

Most cerebral abscesses due to ear disease are located in the temporo-sphenoidal lobe, the septic inflammation directly spreading to the meninges and brain, through a carious spot on the roof of the tympanum. The membranes are here inflamed, adherent, and blackish in colour. In other cases, the bone and meninges are quite unaffected, the abscess having probably originated in septic purulent embolism of some of the tiny veins that pass from the meninges to the petrous bone. In exceptional instances the abscess may be found in quite another part of the brain, as the opposite temporo-sphenoidal, or anterior lobe. The explanation of these cases is probably to be found in septic embolism, and they are sufficiently rare not to require further notice in a work of this nature. The abscess may also be located in the cerebellum, but less frequently than in the temporo-sphenoidal lobe. It has been stated by an author of repute, that the more the mastoid is affected by disease, the more likely, in the adult, is the abscess to occur in the cerebellum.* In a few cases the abscess is subdural, *i.e.* situated immediately beneath the dura mater, being caused by a localised suppurative

* Toynbee asserts that the reverse is true in children in whom the mastoid cells are small and undeveloped, and that in them caries of the mastoid is usually associated with affections of the cerebrum. ("Diseases of Ear," p. 303.)

meningitis. The pus has been known in such instances to burst externally through the squamous bone, or at the junction of the squamous and mastoid, or even through the tympanum, a discharging sinus remaining. Unfortunately, suppurative meningitis is not often localised; it more often spreads forwards over the side or base of the brain. Should a cerebral abscess point under the integuments externally, or should localised œdema appear, operation cannot be too soon undertaken. In these cases the local tenderness on percussion of the bones of the head is very marked, and is a most valuable symptom.

Localisation symptoms of temporo-sphenoidal abscess are largely of a negative nature, because the parts of the brain in which the pus is situated are not those which preside over the important motor centres. "Word-deafness" is noticed in a considerable proportion of cases, the patient taking a considerable time to appreciate what is said to him, his answer being hesitating and his speech slow and "scanned."* Occipital pain and staggering gait may be associated with cerebellar abscess. In two cases seen by myself marked retraction of the head was present; but these symptoms are not to be relied upon, indeed the pain in cerebral abscess is commonly a dull "splitting" or "throbbing" headache, ill-defined as to locality.

It is especially important to remark that cerebral abscess may be associated with cerebro-spinal

* This symptom was especially marked in a case of a gentleman who was a patient of Dr. Cruikshank, of Nairn, upon whom I operated for cerebral abscess due to ear disease. See a paper on this interesting case in the Transactions of the Medical Society of London, vol. xiii. p. 50.

meningitis and general pyæmia; and hence the symptoms become so complicated that an exact diagnosis of the actual pathological conditions is hardly warranted. Rigors almost exactly simulating ague, burning heat of the skin, high fever, and profuse sweating, associated with the symptoms of cerebral abscess, clearly point to septic infection and probably sinus thrombosis. Signs of implication of the cortex or base of the brain denote meningitis. Among these I would call the attention of the clinical observer to "Cheyne Stokes" respiration, retraction of the head, optic neuritis, and oculo-motor paralysis, especially implication of the third nerve. Twitchings of the opposite side of the face, and of the opposite arm and leg, are tolerably definite evidence of cortical irritation in the regions about the fissure of Rolando, from advancing septic meningitis. The more evidence there is of implication of the nerves at the base of the skull, the more general the paralysis and coma, the more certainly will one find, post-mortem, that there is extensive and hopeless purulent meningitis over the base of the brain extending into the ventricles and down the cord. It follows that cases which exhibit these symptoms are very unfavourable. In uncomplicated cases of abscess, where the pus is localised, surrounded by a definite membrane, and systemic infection has not occurred, the temperature may, on the contrary, be sub-normal and the pulse exceedingly slow. These symptoms, ably drawn attention to by Hulke, may readily mislead the observer. Were I asked what special symptoms, in a case of old perforative otorrhœa, denote an abscess of the temporo-sphenoidal lobe, I should reply, throbbing pain, a sub-normal temperature, sluggish cerebration, and vomiting without obvious cause. Optic neuritis is

present in a large proportion of cases, but I have known it to be absent from first to last. This symptom is very commonly found in cases of thrombosis of the lateral sinus. Localised pain on pressure or percussion of the skull, with œdema, may also be discovered—symptoms, when present, of great import. In cases of cerebral abscess the tongue is foul, the bowels are obstinately confined, and the abdomen is retracted. Emaciation is rapid, and the lower limbs are flexed upon the abdomen, the evacuations being sometimes passed involuntarily. Drowsiness, confusion of ideas, terminating in deep general coma with stertorous breathing, indicate that the abscess has burst into the ventricles or that general meningitis is associated. Such cases are hopeless as regards treatment. I have thrice performed the operation of trephining, when deep coma was present in old cases of perforative otorrhœa. On each occasion the detection of an abscess proved the correctness of the diagnosis; on each occasion the patient died, and at the "post-mortem" it was discovered that general purulent meningitis was present, and that an abscess had burst into the ventricles before operation.

Sufficient has now been said to impress upon the reader the importance of these cases, and the immense difficulty which often surrounds their early diagnosis. There can be no doubt that were these abscesses evacuated before they burst into the ventricles, and before they became associated with general pyæmic infection, a considerable proportion of lives would be saved from certain destruction. Accordingly, it becomes incumbent upon anyone who attempts to write on this subject, to take the great responsibility of attempting to draw up some general rules, that may guide a

practitioner in the conduct of, perhaps, the most responsible cases of surgery that he will certainly, at some time or another, in the course of an ordinary practice, be confronted with.

On the one hand, he may interfere needlessly; on the other, he may miss the import of symptoms, and wait until too clear indications arise that the patient has passed into the category of hopelessness.

Treatment, especially free-leeching and mercurial purgation, is so efficacious in cases of mere cerebral irritation and congestion, that it goes far towards assisting the surgeon to determine whether more serious pathological conditions exist. In cases of abscess or meningitis, an observant practitioner will soon ascertain that one or more signs of grave suspicion still manifest themselves. The patient's manner is queer, or he has delusions. There are curious variations of the temperature or pulse, vomiting without obvious cause, giddiness, inequality of the pupils, optic neuritis, or speedy return of the violent throbbing pain on the side of the head. The tongue becomes foul, the bowels confined, and mental processes sluggish, the patient taking some little time to appreciate what is said to him, and then answering with a slow, scanning speech, like one in advanced general paralysis of the insane. He lies curled up in bed, keeps his eyes closed, and his face averted from the light. His belly is retracted, his bowels costive, the urine may dribble, and emaciation is rapid and progressive. I do not hesitate to say that, so far as my own practice is concerned, when symptoms of this nature are present in a subject of old otorrhœa, I should—strengthened, if possible, by consultation—advise an exploratory operation to be performed

without delay. I believe that exploration, if properly conducted, is very free from risk, and it affords the patient his only chance for life should an abscess exist. In a paper upon this subject in the Medical Society's *Transactions* for 1889 I strongly advised the employment of a small trephine,* pointing out that there is ample opportunity to remove large portions of bone, or incise the membranes when the abscess is discovered. The scalp is shaved and cleaned, the patient, unless deeply insensible, must be carefully anæsthetised with chloroform by a highly-competent person. If no œdema or local tenderness be present to guide the surgeon, a large flap, with the convexity downwards, is made above and behind the auditory meatus. The bleeding being arrested by pressure-forceps, a trephine of the diameter of a shilling is applied at a point about an inch above, and three-quarters of an inch behind the auditory meatus. The crown of bone being removed, a scrupulously clean trocar and cannula are passed through the membranes, and directed at first downwards and forwards, next straight downwards, lastly downwards and backwards. As an additional precaution, as soon as the membranes are perforated, I think it wise to substitute for the fine-pointed trocar a fine blunt one. The trocar should be of the size of an ordinary hydrocele instrument, and the blunt pilot trocar should be passed down the cannula, to avoid the possibility of closure by cerebral matter. The cerebral substance is readily penetrated, and such an instrument may be introduced for several inches without the least risk of wounding either a cerebral

* The same point was emphasised by Mr. Barker in his Hunterian Lectures.

vein or a sinus. One of the punctures made in the above directions may enter an abscess. When the trocar is withdrawn some greenish* pus and bubbles of gas of a very fœtid odour may escape. In these circumstances, the cannula should be carefully held in position, and the operator should, if needful, enlarge the aperture downwards so as to drain the abscess in a dependent position. The dura being incised, a director passed into the abscess cavity will freely open it, and it may afterwards be gently irrigated with warm boracic fluid. A drainage-tube of appropriate size should be inserted and brought out through an opening in the base of the flap. Any cerebral or meningeal vessels that bleed can be readily ligatured by passing fine catgut beneath them with a small curved needle. The parts should be well dusted with iodoform, the flap replaced and accurately sutured with horse-hair. Speedy union takes place. The abscess cavity can be well-irrigated through the tube, and, if only the operation is done in time, recovery may be hoped for. I would venture to insist especially upon very complete drainage in these cases, and should not hesitate to remove the bone very freely with strong cutting-pliers in order to effect this. Macewen used decalcified bone tubes. Barker advises tubes of silver, for drainage in these cases. Mr. Dean and others have pointed out that a temporo-sphenoidal abscess can be reached from an opening over the mastoid, which also exposes the lateral sinus and cerebellum. Personally, I should prefer to make the opening as close to the abscess as possible, for I have

* The colour and odour are probably due to the presence of a special micro-organism. See an excellent and important paper by Kanthack in *Archives of Otology*, vol. xix.

witnessed several fatal results in these cases from inefficient drainage.*

Fallacy of using too fine an exploring syringe in cases of cerebral abscess.

I have quite lately experienced the fallacy of using too fine an exploring instrument in cases of supposed abscess. On Sunday, August 26th, 1894, I trephined a girl, who had necrosis and granulations in the left tympanum, with left ptosis, severe headache, shiverings, a subnormal temperature, and general mental confusion. She had no optic neuritis. No abscess was found. The cerebral symptoms culminated in coma, and she died in two days. At the autopsy, Dr. Rolleston found a cerebral abscess exactly under the trephine aperture, and the exploring syringe must have entered it, but being of fine calibre, the hollow needle had become blocked. This imperfection of an instrument probably spoiled an otherwise highly successful case.

The unfortunate and frequent co-existence of cerebral abscess and general purulent meningitis has been noted. It is often exceedingly difficult, in any given case, to differentiate between these conditions. Very acute pain, fever, rigors, and sweating, irregularity of pulse, "Cheyne Stokes" respiration, and especially oculo-motor paralysis, are important signs of meningeal inflammation. In cases where meningeal exudation is poured out with great rapidity, as is well pointed out by Wilks, pain is not such a marked symptom as rapidly-advancing coma and general paralysis. Abscess usually occurs in old cases of

* Should no abscess be found, and the symptoms are strongly marked, the trephine may be applied over the cerebellum well below the superior curved line. From neglecting this, I once allowed a patient to die unrelieved. The abscess was not in the temporo-sphenoidal lobe, but the cerebellum, and was first missed by the ordinary temporo-sphenoidal exploration. This case was under the care of Surgeon-Major Robinson, of the Scots Guards.

perforative otorrhœa without exciting cause, so far as is known. Meningitis comes on in acute tympanic suppuration, or, if it complicates old otorrhœa, there is especially likely to be a history of cold, blows, sea-bathing, or an operation, as the removal of a polypus.

Abscess is insidious in its onset, and dubious in its symptoms. Meningitis is, in its symptoms, more alarming and evident to the practitioner and attendants. When abscess and meningitis co-exist, the symptoms of the latter predominate and conceal those of the former. Although it has been recommended to operate in cases of general meningitis, the chances thus afforded to the patient must be very small. Anyone who has examined these cases post-mortem, will not fail to note the extension of the inflammation, with its greenish purulent exudation, all over the base of the brain, into the ventricles and down the cord. It is therefore very important to trephine early, before general spread of inflammation has occurred. If the surgeon be fortunate enough to find a localised collection of pus, the patient may do well.

There is no doubt whatever that energetic early treatment may prevent the onset of meningitis. Especially is this the case when the products of inflammation are pent up, as by a large polypus or a sclerosed mastoid. Accordingly, if a free exit to pus be afforded in cases of disease of the middle ear, so much the less likely is meningitis to occur.

The following case is quoted as an instance of the extreme clinical difficulties which often surround cases of "head symptoms" associated with otorrhœa.

Case 12.

CASE OF LEFT OTORRHŒA ASSOCIATED WITH RIGHT UNILATERAL DISORDERLY MOVEMENTS OF THE HAND AND FOOT. DIFFICULTY OF DIAGNOSIS. ULTIMATE IMPROVEMENT.

A discharged soldier and ex-policeman, aged 29, was under the care of Dr. Mitchell Bruce in Charing Cross Hospital on 25th October, 1892. Patient has never had syphilis or "sunstroke," and, though he had a fall from his horse, there is no certain evidence of old head-injury. Says he was discharged from the police on account of giddiness and attacks of cerebral confusion. Three months before admission he noticed his right side getting weak, with slight involuntary movements of the fingers. This increased and spread to the right foot and leg. No vomiting or ocular symptoms. The right hand and foot were constantly being moved and shuffled about in a chorea-like manner. There was weakness of the grasp, and the patient declared the movements were uncontrollable. No sluggish cerebration or optic neuritis. The temperature was sub-normal and the bowels sluggish. There was foul discharge from the left ear, a large perforation, and intra-tympanic granulations. Complete deafness was present to watch and conversation. Fork heard on mastoid. No tenderness on percussion over the side of the head anywhere. The patient was treated with large doses of iodide of potassium. A consultation was held over his case. No one would express a positive opinion, but trephining was recommended by several. The patient was discharged somewhat improved on December 8th. He afterwards attended the out-patient department, and his "movements" gradually ceased. He had taken large doses of iodide of potassium throughout his stay in hospital, and there is a possibility that some chronic inflammatory effusion over the cerebral cortex was thereby removed.

This abstract is merely illustrative of some of the curious symptoms associated with cases of otorrhœa. My own idea of the matter was that the man was a malingerer, and to a large extent "traded" on his old ear disease. Had he been a prisoner or a convict, the surgeon in charge would have had great difficulty in deciding the genuineness or otherwise of his symptoms. It may be added that the movements ceased during sleep, so far as the nurse could ascertain.

Purulent phlebitis and thrombosis of the cranial sinuses and jugular vein, with general pyæmia, occur in a small proportion of cases of caries of the tympanum, and especially of the mastoid cells. Thrombosis of the lateral sinus is one of the complications especially to be feared in mastoid caries. These cases are of immense importance to the practitioner, for they are often puzzling and misleading to the last degree. Thrombosis is usually a complication of old cases of otorrhœa. The discharge may have ceased for many months, or even years, and the perforation may have healed. Often the mischief originates in old cases of perforative otorrhœa from a blow on the head, sea-bathing, or some febrile attack such as influenza. The mastoid is usually red and œdematous; a fœtid smell in the meatus is, so far as I know, very commonly present, and a careful investigation will prove that the patient suffered from otorrhœa in early life. The symptoms may often be far advanced before the patient comes under observation; and when he is ill and delirious, with rigors, sweats, and perhaps symptoms indicative of pneumonia, the ear is usually the last part of the body that the medical attendant may think of investigating. These cases are not infrequently mistaken for typhoid fever with head symptoms! Pleurisy, empyema, septic pneumonia, and abscess of the lung, are especially common in them. I have often wondered how many of those cases of fatal septic pneumonia, occurring in supposed healthy persons, may be really due to infective processes originating in a diseased tympanum. Pyæmic symptoms, as severe rigors, and sweating, associated with a patch of pleuro-pneumonia, or pustular eruptions on the skin, should always lead a judicious practitioner to examine the condition of

the ears. Effusions into the joints, especially the sterno-clavicular articulation, may also be present. Curious and anomalous eruptions on the skin (pyæmic rashes) are described and observed. These may be petechial, erythematous, pustular, or roseolous. The "scarlet" rash of bad septic poisoning is indistinguishable from the rash of "scarlet fever." In two cases I have seen, slight general jaundice was present. Locally there will probably be found a fœtid discharge from the ear, "granulations," springing from the tympanum, and perhaps swelling and tenderness over the mastoid. Thrombosis of the jugular will be evidenced by a tender and cord-like swelling, detected on deep pressure, extending down the neck behind the jaw. Care should be taken not to confuse this with glandular inflammation. Redness and swelling over the mastoid, or tenderness on deep pressure, may be associated with thrombosis of the mastoid emissary vein; and the condition of this vein, as pointed out by Barker, is an important clue to the condition of the lateral sinus beneath it. Optic neuritis is present in a considerable number of cases of thrombosis of the lateral sinus. Should symptoms of general pyæmia, especially lobar pneumonia, co-exist with those of meningitis or cerebral abscess, the case is dangerous and hopeless to the last degree. In cases uncomplicated with cerebral mischief the prognosis is grave, but recovery is not impossible, especially in young people or children, after scarlatinal otitis. In such instances one or more joints may be spoiled by suppuration, and the patient have a hard struggle for life, but he will probably ultimately recover.

Case 13.

MASTOID SUPPURATION. THREATENING PYÆMIA, AND DEEP CERVICAL SUPPURATION. TREPHINING OF MASTOID FOR OPENING OF ABSCESS. DESPERATE ILLNESS AND ULTIMATE RECOVERY.

A young man, aged 19, under the care of Mr. Gosse, of Sittingbourne. This patient first came under medical treatment on April 26th, 1892, complaining of severe pain and excessive discharge from the left ear. There was a history of otorrhœa from childhood, and lately he has felt very ill, with rigors and sweats. From the 28th April to the end of May this patient was desperately ill. The temperature varied between 104° and 101°. Repeated rigors occurred almost daily. Pain was described as "excruciating," "awful." Occasional delirium was observed, with rapid emaciation. All surgical interference was absolutely declined. Œdema came on over the neck and the mastoid, about May 19th. May 23rd I saw the patient. He was then desperately ill, emaciated, drowsy, and semi-unconscious. There was an enormous brawny swelling of the left mastoid region and side of neck. Owing to imperfect light, a good view of the optic discs could not be obtained. There was no duskiness of the face or other evidence of pneumonia, or distinct proof of general pyæmic infection. The mastoid cells were opened under chloroform with trephine, chisels, and mallet. The bone was exceedingly thick and sclerosed, and of ivory hardness. Quite half an inch of this dense tissue was cautiously penetrated before foul pus freely escaped. The tympanum was washed through with warm water, and a leaden tube introduced into the mastoid. Strong suspicions of purulent thrombosis of the jugular vein were entertained, but exploration of the neck was negatived by the desperate state of the patient and the amount of swollen tissue to be traversed. It was advised that an urgent watch be kept up for signs of deep fluctuation in the neck. For general treatment, free stimulation and liberal dietary was advised; the sinus to be well washed out daily with warm carbolised lotion. But little immediate improvement followed the operation. On 31st, sensation of fluctuation was felt in neck. A free incision was made, and there was a profuse discharge of putrid pus and disintegrated clots. June 1st to 12th more rigors, with delirium and fresh illness. June 17th

another abscess opened over occipital bone. Improvement now set in, and continued steadily towards convalescence. I saw patient in November strong and well. Scars in neck; no discharge from the ear, but the hearing almost entirely lost. No polypus or granulations to be seen. By daily cleansing he keeps the ear comfortable.

I cannot but think in this instance that suppuration occurred in connection with a purulent thrombus of the jugular vein. The abstract is quoted to show how desperate a case of this sort may, by good care, recover.

In addition to strict antisepsis and cleanliness, a searching examination should be instituted into the possibility of retained pus being pent up within the mastoid. Should there be any evidence of mastoid disease, a free opening should be made into the mastoid antrum. Modern operators have proceeded farther. The wall of the lateral sinus being freely exposed, the surgeon ascertains by palpation the presence or absence of thrombus.* Should the sinus be in a condition of purulent phlebitis, the deep jugular vein should be ligatured in the neck, the sinus opened, and its septic contents evacuated. The jugular vein is best reached about the level of the cricoid cartilage. The operator, if he dissects higher, may expect to find some matting of the sheath, which will embarrass him. The vein should be divided between two ligatures, and the distal end brought out of the wound at the side of the neck. The ligature being removed, all clots and purulent materials can readily be washed out. Before undertaking this operation, the surgeon must be satisfied that hopeless general systemic infection has not already occurred,

* Mr. Lane advises that the sinus should be pricked with a needle to ascertain whether or no the blood is fluid within it. (*British Medical Journal*, June 28, 1890.)

and that the patient is in a proper condition to bear prolonged operative proceedings. These cases are so dangerous that this operation frequently affords the only hope for them. Evident clotting in the upper part of the jugular vein is the main indication for its performance. Optic neuritis is, so far as I have observed, always present in cases where the lateral sinus is blocked.* I here relate a short abstract of a remarkable case of sinus pyæmia, where the thrombosis of the right lateral sinus, from ear disease, was associated with protrusion of both eye-balls and paralysis of the left third nerve. Both cavernous sinuses were filled with clot. The case is a good illustration of the extraordinary symptoms sometimes observed.

Case 14.

SINUS THROMBOSIS, WITH REMARKABLE OCULAR SYMPTOMS.

A patient, aged 25, who had long suffered from right otorrhœa, was seen on March 25, 1892, with Drs. Wise, Smith, and Worthington. The previous symptoms followed influenza, and had lasted about a month. They comprised cerebral pain and discomfort, fever, rigors, delirium, and threatening pyæmia. Dr. Mitchell Bruce had seen the case early, and advised surgical interference, which was declined. On examination, it was noted (1) that the patient was desperately ill, with a jaundiced skin, and in a pyæmic state; (2) that the eye-balls were protruded, as though tumours were behind them, pushing them out; (3) that there was right facial paralysis and left third nerve paralysis. With the ophthalmoscope, optic neuritis was found on both sides. A thrombosed vein was detected near the root of the nose. The man was rational and answered questions promptly. The deep jugular vein was probably also thrombosed, as there was tenderness and swelling in the neck. I declined to operate on account of the extensive clotting over the base of the brain. The patient died some weeks afterwards, and at the post-mortem examination all

* Authors differ on this point.

the sinuses at the base of the brain were filled with puriform clot, extending into the cavernous sinuses, and causing engorgement and protrusion of the eye-balls. Small (embolic) abscesses were found in the cerebral cortex and corpus striatum. Permission was only obtained to examine the head. The case is described in full, with comments, in the *Archives of Otology*, vol. xxi. No. 3, 1892.

The general treatment of pyæmia must be energetically pursued. Efficient nursing, the judicious management of stimulants, and the early opening of secondary abscesses, are matters of the first importance.

In connection with this subject, I cannot do better than quote a summary of the symptoms of sinus pyæmia given by Ballance, who has done so much for the surgery of this affection, in his paper in vol. xiii. of the Medical Society's Transactions :—

(1) A history of purulent discharge from the ear for a period of more than a year. (2) The sudden onset of the illness, with headache, vomiting, rigors, and pain in the affected ear. (3) An oscillating temperature, reaching to 103° or 105° Fahr. and then dropping, say, below 100°. (4) Vomiting, repeated day by day. (5) Second, third, or more rigors. (6) Local œdema and tenderness over the mastoid or in the course of the internal jugular vein. (7) Tenderness on deep pressure at the posterior border of the mastoid, and below the external occipital protuberance. (8) Stiffness of the muscles of the back or side of the neck. (9) Optic neuritis.

To these I would add occasional oculo-motor paralysis, and the presence of thrombosed emissary veins over the mastoid, forehead, face, and scalp. It must be confessed that these cases are at their onset very difficult to diagnose from typhoid fever with

"head-symptoms," especially as it is known that inflammation of the middle ear may, and does, complicate typhoid. The strong rigors and profuse sweats have often led to the erroneous diagnosis of ague, if the patient has lived in malarious climes. The scope of this work forbids me further to follow discussion of this interesting matter, and the knowledge of the similarity of these classes of cases will often serve to guard the practitioner from falling into serious error.

Operations.—In conclusion it will be well to briefly indicate the positions upon the cranium where the trephine is to be applied for the relief and treatment of some of the foregoing serious conditions. In all cases, as preliminary measures, the surgeon will recollect :—

(1) That the most perfect antiseptic measures should be employed; the head must be extensively shaved; the skin cleansed by hot carbolic soap and water, and sponged with ether, and finally swabbed over with a hot (1 in 500) mercuric chloride solution. The ear, probably full of foul discharge, must be well and continuously syringed and packed with iodoform. The hands and nails of the surgeon and his assistant must be scrupulously disinfected. All instruments should be boiled before use, and the exploring trocars and cannulæ especially need careful cleansing.

A large flap, with the base towards the entrance of the main vessels, taking up every structure down to the bone, is generally preferable to a cruciform incision. Any large vessels which spirt may be thus easily reached and secured, but general oozing, which is always free, may be disregarded. As regards the trephine to be employed, there is great difference of opinion. An electro-motor is perfect in its action, but,

except in large cities, is seldom obtainable. I advise a small trephine opening, which may be made with a

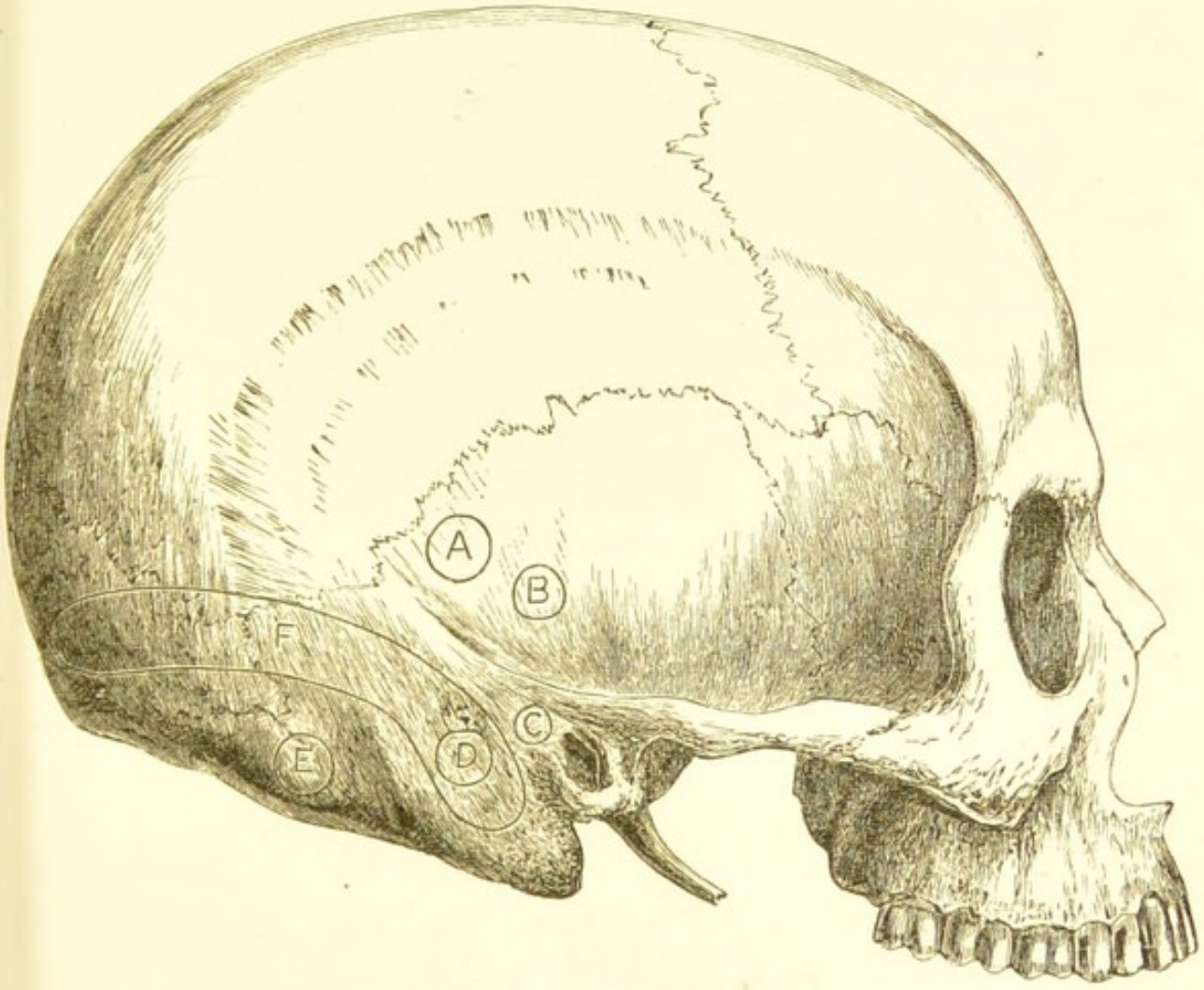

Fig. 27.—Diagram of Side of Skull.

A, Position of opening tempore-sphenoidal abscess advised by Barker, 1¼ inch above, and same distance behind, centre of meatus; B, position chosen by author, 1 inch above, and ¾ inch behind, meatus; C, spot for opening mastoid; D, opening, a full ½ inch behind meatus, exposes sigmoid sinus (this may be enlarged forwards into mastoid, and the cerebellum and temporo-sphenoidal lobe can be explored from it); E, opening well below the sinus, to explore the cerebellum.

sharp hand trephine, and subsequently enlarged, if needful. The flap should be accurately adjusted, and a counter-opening for drainage made through its base. Immediate healing is the usual result.

(2) To trephine over the temporo-sphenoidal lobe

(Fig. 27), the usual site of abscess in ear disease, turn down a large flap and apply the trephine at a point one inch above, and three-quarters of an inch behind, the auditory meatus. If a large trephine be used, Barker's point had better be selected, one inch and a quarter above, and the same distance behind, the meatus.

(3) To trephine over the anterior surface of the petrous bone, as for meningitis, take a point one inch vertically above the centre of the meatus.

(4) To trephine over the cerebellum, take a point an inch and a half behind, and one inch below, the centre of the meatus.

(5) To expose the lateral sinus, apply a large trephine a full half-inch behind the meatus, in a line drawn from its upper margin. Should the sinus be found full of clot, and the mastoid be carious, the bone should be cut away freely towards the auricle. For this purpose angular cutting forceps of great strength are required. Opening the mastoid antrum will be again alluded to.

CHAPTER IX.

AURAL POLYPUS.

FREQUENT reference has been made to the subject of aural polypus as a common association and complication of cases of perforative otorrhœa. The nomenclature of these growths has been sufficiently extensive. They have been classified according to their structure, colour, and consistence. Hence we read of the fibrous polypus, the fleshy polypus, the "raspberry polypus," and the like. Aural polypi may originate in the external auditory canal; others, and probably the majority, grow from the tympanic cavity through a perforation in the membrane. Being soft and vascular, these growths expand beyond the membrane, and fill the canal, gradually projecting outwards, a narrow stalk attaching them to the walls of the tympanum or, more rarely, the ossicles. In minute structure they are largely composed of embryonic connective tissue, covered on the surface with squamous epithelium. Some polypi are soft and gelatinous (myxoma). In cases of slow growth, a higher grade of development into fibroma is met with, but true sarcomatous polypus is exceedingly rare. The obstinate recurrence of these growths, after removal, is not due so much to their structure, as to a persistence of the morbid conditions, especially caries and otorrhœa, from which they originate. A soft, small polypus is easily overlooked, and will keep up an otorrhœa indefinitely. The fibromatous polypus is often so large as to absorb the walls of the canal by

pressure and project from the meatus. It may be covered with epidermis, and this form of growth seriously impedes the exit of pus from the tympanum, giving rise to such symptoms as giddiness, pain in the head, vertigo, epileptiform attacks, and vomiting. Mastoid suppuration is likely also to ensue. The pressure of the growth and accumulated discharge on the ossicles, may originate the most distressing tinnitus. The diagnosis of polypus is usually extremely easy. When these growths are large, they are visible to unaided inspection; when small and deeply-seated, they are only to be detected after good illumination and careful cleansing of the parts with cotton-wool and probe (Plate III. Figs. A, B, C). In the case of a large growth, the site of its stalked attachment can usually be judged by its mobility, and by passing gently around its circumference a fine probe. If it springs from the tympanic cavity, the probe can be passed to a corresponding depth.

Few cases in surgery give more satisfactory results than those in which the removal of aural polypi are concerned. Few are more difficult to manage satisfactorily. It must be remembered that these cases are never devoid of the risks which have been already hinted at in operative proceedings connected with old ear-disease. It is a safe rule never to operate upon aural polypi, without careful preparatory treatment, unless urgent symptoms of retention of discharge compel one to act immediately.*

In cases of polypus associated with severe cerebral symptoms, the surgeon is often placed on the horns of a dilemma. The greatest diversity of opinion is often

* See a clinical lecture by myself in the *Lancet*, May, 1892.

PLATE III.

A.—Large, soft, lobulated polypus, appearing in the auditory canal.

B.—Deeply-seated polypus, as seen through a large speculum.

C.—Small polypoid growth within the tympanic cavity.

D.—Dark-coloured cerumen.

E.—Light-coloured cerumen.

F.—Multiple aural exostoses, enlarged.

G.—Small yellow pebble embedded in the auditory canal of a boy.

H.—Post-scarlatinal otorrhœa. A fringe of the drum is left, the ossicles are discharged, and the inner surface of the tympanum is red and bare.

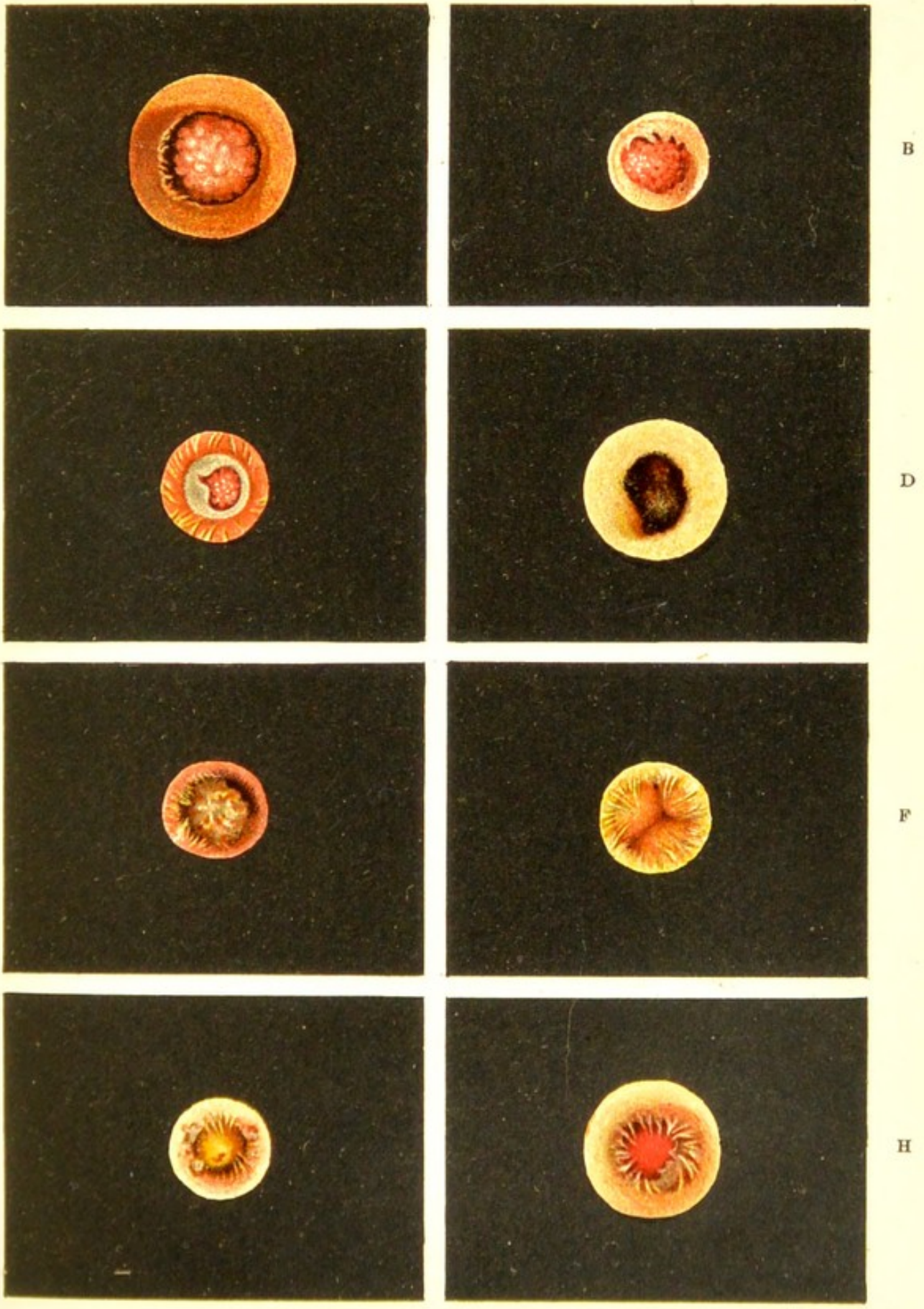

PLATE III.

expressed as to the propriety of operating in these instances. Personally, I should usually urge immediate operation. Any definite signs of meningitis or pyæmia will make the prognosis the more grave and more guarded. Polypus cases are sometimes only brought to the surgeon, when cerebral mischief has actually commenced; and then, should the growth be removed, the operator may be blamed for the death of the patient, really due to pre-existent meningitis. Great care should be taken to discover the presence or absence of cerebral troubles, and the prognosis fashioned accordingly. Oftentimes, however, after the removal of a large polypus, a quantity of inspissated secretion escapes, and immediate relief is afforded to the most threatening and most urgent symptoms. The operation of opening the mastoid antrum should always be performed, should there be any symptoms of retention of pus in this cavity.*

In old-standing cases, where the symptoms are not urgent, the surgeon will remember that, in removing a polypus, he leaves a breach of surface and open vessels, to be bathed and soaked in the most septic and virulent discharge. Accordingly, it is always wise, if possible, to institute a preliminary cleansing of the ear for at least three days prior to operation. In addition to the careful use of the syringe, the parts should be inspected and cleansed by the surgeon himself. The ear should thrice daily be filled with a tepid solution of some antiseptic fluid, and this should be allowed to soak and percolate far into the canal for

* See especially a paper by the author in the *Lancet* for 1891, vol. i. p. 307, on a case of aural polypus accompanied with mastoid suppuration and threatening thrombosis of the lateral sinus; perforation of mastoid cells; removal of the polypus; cure.

thirty minutes at a time. The effect of these measures will be to diminish the discharge and to cause some shrinkage of the polypus. The surgeon will also obtain a more clear idea of the connections and consistence of the latter, and of the appropriate measures to be employed. A proportion of alcohol mixed with the lotion generally aids in shrinkage, but not enough should be added to cause pain.

Illustrative cases of the danger of removing polypi.

In the winter of 1883 I assisted a surgeon in the country to remove a large fleshy polypus which had existed for three years in a girl, aged eighteen. She had long suffered from otorrhœa. The removal was effected by the snare with comparative ease, and the girl returned home, a distance of some miles. There was a bitter east wind. On the following day she was attacked with severe pain in the head, rigors, and vomiting, and, despite all treatment, these symptoms continued; distinct symptoms of meningitis, as squinting and retraction of the head, manifesting themselves on the fourth day. She died on the sixth day after the operation in a condition of deep coma, doubtless from purulent meningeal exudation.

In April, 1892, I removed a large polypus from a girl, aged eighteen, the subject of congenital syphilis. Great relief followed the operation, and for a fortnight all her symptoms were satisfactory. I then received a letter from a practitioner, informing me that he had been called to this girl, to find her seriously ill from meningitis, ending in deep and fatal coma.

I am cognisant of like cases having occurred in the practice of others; but, out of a large number of operations, these are the only two fatalities which have come under my immediate notice.

Treatment. — Polypi of large size are easily removed. Polypi of small size that are deeply-seated, soft, and vascular, are most difficult to deal with, and there are few cases in surgery that require more skill, dexterity, and patience. Any polypus that markedly

projects into the canal, and moves readily upon pressure with the probe, is, generally speaking, a case for the snare. The firmer the growth, the more easy the removal. Red, florid, extremely soft growths are more difficult to enclose with the loop. The snare I

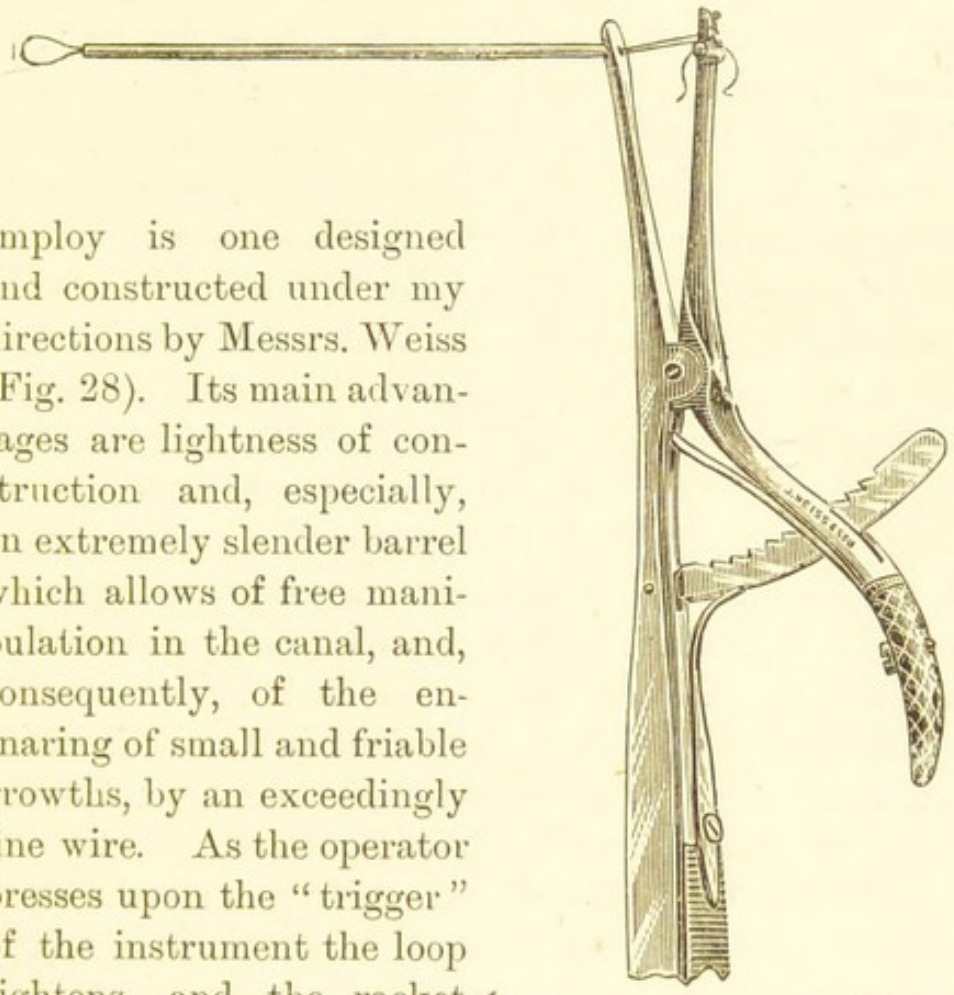

Fig. 28.—Aural Polypus Snare.

employ is one designed and constructed under my directions by Messrs. Weiss (Fig. 28). Its main advantages are lightness of construction and, especially, an extremely slender barrel which allows of free manipulation in the canal, and, consequently, of the ensnaring of small and friable growths, by an exceedingly fine wire. As the operator presses upon the "trigger" of the instrument the loop tightens, and the racket apparatus prevents any slipping. The loop, before being used, should be moulded over a speculum to the appropriate size and shape of the polypus. The most convenient position is the recumbent one, upon a high couch, the head being well raised. Strong daylight, if obtainable, is the best, and the couch should be placed sideways to a window. In London,

however, we more often have recourse to artificial light. I have operated in several cases with the electric forehead light, but this is costly and apt to go out of order, and for all practical purposes a powerful lamp with a large forehead mirror answers every purpose. The use of an anæsthetic is generally advisable, and the risk of igniting ether vapour from the lamp-flame will not be forgotten. Prolonged soaking with a 20 per cent. solution of cocaine, certainly greatly lessens the sensibility of the softer growths originating from within the tympanum, and I have often operated under its influence. The matter of illumination has been much dwelt upon because it is most essential that a complete view of the parts be obtained and maintained. Any groping in the dark or the making of chance "plunges" with the snare or forceps is tolerably certain to lead to complete failure in the operation—or worse. Should the polypus be cut off or twisted from its attachments? In contradiction to the practice of many, I believe that a rotation of the pedicle is advisable, and this, followed by traction, will often, especially in large polypi, bring away the entire growth, pedicle and all.

Method of rotation.—Mobile growths with slender pedicles may be treated in this way. The surgeon simply twisting the polypus upon its own axis a variable number of times in the same direction, the growth undergoes death and degeneration from torsion of its vessels, and is ultimately spontaneously extruded. Spontaneous extrusion of a polypus may take place from actual growth outwards and attenuation of its pedicle. Precisely the same termination is observed in polypus of the uterus.

Removal by forceps.—Small, soft growths

are extremely difficult to ensnare. For these forceps are infinitely the best. Toynbee's lever-ring forceps are still largely employed, but they are scarcely strong enough in the grasp, to extract the growth properly. The ring forceps of Hinton have long been in use, but the same failing attends the action of this instrument. A modification of these forceps has been made for me by Messrs. Weiss (Fig. 29). The construction of this little forceps renders it impossible for any small, soft growth to escape from its clutches. In addition to the ordinary serrations, a small double catch, similar to that of an artery forceps, is fashioned on the ring. In the handle is a clamp catch. The action of these forceps can best be explained by inspection. Since adopting them I have ceased to have any trouble with the extraction or complete laceration of small deeply-seated growths. They are also most useful in extracting fragments of a polypus left after removal by the snare.

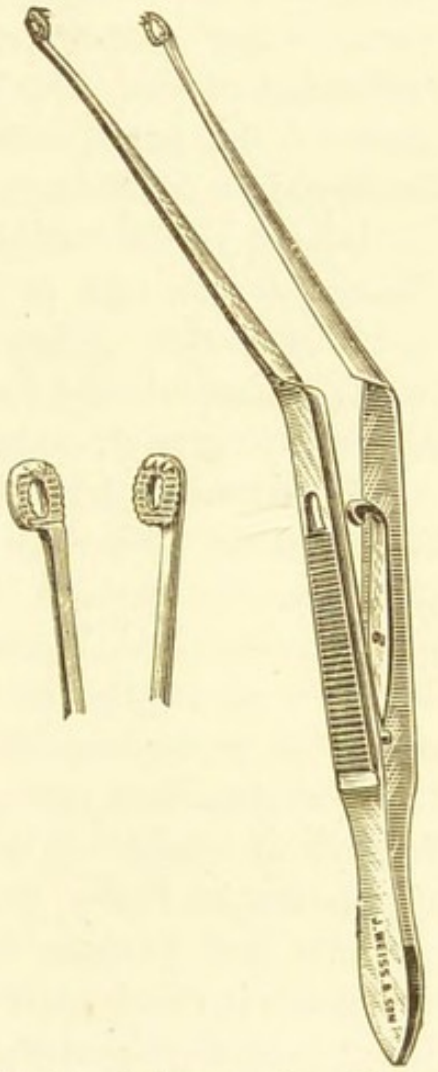

Fig. 29.– Polypus, or Granulation Tissue, Forceps.

Hæmorrhage after extraction. — Smart bleeding frequently occurs from the canal, when a polypus is removed. This is salutary, and may be

allowed to continue. It usually soon ceases spontaneously, and then the canal may be gently syringed with warm water, and plugged with wool. For the first three days the patient should be confined to the house, and the ear gently syringed thrice daily with warm water containing some antiseptic. At the expiration of this time a careful inspection should be made of the parts, and any remains of the polypus destroyed by caustics.

I have no hesitation in affirming that the after-treatment of a case of aural polypus is as important as the operation. These growths are as a rule obstinately recurrent, and too much pains cannot be spent in destroying any remnants of growth.

Treatment by caustics.—The caustic agents employed are numerous. Those most worthy of mention are, the potassa fusa, solid nitrate of silver, glacial acetic acid, liquor plumbi, perchloride of iron, sulphate of copper, and pure chromic acid. Some operators prefer one remedy, some another. All of these applications are good; all are powerful agents for evil, if unskilfully applied. Following the recommendation of Dalby, I almost invariably apply pure chromic acid in these cases. A small "bead" of the substance is fused upon a fine bent probe. The parts being carefully dried and well illuminated, the probe, coated with the acid, is pressed gently upon the growth and into its substance. A vulcanite speculum had best be employed. The pain induced is variable, and depends largely upon the ability of the operator to confine the application of caustic to morbid tissue. A syringe full of warm water should be at hand, and, if the suffering is unbearable, the ear should be gently irrigated, which at once eases the pain. It is better to

do too little at one sitting than too much, and the repeated application of the agent to the "stump" of growth itself should be especially aimed at. A caustic-holder like a small crayon has been constructed for me by Messrs. Weiss (Fig. 24); with this instrument any solid caustic substance can readily, and with certainty, be applied. The ear should be syringed with warm antiseptic fluids daily, and the operator will be rewarded by finding the fragments of disintegrated growth coming away in the fluid. Small polypi may be readily removed in this way in patients who are nervous of instrumental interference. The potassa fusa is a most potent caustic, and great care must be used in its application. I have used it with success by placing a piece the size of a No. 1 shot in the small "crayon," used through a speculum, pressing the caustic upon the growth. It is most essential here that the canal and adjacent parts be carefully dried with cotton-wool. The liquor plumbi may be applied with a fine camel-hair brush, and is an efficient remedy. Before applying any caustic to a small growth, it is well to lacerate and break it up with the catch forceps, as the chemical thus the more readily passes to its interior.

Case 15.

POLYPUS WITHIN TYMPANIC CAVITY (PLATE III. FIG. C). CONSTANT VOMITING AND GIDDINESS. TREATMENT BY CHROMIC ACID, WITH DESTRUCTION OF POLYPUS AND GREAT RELIEF TO SYMPTOMS.

A patient of Mr. Hughes Davies, of the Bow Road, aged 42, wife of a tradesman. There was a history of old ear-troubles, with aching and discharge on both sides. In September, 1892, she had a severe cold and ear-troubles became much aggravated. I saw her with Mr. Davies on December 21st, 1892. She was then very deaf, in much suffering, with profuse bilateral

discharge. Occasional attacks of giddiness and vomiting were experienced, the latter being of an alarming nature, but no other symptoms of cerebral mischief were present. The discs were normal. I found in the left ear a reniform perforation, and a florid polypus, the size of a small pea, could plainly be seen filling the tympanic cavity on the other side of the drum. It was sessile, and seemed to grow from the posterior wall forwards. The right membrane was perforated, the perforation being of ancient date. The treatment first adopted was free of mercurial purgation: bromide of potassium at nights, warm carbolised syringing and soaking the left ear with a spirit and carbolic lotion. Under this treatment she rapidly improved, and the "head-symptoms" disappeared.

On January 14th the polypus had shrunken considerably, and the pain and discharge were less. The general health had markedly improved. January 29, 20 per cent. cocaine was well soaked into the ear for ten minutes, and then I passed the "bead" of chromic acid into the centre of the growth, through the aperture in the membrana tympani. Very severe pain, tinnitus, and vertigo at once ensued, and continued for some days. No treatment beyond warm syringing was adopted.

March 17.—The patient visited me; for the last three weeks she had been using the dry treatment, blowing finely-powdered iodoform and boric acid into the ear. The polypus has now quite disintegrated and disappeared; there is a large destruction of the membrane; the discharge is scanty and sweet. The cotton-wool pellet was applied, and she at once heard conversation fairly well. She was advised to wear iodoform wool pellets, and to avoid further syringing the ears. The general health had much improved. When last I heard of this patient her improved condition was maintained.

After-treatment of polypus cases.—When the surgeon believes he has destroyed all the growth, he may give his patient a respite from active treatment for about two months. During this time the ear must be carefully protected from cold, gently syringed with warm water and some very dilute astringent "soaked" in the canal at night. I have

found nothing better for this purpose than the dilute liquor plumbi diacetatis mixed with equal parts of warm water. If, on the other hand, there should be no discharge, finely-powdered iodoform mixed with tannin should be insufflated, and the ear cleansed with wool. At the expiration of two or three months the ear may be again carefully inspected. The surgeon may expect, if the primary treatment has been efficient, to find a marked improvement in the local and general condition of his patient. There are few cases, however, where the local and general treatment of perforative otorrhœa must not be carried out for a considerable time. Yearsley's pellet may be applied should a "dry" perforation remain. If, on the other hand, the growth shows a tendency to recur, it may again be carefully attacked with caustics. It is evident, therefore, that the proper and efficient treatment of a case of aural polypus extends over many months, and carelessness in the after-treatment is certain to lead to recurrence of the disease, disappointment to the patient, and loss of repute to the surgeon.

Polypus springing from walls of canal.—Should the polypus obviously spring from the bony canal, an examination of the part from whence it originates should be made with a probe immediately after removal. Any carious bone that may be felt should be, if possible, removed by a small, sharp curette, which, in the canal, may be used with comparative freedom. Caustics are to be more freely and readily applied in these cases, and the disorganisation and destruction of the growth can be more complete. The galvano-cautery also may be used to the "stumps" of extra-tympanic polypi.

Granulations.—It is now convenient to speak of granulations within the tympanic cavity. These are commonly met with, when the drum is extensively destroyed, and otorrhœa has existed unchecked for many years. The novice will recollect that a polypus is a growth of definite size and shape; granulations are multiple, florid, of various sizes, easily bleeding, often excessively sensitive to the touch of a probe. I draw especial attention to this subject because, so far as I know, authorities have not given it that prominence which, in practice, it deserves. Those who have experience in the post-mortem rooms of our metropolitan hospitals, will know that these are the cases commonly associated with caries of the walls of the tympanum, in which cerebral complications are common, and to which active local treatment must be applied with the utmost caution. Even warm antiseptic syringing must be tentative, for it sometimes occasions pain and inflammation. The insufflation of fine powders, especially boric acid, alum, tannin, and iodoform is often very advantageous, the parts being dried and cleaned with small fragments of cotton-wool. Often the mastoid cells are filled with caseating material. Should there be evidence of mastoid tenderness and inflammation, a free opening is generally advisable. Indeed, especial attention should be directed to the mastoid in all cases of granulations and polypus, especially in children. It is useless to direct attention to these growths, whilst leaving pent-up secretion within the mastoid cells. After a free opening has been made into the mastoid cells and the middle ear washed through the meatus, granulations will often shrink and disappear in a remarkable manner. After some days of the most

persistent cleansing, should the parts be tolerant, the granulations may be "picked" away with the ring forceps and weak astringents applied. So soon as a free exit for discharge is made, the surgeon, recognising the probably incurable nature of the case, will wisely be content with carefully pointing out to the patient those general and local directions that will best ensure his comfort, and safety from cerebral complications.

Some surgeons remove granulations with a small curette. I prefer a tiny ring-knife (Fig. 24), followed by chromic acid. It is wise not to attempt to remove necrosed bone from the tympanum in cases of granulation growth unless, by probe or sight, a definite loose sequestrum is observed, as a carious malleus or a scale of dead bone.

It has been already pointed out that true sarcomatous polypus is very rare. I have related a case* where the microscopical evidence was in favour of sarcoma, but the patient, a young lady, still remains perfectly well after removal. Epithelioma is the form of malignant disease which is sometimes found springing from the tympanum. There is rapid increase of fungation, and a foul watery discharge, which is very characteristic. The patient, pale and emaciated, experiences agonising pain. Facial paralysis is common. The glands in the neck are involved, and death from exhaustion or invasion of the cerebral cavity closes the scene. The symptoms are very evident, and the disease sometimes occurs in comparatively young people. The treatment must be conducted on general principles.

* *Archives of Otology*, 1891.

CHAPTER X.

SOME IMPORTANT AFFECTIONS OF THE MASTOID BONE.

THE affections of the mastoid are principally inflammatory, and reference has been made to them from time to time in dealing with such affections as otorrhœa and polypus.

Periostitis.—Periostitis over the mastoid may be acute, sub-acute, or chronic. Acute primary periostitis, apart from affections of the adjacent bone, is very rare. Cases are reported from cold, blows, and after the specific fevers. I have myself seen one instance following scarlet fever, and considerable necrosis resulted; the middle ear was declared to be healthy, and the case seemed on a par with the acute infectious periostitis observed in the long bones of children. In the vast majority of cases acute mastoid periostitis is associated with mischief in the auditory canal or tympanum, inflammation spreading from the bone by direct continuity of tissue. In low conditions of the system associated with perforative otorrhœa—as the cachexia following fevers, bad syphilis, tuberculosis, or diabetes—mastoid periostitis and necrosis may assume very formidable characteristics. Tubercular disease of the mastoid may be primary.

The symptoms are those of acute periostitis elsewhere, excepting that, from the density of the aponeuroses and periosteum, the tension and agony are very marked. The affection commences with violent pain, high fever, and usually rigors. Locally, there is swelling, heat, redness, and exquisite tenderness.

The cervical glands are swollen and painful, and there is much stiffness of the muscles of the neck. As the inflammation progresses, all these symptoms become intensified; the patient, despite narcotics, becomes sleepless and delirious from the agonies he endures. Finally a red, hot, exquisitely tender, and brawny swelling may extend over the scalp and towards the forehead, the skin becoming glazed and shining. The auditory canal is closed, and the auricle, being pushed forwards, seems to stand out at right angles to the head. If no incision be made, fluctuation will be ultimately detected. Gangrenous sloughs of the skin appear, and finally a quantity of pus is discharged from one or more openings. The periosteum is found separated from the bone beneath, which is probably rough and carious. In neglected cases of mastoid periostitis with suppuration, pus is very apt to burrow extensively beneath the cervical fascia, and among the deep muscles of the neck, leading to the formation of intractable sinuses. Death from pyæmia is no infrequent result. Exceptionally, the matter may find its way into the auditory canal through the posterior wall. It is often difficult to ascertain to what extent the bone is implicated in these cases. I believe that acute inflammation of the mastoid cells is commonly combined with periostitis, the mischief spreading by continuity of tissue. If there is a previous history of otorrhœa, and especially if there have been other attacks of mastoid pain or marks of old sinuses, implication of the bone is tolerably certain.

The treatment of this formidable malady should be prompt. Too often the practice is adopted of lulling pain by powerful doses of morphia, and applying poultices over the affected region. Under nitrous

oxide gas a free and deep incision (Wilde's incision) should be made vertically downwards behind the auricle. The point of a strong scalpel should scrape hard upon the bone. The bleeding will be very free, and had better not be checked. Should the posterior auricular artery be divided, a clamp may be placed upon it temporarily, but the size and importance of this vessel are greatly exaggerated. When the bleeding has moderated, the incision may be stuffed with iodoform gauze, and a large antiseptic dressing applied. The relief afforded to the symptoms by this proceeding is often marvellous, the patient immediately falling asleep and all pain vanishing. If, however, pus should be pent up within the bone, the symptoms will persist, and it will then be requisite to proceed to open the antrum. Should the surgeon contemplate opening the bone—and from what I have seen this is usually advisable—more prolonged anæsthesia must be induced. Should the patient, as is probable, be very ill and exhausted from fever, pain, and sleeplessness, chloroform or the A.C.E. mixture given in a cone will be found the most suitable anæsthetic. A large horse-shoe-shaped flap had then better be turned down, so that the bone may be freely exposed. Before making the mastoid incision, the hair should be shaved and the parts well cleansed with a hot solution of 1 in 1,000 corrosive sublimate. If the surgeon have reasonable suspicions that the mastoid itself is affected, he had far better open into the bone at the time, than subject the patient to a second operation. Should abscess have formed in the neck, it must be freely opened, and large counter-openings must be made in whatever directions the pus has burrowed.

The operation of opening the mastoid cells is one of great antiquity, and it has been much abused both in the breach and the observance. The indications for its performance are often not very clear, and at the termination of this chapter certain rules will be formulated which may generally guide the surgeon. The methods of performing the operation are very numerous, and the instruments employed vary much in nature. Thus, while one author advises an electro-motor drill, another supports a special perforator, while a third makes use of a simple carpenter's gimlet. The fact is, that any strong-pointed instrument can by perseverance be worked into the mastoid cells, and we can best decide what operation to adopt, by reflecting upon the indications to be carried out. These are, firstly, the making of an opening into the mastoid sufficiently large, not only to allow of the escape of pus, but also to permit the evacuation of "cheesy" *débris* or of sequestra. Secondly, to make this opening in such a way as not to imperil the sigmoid sinus or the contents of the cranial cavity. All small pointed instruments have this disadvantage: that the operator cannot see the structures he is penetrating, and hence, when some thickness of bone has to be traversed, he loses confidence as the sharp instrument passes deeply out of his sight. If, on the other hand, he perforates the bone rashly, he will sooner or later wound the lateral sinus. The mastoid cells differ exceedingly in number, size, and especially in their depth from the surface. The position of the sigmoid sinus and the thickness of its bony parietes are very variable. In some cases this great venous channel makes an abrupt forward bend close behind the auricle, being covered by a shell of bone only a few

lines in thickness. The danger of wounding the sinus in operations is then considerable. It is a safe rule in practice, and one I always adopt, to imagine, when operating, that the sinus may be exactly under the spot one has selected, though on anatomical grounds it should be remote from it. The numerous and extensive researches that have been made by anatomists on this subject, have resulted in general rules whereby, from the shape of the skull and measurements, the depth and position of the sinus can be estimated. Exceptions to strict anatomical rules are, however, not infrequent, and a judicious operator will take this into account, and will rather trust to operative skill and cautious procedure, than to preconceived ideas which, in any given case, may lead to undue security and surgical disasters.

Author's method of operating.—The following is the method of opening the mastoid antrum adopted by myself. The parts are well cleansed and shaved. The instruments (which are to be previously immersed in boiling water and soaked in carbolic lotion) are as follow :—A strong scalpel, a sharp trephine of the diameter of a sixpence, a set of small finely-tempered gouge-chisels (Fig. 30), a hammer or mallet, a strong blunt probe, a set of sharp and blunt spoons (Fig. 30), a powerful syringe with a fine nozzle, a piece of leaden tube of the diameter of a crow-quill, artery forceps, clamps, retractors, ligatures, needles, and sutures of fishing-gut and horse-hair. A plentiful supply of hot water, antiseptic lotions, and iodoform should be at hand. As an after-dressing, I have found nothing superior in these cases to iodoform-gauze covered with a large pad of cotton-wool.

The patient being anæsthetised, I turn down a

large flap from the mastoid, so as to expose freely its whole surface up to the attachment of the cartilaginous canal with the bone. Any large vessel is readily secured, and the free oozing will soon be checked by hot-sponge pressure. Should a soft spot be detected or a sinus exist, the operator will, with a small gouge, cautiously follow the channel indicated, enlarging the sinus sufficiently to pass the blunt spoon into the cavities. Should no such indication exist, the trephine is placed on the bone, with its centre in a line drawn backwards from the upper margin of the meatus, and as near the bony canal as is possible without opening it. Working with a light hand, I remove with the trephine the compact tissue only, and even in cases where the bone is peculiarly hard and dense I never penetrate with this instrument to a greater depth than quarter of an inch. With the small, sharp gouges I next chip away the edges of the trephine opening and cautiously deepen its centre, removing layer after layer. The direction of the opening should be downwards and forwards, and absolutely parallel with the course of the canal. The instruments will then be directed well away from the sinus. After every layer of bone is removed, an attempt may be made to push a probe into the cavities. This will sooner or later succeed, and on withdrawing the instrument, pus will

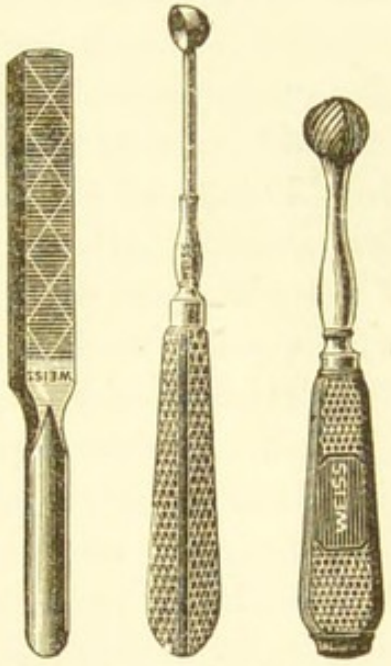

Fig. 30.—Small Gouge, Spoon, and Rose-headed Burr for Mastoid Operations.

probably escape, and free oozing will occur. With the sharp spoon the opening is now enlarged, and, small blunt spoons being passed into the cavities, as much *débris* as possible is evacuated. The syringe, filled with hot carbolised fluid, is next inserted into the opening, and the injected stream may issue from the meatus, carrying with it pus and blood. The head should be on the side during this manœuvre, lest fluids pass down the Eustachian tubes into the air-passages, which is always embarrassing to the anæsthetist. The operator need not be surprised if syringing by the mastoid opening fail to carry out pus by the meatus. In old cases of disease the normal openings between the mastoid cells and tympanum are often blocked. The cavities are packed with iodoform, and wiped out with pure carbolic acid, on small pledgets of wool. The drainage-tube is now inserted. I prefer it made of lead. It should pass out through an opening in the base of the flap, and the portion that projects may be split on each side with the scissors, and turned down upon the skin. The after-treatment simply consists in careful dressing and cleanliness, the tube being well syringed through twice or thrice daily. I am strongly in favour of prolonged drainage in these cases. Several of my patients have worn the tube for over twelve months with benefit.

In children the compact bone covering the mastoid is small in amount, and the antrum can often be easily entered by a stiff probe after removing the compact tissue.

In old cases of otorrhœa in adults, when many attacks of mastoid inflammation have occurred, and especially when puckered scars indicate the existence of former sinuses, the surgeon may expect to find the

mastoid bone much altered. Indeed, it may be converted into a mass of dense, very hard tissue, devoid of any definite cellular cavities. If pus should form deeply in such a bone as this, the symptoms are most severe, and the results correspondingly dangerous. It is almost impossible for the pus to work its way to the surface through the dense wall of bone. Great difficulty will be found in operating upon these cases. The bone is so hard that it is not easy to get instruments to cut it, and the operator may penetrate even to the depth of three-quarters of an inch without finding pus, or traces of cellular cavities of any kind. He had then better desist, and probably the opening in the sclerosed bone will give the desired relief, or pus may afterwards flow from the opening. In these cases, the outer compact layers must be freely removed with a larger trephine, or by the free use of a highly-tempered gouge. On opening the mastoid antrum, very free hæmorrhage is not infrequently encountered. In cases of very acute inflammation I have seen bright arterial blood spurt forth with vehemence and distinct pulsation, so that alarm and apprehension might easily be excited in the mind of an inexperienced surgeon. Syringing with hot water readily checks this bleeding, which is highly salutary.

Wound of the sigmoid sinus may easily occur in opening the mastoid cells, though the risk of it should be reduced to a minimum by careful operating. This accident once occurred to myself, and was solely due to the trephine having been applied a little too far behind the meatus. In this case, the sinus was far forwards, and the bone covering it extremely thin. The symptoms are alarming and unmistakable; a jet of dark venous blood will rise

to the height of several inches, ebbing and flowing with the respirations of the patient. Plugging with iodoform-gauze readily controls the bleeding, and the sinus has been wounded on many occasions by different operators without untoward result. The dangers of septic phlebitis are, however, not to be ignored, and the accident is correspondingly serious. In cases of mastoid abscess where fistula or swelling indicates that the collection of pus is close to the posterior wall of the auditory canal, an opening may here readily be made into the cells. A short wide speculum may be employed, and the operation performed with a strong, curved, sharp spoon.

Necrosis.—Necrosis of the mastoid is commonly associated, to a greater or less degree, with the inflammatory affections before described complicating old suppuration of the middle ear. The worst cases are found in ill-nourished individuals, suffering from tuberculosis, congenital syphilis, or diabetes. After the specific fevers, especially scarlet fever, very acute and dangerous necrosis may occur. The management of these cases is conducted on general surgical principles. Very free and good drainage should be effected to prevent the burrowing of pus about the jaw and neck. The strength should be freely maintained by good air and generous diet. As regards the removal of the dead bone, no fixed rule can be laid down, but I have never seen good results from "haphazard" operations. Should the surgeon be able to assure himself of the existence of loose sequestra or "cheesy" *débris* and broken-down bone, I believe that it is justifiable to remove freely the compact tissue with trephine or sharp chisels in order to reach the disease. Carious bone and *débris* may be then scooped away even to the dura. Great

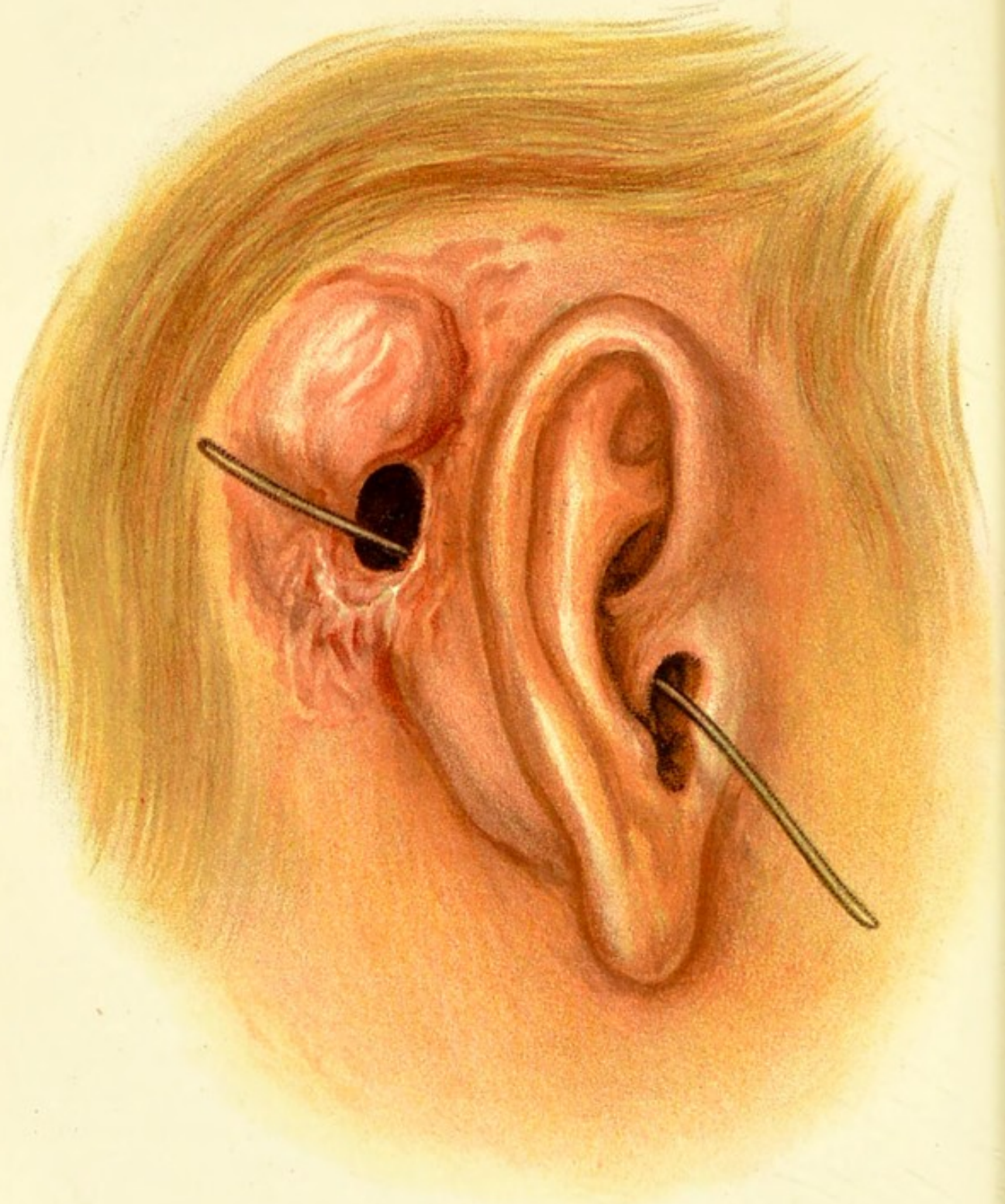

PLATE IV.

PLATE IV.

Large cavity in mastoid, after evacuation of a cholesteatoma.

assistance is afforded by continuous flushing with hot water, which checks the oozing in a remarkable manner. The greatest care must be exercised in these cases not to wound the lateral sinus or the dura mater. Too often, in cases of mastoid disease, the dead bone is deeply seated, and embedded in sclerosed tissue, its exact situation being uncertain. Beyond free drainage and enlargement of sinuses there is little to be done in these cases. They will severely tax the endurance of the patient and the patience, judgment, and skill of the surgeon. For many years openings have to be enlarged, collections of pus evacuated, and minute sequestra cautiously extracted through sinuses. If only the patient be sufficiently well off to command good diet, nursing, and fresh air, a satisfactory result may ultimately be obtained. Much depends upon these latter considerations, especially on the obtaining of good mountain or sea air.

As an instance of the good results that may follow bold surgery in these instances, the following case may well be perused.

Case 16.

CARIES OF MASTOID, AND BELL'S PARALYSIS. EVACUATION OF CHOLESTEATOMA BY SHARP SPOONS. DRAINAGE. GREAT TEMPORARY RELIEF. SUBSEQUENT CHISELLING AWAY OF ENTIRE MASTOID (PLATE IV.).

A pale, weak, anæmic general servant, aged twenty-one, who had originally come from the Foundling Hospital, and seemed of poor intelligence, was admitted under Dr. Mitchell Bruce, on February 7th, 1893, for Bell's paralysis. The right side of the face was smooth and devoid of expression, and showed the well-known smirk of facial paralysis. Behind the right ear was a scar and partially-healed sinus. There was an offensive purulent discharge, and small granulations could be seen through

a partially-destroyed drum. Patient had constant dull, aching pain over the right side of the head, with occasional exacerbations. She asserted that some "dead bone" had been removed from behind the ear "six years ago," at Bartholomew's Hospital. There was complete deafness on the right side, and distinct loss of nerve-power evidenced by the tuning-fork. Muscles on right side of face failed to respond to Faradic current. An operation was performed on January 10th. The tiny fistulous opening in the bone was freely enlarged, and with a sharp spoon about two drachms of firm caseating material of the consistence of cheese was removed by cautious scooping. This was composed of inspissated pus and epithelial *débris*, and was exceedingly offensive. On syringing iodoform emulsion, a quantity of the same substance escaped from the meatus, showing a free communication between the mastoid and tympanum. There was an extensive cavity within the bone, and the escaped discharge pulsated freely, showing a close relation to the dura mater and cerebrum. A full-sized tube was introduced and tied in, and the cavity daily washed through with antiseptic lotions of mercuric chloride. Great relief to the pain and cerebral discomfort at once ensued.

March 2nd.—Patient had greatly improved, but still a sinus, inclined to be foul, persisted. Much *débris* had been evacuated, and the cavity syringed daily with solution of peroxide of hydrogen. Chloroform was administered, and a semilunar flap turned down from the mastoid region. Bleeding vessels secured by clips. Taking the sinus as a centre, I freely chiselled away bone over an area of at least a florin. An extensive smooth-walled cavity was found which would have held a large walnut. Superiorly, its parietes felt yielding, as though in contact with dura mater. Elsewhere, it was formed of smooth bone; much "cheesy" *débris* was evacuated from it. The soft tissues were cut away over it, and it was dressed from the bottom with strips of iodoform gauze. The whole of its external bony parietes were removed.

March 14th.—Marked improvement. Cavity becoming rapidly lined with epithelium, the integument of the auditory canal advancing through the aperture into the mastoid cavity. The general health is excellent. There is no change in the Bell's paralysis. She hears conversation well, and the discharge has

ceased from the meatus. A large dry perforation is to be seen above the drum.

May 2nd.—Discharged. The opening behind the ear was subsequently closed by simple plastic operation.*

The mastoid antrum and cellular cavities should be opened,—

(1) In acute inflammatory affections of the cells spreading from an inflamed and diseased tympanum.

(2) In some cases of caries of the middle ear, with formation of granulations, and retained discharge.

(3) In any case of old ear disease where such symptoms as persistent pain and tenderness on pressure, or inflammation and swelling of the soft parts behind the ear, lead to the supposition that products of inflammation are locked up deep in the bone.

(4) In cases where it is needful to explore the lateral sinus, the mastoid may at the same time be freely opened and purulent *débris* cleared away. Should the sinus not be thrombosed, this proceeding may check pyæmic infection.

(5) The simple incision through the periosteum as formerly practised is seldom sufficient, and the bone beneath generally needs perforation.

Pain in the mastoid without obvious inflammation.—A certain number of cases will be met with in which the mastoid is the seat of pain and uneasiness, without obvious signs of inflammation or febrile disturbance. The term "neuralgia" of the mastoid has often been used for this affection. The first duty of the aural surgeon will be carefully to investigate the condition of the ear; for many of these

* For a full account of this case, and a discussion on the pathology of cholesteatoma, see a paper by me in the *Lancet* for May 13, 1893.

cases are really due to deeply-seated inflammatory affections of a sub-acute nature, dependent upon old, forgotten, quiescent middle-ear disease. A careful inspection of the drum will show an old cicatrix (Plate II. Fig. G), and then the patient will remember having "ear-ache" and discharge, perhaps many years before. Where no such indications can be found, the case resolves itself into general considerations. It should never be forgotten that neuralgic pains about the ear and mastoid are often symptomatic of disease in the course of some of the divisions of the fifth nerve or the upper cervical nerves, as has been already pointed out.

Should the surgeon have good reason to believe that the pain is caused by deeply-seated sub-acute, bony inflammation, there is no remedy so efficacious as the actual cautery. I generally use the galvano-cautery at a white-heat, and lightly "score" the skin over the affected mastoid in a series of parallel stripes. Much relief may be promised if the case be a suitable one for such treatment.

CHAPTER XI.

A SHORT DESCRIPTION OF THE PRINCIPAL AFFECTIONS OF THE NOSE AND NASO-PHARYNX, CAUSING OR COMPLICATING DEAFNESS.

In treating of affections of the tympanum, attention has been drawn to the fact, that the majority of affections of the middle ear are secondary to inflammatory processes of various degrees of severity spreading by continuity of tissue up the Eustachian tubes from the naso-pharynx. As a general rule of great importance, it may here be stated that any unhealthy condition of the nose or naso-pharynx whereby free respiration is impeded, may act injuriously upon the hearing by inducing attacks of catarrhal inflammation. Many theories are advanced to explain the co-existence of deafness with nasal obstruction. Some authors maintain that the muscles which open the tube are impeded in their action; others that mechanical obstacles exist at the mouth of the tube to the passage of mucus from the tympanum. Again, it has been well pointed out that when the tube is partly or wholly blocked, the proper balance of atmospheric pressure within the tympanum cannot be maintained, and consequently the drum becomes retracted and the ossicles pressed inwards. Probably all these conditions may exist separately or together in any given case. We do not, however, at present understand the exact action of the muscles upon the Eustachian tubes. There is no doubt that the latter usually open on swallowing, and the free ventilation of the parts around the orifices of the

tubes seems very essential to a healthy condition of the organ of hearing.

In most cases of bad nasal obstruction, a quantity of unhealthy inspissated mucus clogs the back of the pharynx, and may readily mechanically obstruct the tubes, or cause inflammation of their lining membrane. It is, therefore, very essential that the surgeon, as a matter of routine, should make a thorough examination, under a strong light, of the nose and throat in every case of ear disease. While drawing attention to this most important duty, I wish, however, strongly to condemn anything like wholesale or injudicious operating upon the nasal cavities in cases of aural disease. Unless the surgeon can assure himself that definite pathological conditions exist which, when removed, would certainly benefit the hearing, he should hold his hand, and in many minor cases of nasal obstruction from deviation of the septum, swelled mucous membrane, and accumulated inspissated discharge, the nasal syringe and Politzer's process will effect all that is needful without any operative procedures.

The principal conditions of the nose itself causing or complicating deafness, are polypi of various kinds, hypertrophy of the mucous membrane over the turbinals, bony outgrowths, carious bone, or ozæna, and atrophic rhinitis, fractures, deviations of the septum, and, lastly, stenosis of the nostrils, congenital or acquired. In the naso-pharynx the well-known adenoid growths are of the first importance, and these are often combined with considerable enlargement of the tonsils.* Morbid conditions of the pharyngeal

* See a clinical lecture by myself on this subject in the *Lancet* for 1891-92.

mucous membrane, as granular pharyngitis, and especially syphilis, need recognition and treatment. In this chapter space will only allow of a sketch of these conditions and their treatment.

I must refer the reader to works upon general surgery, and upon the throat and nose, for full particulars as to the diagnosis and treatment of all the intra-nasal conditions that may possibly need attention; but that practitioner will be the most successful in his management of cases of deafness, who recognises nasal and pharyngeal complications and is able to treat them.

Adenoid growths.—Much lymphoid tissue exists in the so-called fossa of Rosenmüller immediately behind the extremity of the lower spongy bone, about the mouth of the tubes, and in the vault of the pharynx. A mass of lymphoid tissue occupying Rosenmüller's fossa has received the name of the pharyngeal tonsil. Hypertrophy of this tissue is not uncommon in delicate children, especially when exposed to damp and cold. Soft, friable, tongue-shaped masses of lymphoid growth, like granulation tissue, originate abundantly in these parts and about the vault of the pharynx. They mechanically occlude the orifices of the tubes and the nose, depress the soft palate, and impede nasal respiration to a marked degree. Besides deafness and impaired breathing, the subjects of this affection are usually mentally depressed and stupid. Probably the deafness is the main cause of the mental dulness. Professor Guye believes that in these cases, the proper circulation of blood and lymph through the nose being interfered with, the nutrition of the cellular elements of the cerebral lobes is not properly effected. He terms this condition

"Aprosexia," and gives striking instances of the mental sluggishness which accompanies nasal obstruction. A peculiar intonation of the voice is usually present, the child "biting his words," as saying "dub" for "rub." The tonsils are usually enlarged and friable, and the pharynx granular, with masses of inspissated mucus hanging upon it.

The patient breathes with his mouth open, the teeth are often carious, and the vault of the pharynx high and arched; he snores loudly when asleep, and usually presents a stupid and vacuous appearance. At school he is noted for "stupidity," has his "ears boxed," or is otherwise frequently punished for presumed idleness and inattention. Notice is thus frequently drawn to the nature of his case, and the deafness is often wrongly assigned to the "boxing of the ears." There are, of course, minor degrees of this ailment where deafness is slight. I feel sure that a large number of these cases escape recognition. The subjects fail in the modern educational and competitive race, and as adults are frequently "hard of hearing." This subject should especially commend itself to those interested in education, for there can be no doubt that a deaf child loses as much unconscious education, as a myope whose sphere of vision is limited. Cases of adenoid growths are always worse in damp weather, for climatic conditions powerfully affect them. As the child grows up, the growths generally disappear. If they persist over the age of twenty, they are usually very tough and fibrous. The general disappearance of the growths in adults is no argument against treating them in the young. The catarrhal and other morbid processes induced by their presence, may readily produce

a chronic inflammatory condition of the middle ear, which may terminate in incurable deafness. Besides this, the general health often suffers. In cases of adenoids, as well as in other forms of nasal obstruction, the passage of normal discharges from the nose is interfered with. Inspissated masses of thick mucus accumulate in the naso-pharynx in great quantity. This material aids in the mechanical obstruction of the tubes, and is increased by catarrhal processes, of which it is at once the cause and effect.

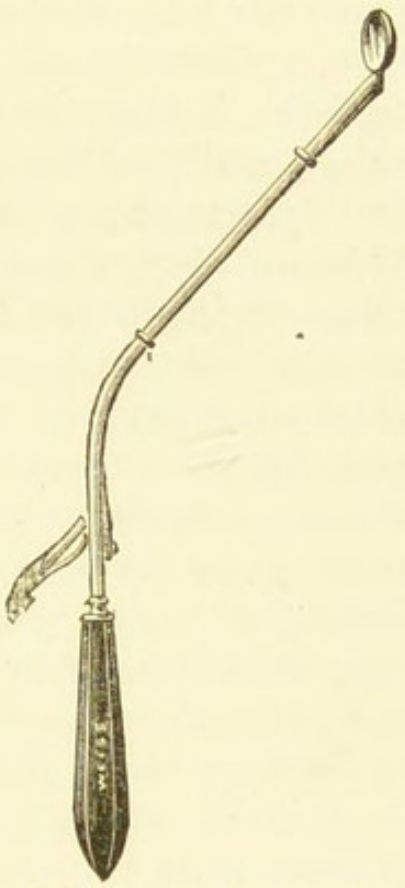

Fig. 31.—The Rhinoscope, with movable Mirror.

The diagnosis of these cases is not difficult. Any child or young adult complaining of deafness associated with the characteristics described is probably suffering from this affection. The finger, passed rapidly behind the palate, enters a mass of soft growth which is extremely friable and bleeds readily. In children this manipulation is often difficult unless executed with great rapidity. The soft palate may be painted with a weak solution of cocaine in young adults. This renders it easy to pass the finger. The child's head should be held in the left arm of the operator, and the right forefinger (well protected) used to explore. The manipulation need only be momentary, the soft granular obstruction being quite characteristic.

The use of the rhinoscope (Fig. 31) is exceedingly difficult in children, and the momentary glances obtained by those who use it, scarcely reveal any conditions that may not be better appreciated by an educated finger. In older patients, especially if the case should not be clear, rhinoscopy should be practised with the aid of cocaine. I have found pulling forwards the soft palate with a hook very advisable in these cases, and have several times been able to verify such conditions as syphilitic ulceration, and hypertrophy of the posterior end of the spongy bone, in tolerant patients. In many cases posterior rhinoscopy is difficult, if not impossible, without many sittings and much patience. The cursory glances obtained in nervous or intractable patients, leave free play for the imagination, and that essential for true diagnosis—accurate inspection—being absent, dubious opinions are too often formulated. It must be remembered that these growths differ from time to time in size, according as they are congested and enlarged or not. Hence one examiner may find them, and another, at a different time, deny their existence.

I always strongly advise the removal of adenoid growths when they really exist. Should otorrhœa be present, it should be first treated for about a week by antiseptic remedies. For clinical purposes these cases may be divided into three classes:—

Firstly, those where the growths are small in amount and there is much accumulated discharge.

Secondly, those where the growths are abundant but exceedingly soft and friable.

Thirdly, those where the growths are not only abundant, but of firmer consistence. These latter constitute the extreme cases, and are found in young

adults. In such there may be total nasal obstruction, and the soft palate is much depressed.

It is only right to point out that great precautions must be taken in the administration of anæsthetics in these operations. The hæmorrhage is sudden, and sometimes alarmingly profuse, and the blood—mixed with fragments of growth and thick mucus—may readily be drawn into the air-passages, causing asphyxia.

No risk need be apprehended from bleeding, unless the patient be of the hæmorrhagic diathesis. It is always well to inquire into this point; for in "a bleeder" troublesome, dangerous, and persistent oozing may doubtless occur after such an operative procedure. Diphtheria may readily attack an operation wound in the naso-pharynx of a child, and so may the virus of scarlet fever. Great care must be taken not to convey these affections, by a practitioner engaged in seeing and treating them. Bearing in mind the readiness of the scarlet fever virus to attack wounds in general, and the naso-pharynx in particular, the cautious surgeon will do well not to operate upon a child, when located where cases of scarlet fever are at the time prevalent.

Case 17.

OPERATION UPON NASAL ADENOIDS. SEVERE AFTER-SYMPTOMS. SCARLET FEVER ON THE THIRD DAY.

A little girl, aged seven, was operated upon by me on the 24th of July, 1890, for nasal adenoids causing considerable deafness. The case was a slight one, and there was no unusual difficulty in performing the operation. The most severe reaction followed. High fever, delirium, intense headache, and constant vomiting were marked on the second day. The tongue was white and coated, and the throat lined and intensely sore and inflamed. The symptoms were attributed to some form

of septic absorption, or possibly to meningitis. The child being exceedingly nervous, it was thought that much of the fever and headache was due to that cause, but the symptoms were alarming and anxious.

On the morning of the 27th July the temperature and pulse fell, and the child was covered with a copious scarlatiniform eruption. She passed through an ordinary attack of scarlet fever, and by the exercise of great care in cleansing the naso-pharynx, suppuration of the middle ear was avoided, and in the end the hearing was well restored. There was no distinct evidence as to how the poison was conveyed to the wound, and the sanitary arrangements of the house were excellent.

Operation with the steel nail.—My own method of operating is as follows:—The patient is anæsthetised with the A.C.E. mixture, or with ether followed by chloroform, and a strong gag is fixed in the mouth. I commence by passing a bougie through each nostril from in front. This proceeding clears the way for the subsequent passage of blood and mucus. The patient is now turned upon the side, with the head hanging over the edge of the table. The guarded fore-finger, armed with the steel nail (Fig. 32), is passed behind the palate, and the growths are scraped away by methodical powerful strokes of the finger. A strong piece of silk should be attached to the steel nail, and wound round the index-finger. This prevents the instrument from slipping off, and obviates any risk of its falling into the larynx. I usually first clear the orifices of the posterior nares and the roof, and then turn my attention to the sides, towards the orifices of the Eustachian tubes. The steel nail is next taken off, and the finger nail used to scrape away fragments of growth which may have remained. The broken-down soft growth mixed with mucus and blood escapes freely into the

dependent cheek, from whence it may readily be sponged away. There is in this position not the least risk of the air-passages being implicated. If the anæsthetic has been judiciously given, sensibility should be returning towards the end of the operation, as indicated by coughing or crying and commencing struggling. Any blood that finds its way to the air-passages is thus expelled, and I regard it as most important that the laryngeal reflex should never be quite abolished. By this precaution all risk of asphyxia is comfortably avoided. The bleeding always stops spontaneously. A sponge covered with powdered tannin attached to a string and passed behind the soft palate is a useful adjunct. This should be swept round and removed. Should bleeding persist, a gag should be kept in the mouth, and the patient be placed upright in a chair before an open window, and encouraged to respire the cold air freely. This position is also useful for hæmorrhage after tonsilotomy. For the first three days after operation the patient is confined to one room, and the nose gently syringed through into the throat with dilute and warm alkaline lotions combined with an antiseptic. Plugs of iodoform wool, with a little oil of eucalyptus dropped upon them, are lightly placed in each nostril, or a mask of the same material may be placed before the nose and mouth, at intervals throughout the day. The after-treatment of "adenoid growth" cases is, in my opinion,

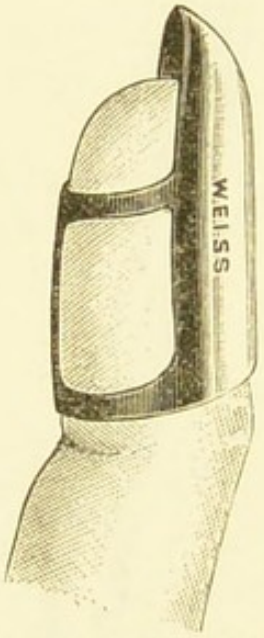

Fig. 32.—The Steel Nail for Adenoids.

most important.* It comprises the application of astringents by a curved brush and the retro-pharyngeal syringe, and the methodical inflation of the ears by Politzer's process. A course of tonics, especially the iodide of iron, is very beneficial, and a month's residence in dry mountain air at the conclusion of the case should be advised. In all operations about the oral cavities of children the earlier summer months are the best to choose, should the case permit of delay. Many cases of deafness are little remedied by the operation for adenoids because the all-important question of after-treatment by inflation is ignored. Adenoid growths are very liable to recur. The operation should never be hurried for the sake of display, but done with great thoroughness, and much pains should be taken with the after-use of astringents.

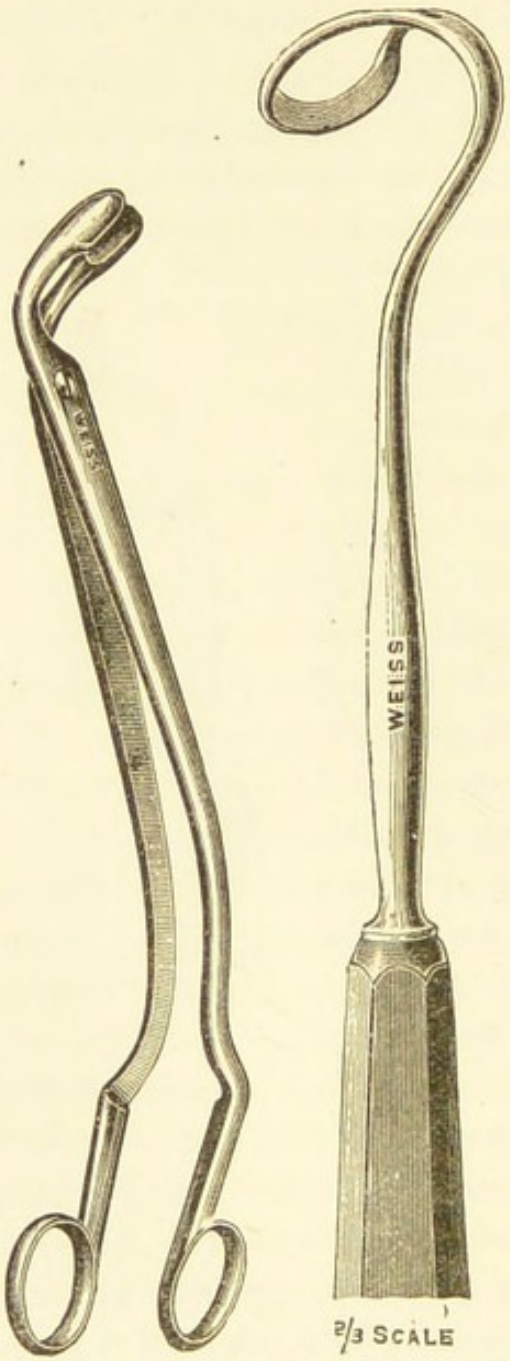

Fig. 33.—Lowenburg's Forceps and a Ring-Knife.

* This is contrary to the practice of many London surgeons, who advise no after-treatment in these cases.

In older patients the growths will partake more of a fibrous nature, being tough, tongue-shaped projections from the naso-pharynx. They are then difficult to remove with the nail, though it is astonishing how much can be done with this instrument, if it is only used with the full strength and power of the fore-finger. In these cases I always use Lowenburg's forceps (Fig. 33), or some form of ring-knife. The best position is the lateral one above-mentioned. A strong gag should be fixed in the mouth, and a good light employed, while a skilled anæsthetist is absolutely essential. The pharynx should constantly be mopped out with large sponges held in the hand, and rapidly used, and the "laryngeal reflex" should never be entirely abolished by the anæsthetist. When the patient recovers from the anæsthetic, he will probably vomit a quantity of blood. The operation for adenoids in young adults is a more severe proceeding than in children. Very profuse bleeding, with severe inflammatory reaction, and some after-weakness, is not uncommonly experienced. Before undertaking the operation for adenoids it is well to ascertain that the deafness is due to no other cause. Thus in congenital syphilis adenoids are common, but too often little or no improvement ensues on operating for them. The surgeon should also be sure of the sanitary arrangements of the room in which he confines his patient. The wounded pharynx of a child would be readily affected by "sewer gas." The numerous precautions dwelt upon in connection with surgery of adenoid growths apply to most nasal and oral operations. They will sound as exaggerations to some readers. To such I would only point out that any fatality or mishap, occurring in consequence of what is considered a minor operation, not needful to

save life, is so terrible a calamity, that when such occurs it must bring great grief to any right-minded surgeon, and tend to cause apprehension and distrust among the public. No pains should be spared by attention to detail, to avoid any such risks.

Enlarged tonsils.—The treatment of enlarged tonsils is sufficiently familiar to surgeons, and is dealt with in works on general surgery. The affection will constantly come before the notice of the aural surgeon in cases of deafness and adenoid growths. The tonsils should usually be removed with the guillotine, and the adenoid growths at the same operation. When the tonsils are flat, friable, and large, they may be well enucleated with the finger-nail under anæsthesia or with Volkmann's spoon. Hæmorrhage is thus lessened, but the operator must be careful that the piece of tonsil does not fall into the larynx. This operation is "far and away" the best for the flat friable tonsils of children. The application of the galvano-cautery to any ragged fringes or fragments of tonsil that may remain, will give excellent results.

Deformity of the septum or spongy bones.—The greatest difference of opinion exists among surgeons as to the pathological significance of these affections. It may be pointed out that noses, like many other parts of the body, are seldom constructed on exactly the same plan in different individuals. What the surgeon has to consider is not whether in any given case the state of the nasal passages comes up to a preconceived standard, but whether the conditions are such as are enough to satisfy the respiratory requirements of the individual under consideration. Without being dogmatic or condemning the practice of others, I merely here set forth my own ideas on

this subject. In many cases of catarrhal deafness, the spongy bones will be seen to occlude the nostril almost entirely. The anterior end is especially swollen and prominent, of a grey colour and gelatinous aspect, and is often mistaken for polypus. The patient will complain of constant difficulty of breathing, and the obstruction will often shift from one nostril to the other. This last observation shows us that in many of these instances the obstruction is mainly due to great and hyperæmic swelling of the nasal mucous membrane (hypertrophic rhinitis). Such cases are greatly benefited by the following treatment:—The nose is cocainised and illuminated by a good light. With the galvano-cautery the whole mucous surface of the lower turbinals, as far as can be seen and reached, is lightly scored with the cautery blade at a white heat. Should the mucous membrane over the posterior extremities of the turbinals be hypertrophic, this needs treatment by the cautery, écrasure, or steel nail. Simple syringing is afterwards employed, and when cicatrisation is complete the passage of nasal bougies should be carried out, if needful under anæsthesia. They should be passed well along the floor of the nostril, beginning with a small and going up to a large size. If needful, nitrous oxide gas should be given, and the lower scroll of the turbinals may be felt to fracture and is crushed outwards. After healing has taken place, the result is usually very satisfactory. I encourage the patient to wear vulcanite tubes in either nostril at nights for some months after operation. These are flattened from side to side, and, when smeared with cocainised vaseline, are readily introduced by the patient himself. Should the spongy bone itself be enlarged or much deformed, and the

surgeon convince himself that its removal is needful, he may proceed with the forceps, a fine nasal saw, a strong wire snare, working on the "écrasure principle," or a sharp ring-knife. Anæsthesia is needful; the head should hang well over the edge of the table, and sponging of the pharynx should be carefully managed. A strong, well-fitting gag is very essential in these cases. The hæmorrhage may make it needful to plug the posterior nares, and the material for this should be at hand. I have only found it needful to remove the turbinated bones in a very few instances, and have then always shaved them off with a fine saw, a comparatively simple operation.

Hæmorrhage after intra-nasal operations.—Any intra-nasal operation, especially shaving off a projecting septum, may be followed by troublesome or even dangerous bleeding. It is true that this is exceptional, but a prudent surgeon will never perform such operations and send his patient away by train, or to a district remote from aid. The nostrils have sometimes to be plugged in these cases by the rubber tampon, or other methods for the checking of epistaxis adopted.

Deviation of the septum nasi, unless extreme, seldom needs treatment. Whether it be the result of congenital malformation or of injury, it is by no means easy to remedy it perfectly. A simple method is to cut the projecting portion right off. This has the slight disadvantage of sometimes resulting in a communication between the two nasal cavities. The method I usually adopt is to cut through the cartilage with a tenotomy knife, round the margin of the projection as far as can be reached, and then to force it into position with a pair of forceps constructed on the

punch principle. The ring blade of the forceps is placed on the concavity of the deviation, the "punch" blade upon the convexity. Firm pressure is now exerted, and the previously weakened portion of cartilage is broken and pressed towards the concavity. It should be made to protrude through the ring on the concave side, and, if well fractured, will seldom fly back into its old position. An intra-nasal splint must be perseveringly worn at night for some months afterwards, as the deformity has a peculiar tendency to recur. Improvement only should be promised.

Ozæna will sometimes complicate deafness, and needs especial attention. The surgeon will always recollect the question of syphilis in these cases, and will particularly remember the importance of detecting nasal obstruction if it coexists. Few cases of ozæna cannot be remedied by treatment, and the mechanical removal of crusts and secretion, with the use of an alkaline and antiseptic douche, will often greatly lessen the fœtor, improve the health, and benefit the hearing. The treatment of the various forms of polypi of the nose belongs also to the domain of general surgery. The detection and treatment of these growths are most important in deafness. Naso-pharyngeal polypus is a formidable disease, demanding operative skill and judgment. In several of these cases treated by myself, deafness was the first symptom complained of. The growth is readily detected by passing the finger behind the palate.

Granular pharyngitis.—In many of the foregoing cases the mucous membrane of the pharynx is unhealthy, congested, covered with tenacious mucus, and presenting a number of pinkish elevations the size of a shot or millet-seed. These are aggregations

of lymphoid tissue, and their presence causes a constant irritation, a tickling cough, a tendency to "hawk and spit," and a catarrhal state of the naso-pharynx. In the treatment of them it is well first to interdict tobacco, and then to cocainise the parts and destroy them one by one with the galvano-cautery or a chromic acid bead. The application should be very thorough and painstaking, and the subsequent result is usually satisfactory. Astringent sprays and applications of sulphate of zinc, iron, or nitrate of silver are useful in such cases.

Much of the foregoing treatment should be carried out in the early stage of deafness due to nasal or pharyngeal disease, and may be looked upon as preventive. Operations upon the nose in chronic affections of the middle ear, as sclerosing catarrh, are not founded upon sound principles, and little, if any, permanent benefit will accrue to patients by submitting to them. All operations involving the removal of bone from the nasal cavities are attended with the risk of meningitis or sinus pyæmia. The higher in the nose the operation is conducted, the greater must these risks be. It is difficult to maintain asepticity in the nasal cavities, and in cases of ozæna or nasal necrosis, the opening up of the larger veins that pass through the ethmoid to the meninges must be attended with peril. In my own practice, I make patients wear a mask of gauze after an intra-nasal operation. Upon this is sprinkled a mixture of benzoin, eucalyptus oil, and carbolic acid. The vapours of these agents must act beneficially on sloughy tissue. The greatest after-care should be taken with all inter-nasal operations. The least of them are not quite free from risk.

CHAPTER XII.

NERVE-DEAFNESS AND ANOMALIES OF HEARING.

UNDER the heading of nerve-deafness it is proposed to consider a group of cases where presumably the conducting media are not necessarily at fault, but where disease or injury implicates the auditory nerve in its nucleus of origin, course, or termination. The pathology of many of these cases is confessedly obscure. In others definite disease of the semicircular canals or cochlea has been demonstrated pathologically. Thus hæmorrhagic exudation may occur in pernicious anæmia, in leucocythæmia, and from degeneration of vessels in chronic renal disease, also after severe head injuries and loud concussions (as the discharge of artillery). In bad cases of syphilis both congenital and acquired, sclerosis of the bones, cell hyperplasia and chronic inflammatory processes in the terminal perceptive apparatus have been discovered. The nerve-deafness of secondary syphilis is very rapid and complete, and seems analogous to those rapid exudations about the iris and ciliary body, which occur in the eye. Gowers is of opinion that deafness from intra-cranial disease is usually due to disease of the nerve at the base of the brain, less frequently to that of its nucleus in the medulla. Nerve-deafness seems very rarely to result from disease of the auditory centre in the first temporo-sphenoidal convolution, and the disease is then on the side opposite to the deafness. Bilateral deafness may be due to the damage of both auditory nerves, or a tumour of the corpora quadrigemina. In

cerebro-spinal meningitis inflammatory processes have been described passing down the sheath of the auditory nerve. It is likely that in many such cases the true origin of the mischief is really in the middle ear. Hæmorrhage into the nerve apparatus of the internal ear, with subsequent inflammatory exudation and softening, may be found in cases of advanced renal disease or alcoholism with atheromatous degeneration of the vessels. Various forms of incomplete development of the internal ear and absence of the auditory nerve, were long ago demonstrated by Cock, of Guy's Hospital, in cases of congenital deafness. After the specific fevers, especially mumps, sudden and intractable nerve-deafness may eventuate. In my experience, these cases are comparatively very rare. Nerve-deafness has been known to follow severe mental shock, profound anæmia, and the administration of large doses of quinine and salicine. The practitioner must be on his guard in the matter of "hysterical" deafness. In these cases the true explanation of the symptoms is found in the general condition of the patient, the age and sex, and other manifestations of the neurotic tendency. The subjects are usually anæmic, overworked or anxious in business, or the victims of disappointment in some "love affair." No certain symptoms of aural disease can be demonstrated, and the patient seldom, if ever, answers rationally to the tuning-fork tests. She will declare that when one ear is closed the fork on the vertex is heard better in the open ear, or that the fork is heard on the vertex and not on the mastoid, or that it is heard in one position one day and another the next. The deafness often shifts from one ear to the other. Such contradictory statements are diagnostic of prevarication,

and the case then resolves itself into the treatment of a functional malady. Here constitutional and moral treatment are of more importance than local, and will need all the acumen of a judicious practitioner. Counter-irritation over the mastoid and the smart application of the interrupted current, are usually indicated in these affections. In connection with functional nerve-deafness, attention must be drawn to the fact that loss of nerve-power with deafness, and especially tinnitus, is found as a result of sexual excess in both sexes. I have seen two cases in school-boys, undoubtedly due to excessive masturbation. Such conditions as cerebral tumour and aneurism, sclerosis of the nerve-centres, and chronic nerve disorders of various kinds may be associated with deafness, which here may be looked upon as only a symptom of the more formidable malady. In some instances of chronic nervous maladies, as ataxia, there is a loss of perception of high notes. Very rarely certain notes are lost, others maintained. The most curious variations occur in these cases, which are doubtless due to implication of certain filaments of the auditory nerve; but such symptoms follow no constant rule, so far as I know. Every practical aural surgeon knows that a number of cases of nerve-deafness come before him in which he is utterly unable to give any rational explanation of the true pathological lesion. It is especially important to point out that a certain number of cases associated with vertigo and sickness are due to vascular congestion, in such conditions as chronic renal disease, gout, and alcoholism, just the conditions, indeed, in which hæmorrhages may also be found in the brain and retina. A careful examination of the urine

should always be instituted in these cases. When there is great vascular tension, free purgation and restriction of diet are very essential.

The diagnosis of nerve-deafness is made by a careful consideration of all the facts and clinical history of the case, and especially by the use of the tuning-fork. It is important to observe whether the alleged history corresponds, pathologically and clinically, to any of the known causes of nerve-deafness above stated. Slight cases of nerve-deafness are exceedingly difficult to detect certainly, and a judicious practitioner will give a guarded opinion regarding them. Marked cases are fairly easy to interpret with certainty if the patient be intelligent and truthful. The fork in these instances is heard faintly or not at all from the mastoid, even though the ear be stopped firmly with waxed wool. In a case of nerve-deafness the fork should be heard faintly, and for a short time on the mastoid, and again on holding it close to the meatus, indicating that the conducting media are not at fault. In extreme cases the sound of the fork can be heard neither through the ear nor bones. The better and longer the fork is heard through the bones in a case of deafness, the more reason is there to exclude nerve-deafness. Care must be taken before applying the fork to remove impacted cerumen.

As sufferers from middle-ear mischief usually hear better in a noise, so sufferers from nerve-deafness usually hear worse in a noise, and better in a quiet room. Absolute deafness to shouting or a loud fork undoubtedly means nerve-deafness. This condition is comparatively rare. The inability to hear high notes, as the cry of a bat or the sound of a shrill whistle,

or the hearing of high notes, is usually considered as highly diagnostic of cochlear disease. It is well to use at least three forks of different pitch, for in certain of these cases the hearing for high notes is especially impaired. Boiler-makers, who are subject to constant hyperæmia of the labyrinth from the constant "concussions" of sound to which they are liable, are good examples of nerve disease for the observation of the student. The treatment of cases of true nerve-deafness is for the most part highly unsatisfactory. Whether any treatment should be instituted or not, will depend largely upon the surgeon's estimate of the pathological changes in any given case and of the situation of the lesion. In marked congenital syphilis, after mumps and fractures of the base of the skull, so far as I have seen, treatment is of little avail. In the deafness of acquired secondary syphilis a prolonged course of mercurial treatment should be tried; the subcutaneous injection of mercury may in these instances be advisable. The injection of pilocarpine has been largely used in such cases, three minims of a 2 per cent. solution being injected daily, and increased to five minims, producing free diaphoresis. I am quite unable to point out any exact indication for this remedy. There can be no doubt that its use causes free transudation from the smaller vessels, and so facilitates tissue change; and I have seen marked improvement from its employment in a few cases of presumed syphilitic nervous deafness. The patients were, however, taking mercury, and it will be remembered that a certain amount of catarrhal swelling of the tubes and adjacent mucous tracts is so common in early syphilis, that the relief of this by mercurial treatment might readily lead to an improvement in the hearing. Bell's paralysis sometimes occurs

with deafness in secondary syphilis, and this is highly suggestive of exudations compressing the nerve-trunks themselves. In investigating a case of syphilitic nervous deafness, I have often been in doubt as to how far the symptoms depended upon nerve causes, and how far upon inflammatory affections of the middle ear. These conditions, when associated, render the tuning-fork tests very difficult to estimate correctly, unless in extreme cases. In the nerve-deafness of secondary syphilis, I should pin my faith on rapid and thorough mercurialisation. In many cases of nerve-deafness from other causes pilocarpine is quite useless. A sound practitioner knows well that alkaloidal extracts of powerful drugs are potent agents for evil as well as for good, and act very diversely in different individuals. I have seen severe prostration and cardiac depression produced by pilocarpine, and I am sure that it is a remedy to be used with much caution in elderly, weakly, or debilitated persons. It is only right to allow that some authorities have a higher estimate of this remedy than is here set forth. Cases of nerve-deafness which may be termed functional, and seem to be dependent upon obvious disorders of the general constitution, as anæmia and constipation, prolonged suckling, ill-health after fevers, severe mental shock, and the like, are commonly improved by appropriate medicinal and hygienic treatment, especially good air and diet. Galvanism and strychnia may well be tried in such cases. Nerve-deafness associated with such chronic nerve disorders as ataxia, is not hopeful. Of the influence of "electricity" in nervous deafness I have little to say, except as to the use of faradic shocks in some cases of "hysterical deafness." It does not behove one to speak too lightly of a remedy

which is largely employed by different eminent authorities. I have, however, been quite at a loss to understand how measurable electrical influence could be certainly brought to bear upon a nerve so deeply-seated as the auditory trunk. A sufficient current of electricity might be used, however, on the supposition that some of it would affect the auditory nerve, the remainder being dispersed in various directions; but such a consideration must lessen the value of the remedy in the eyes of thoughtful practitioners. There can be no doubt that the application of electricity in cases of nerve-deafness requires much consideration, and especially an approximately correct estimate of the pathological condition of the case under treatment. In none of the cases of extreme nerve-deafness where I have known it employed by skilled experts, has any sensible improvement been observable. When there is good reason to suspect hæmorrhage, congestion, or recent exudation, galvanism and strychnia would, indeed, probably be harmful. The free administration of iodide of potassium and mercury in these cases, combined with the abstraction of blood by an occasional leech over the mastoid, is often useful, and such measures may be tried with advantage.

Quinine in all forms of nerve-deafness should be avoided; and treatment to the middle ear, especially by inflation or injections, does harm rather than good. This may sometimes assist the diagnosis.

Ménière's disease.—This is a term far too loosely applied to various aural affections associated with vertigo and cerebral pain, vomiting, and deafness. The onset is commonly sudden, and pathologically exudation of a sanguineous fluid has been

demonstrated in the semicircular canals. It is always difficult to assign an exact situation to the lesion of nerve-deafness. Ménière's disease should be applied to those cases where the semicircular canals alone are affected. Many excellent neurologists doubt the pathology of this affection as commonly stated, and are inclined to consider the symptoms as primarily cerebral.

Ocular symptoms in nerve-deafness.— It will be useful in connection with nerve-deafness to draw the attention of the reader to the importance of examining the eye in cases of auditory nerve mischief. In both eye and ear we have a nerve starting from a cerebral nucleus, running along the base of the skull, and terminating in a delicate perceptive apparatus. In the eye this is visible, and the changes observed by the ophthalmoscope in the visible retina may help us greatly in our diagnosis of the concealed changes in the auditory apparatus. Thus a case of nerve-deafness from congenital syphilis, may alone be declared by a faint dimness of the cornea from old keratitis or patches of choroidal atrophy. Nerve-deafness and tinnitus, with vomiting and headache, may be associated with optic neuritis, pointing to tumour or meningitis. Serous and hæmorrhagic effusions into the perceptive apparatus of the ear in renal or cardiac disease have their exact counterpart in cause and effect in the retina, and the "hardness of hearing" of advancing life is associated with presbyopia, early cataract, or the arcus senilis. So the paralysis of the oculo-motor nerves from pressure of gummatous or inflammatory material, has its exact counterpart in the cases where the auditory nerve-trunk itself is involved by pressure, causing deafness.

Case 18.

DOUBLE NERVE-DEAFNESS OF SUDDEN ORIGIN. CAUSE OBSCURE. IMPROVEMENT UNDER TIME AND MERCURIALS.

A medical man, aged 35, consulted me on April 26th, 1892. He had always experienced good health, and had never suffered from syphilis, malaria, or head injuries. Before the onset of this attack, except for some business worries, he was well, and had not suffered from any of the specific fevers, or mumps. General bodily health good. No albuminuria, vascular system normal, and eyesight unimpaired. The retina was anæmic, the discs normal. The right ear had become suddenly deaf five months before I saw him. The left ear became deaf one month ago, after the morning bath. On both occasions he had suffered from some vertigo and vomiting, but this he attributed to "migraine," from which he occasionally suffered. There was also a history of obscure rheumatic pains at the back of the neck, and he had taken considerable quantities of quinine from time to time. He was quite deaf even to shouting, and subject to attacks of low spirits and crying. A large fork could be heard only feebly on the mastoids, even when the canals were plugged. He had undergone three weeks' treatment with pilocarpine injections, without any good result. I imagined that his symptoms were due to hæmorrhage or inflammatory exudation about the labyrinth, and advised a long-continued and mild mercurial course by inunction, and to take the iodides of sodium and potassium with nux vomica internally. Before seeing me, this patient had consulted most of the leading physicians who deal with affections of the nervous system, and some of them expressed their belief that the condition was cerebral, and that he would never recover. This plunged him into much despair. Another authority diagnosed the case as one of peripheral neuritis following influenza, and took a favourable view of the future.

In May, 1893, this gentleman writes as follows:—"My condition is an improving one, but the pace is slow. I cannot hear my watch tick, but I can hear a small clock away from the ear. This morning, when in my bathroom, I heard the Abbey clock strike nine. I get along very well in my work, and can detect murmurs, râles, rhonchi, pretty nearly as well as ever."

I relate this case to illustrate how little we know regarding the true pathology of many cases of nerve-deafness, and how unwise it is to form definite diagnoses and prognoses in such cases, the terminations of which are beyond our ken.

Deafness of old age.—A few remarks will here be offered concerning the deafness of old age, which I venture to think has not sufficiently attracted the notice of the profession. There can be no question that a certain amount of deafness, very variable in degree, is apt slowly and insidiously to develop after sixty years of age, until it progresses to an extreme extent. In these cases the membranes are observed to be white and "chalky" in appearance, while the auditory canal is almost invariably dry and collapsed. The fork may show diminution of perception through the bones, indicating some loss of nerve-power. Sight is usually affected. There is marked presbyopia or early cataract. Some of such cases may fall under the heading of extremely chronic catarrhal inflammation. In the majority it is well to reflect that the general tendency to calcareous and fibroid changes, and the loss of nervous power and function, which attends white hair and the natural decline of life, must seriously affect the especially delicate nerve apparatus of the internal ear. Aged persons affected with chronic gout or rheumatism are commonly more or less incurably deaf, and it is useless to subject them to modes of treatment which are invariably unsatisfactory. I feel bound to say that the treatment of such hopeless cases of deafness has done much to bring aural surgery into deserved disrepute among the profession, and the intelligent section of the public.

Anomalies of hearing.—*Hearing better in a noise* (*paracusis Willisii*). This symptom has already been referred to as commonly associated with middle-ear deafness. The explanations of it advanced are (1) that the auditory nerve is excited to action by the loud noises; (2) that the tympanic membrane and ossicles, impeded in their action by disease, are moved more forcibly by the powerful waves of sound, and thus the hearing is improved. This symptom is of importance in a diagnostic sense, as indicating middle-ear deafness.

Hyperæsthesia.—Painful acuteness of the organs of hearing is sometimes observed in inflammatory conditions of an obscure nature and in certain mental conditions, especially severe surgical shock.*

Diplacusis.—This symptom—the hearing of a single note or sound double—is rare, and for speech very rare. It is usually regarded as dependent upon some disease or injury of the cochlea. I have certainly observed this symptom in some cases of middle-ear catarrh.

Paracusis loci (inability to determine the direction of sounds).—This is present in all of us to a degree which surprises many. If a person be blindfolded, and a sharp sound, such as the clink of two coins against each other, be made close to him, he will usually be quite unable to point to the spot where the note is created. In determining the direction of sounds, we are largely aided by position and by sight.

Malingering.—The surgeon will occasionally be

* In a bad case of railway accident, when both thighs were crushed, I once heard a woman loudly complain of the noises made by those "shouting" or "stamping round her"! In this case the nerves of smell were also hyperæsthetic, the patient complaining bitterly of the intolerable smell of tobacco!

consulted as to alleged loss of hearing after accident or disease. It has been already pointed out that the diagnosis of nerve-deafness depends largely upon the truthful and accurate statements of the person examined. When the patient purposely prevaricates, and especially when he belongs to the educated classes, and is conversant with the uses of the tuning-fork, the difficulty of forming a reliable opinion becomes very great. Malingering of deafness is fairly common among soldiers, sailors, and those who have met with slight head accidents and seek pecuniary compensation. An opinion can only be offered in these cases after repeated examination, and it is well to commit the patient's statements and the results of the tests to writing in his presence. If obvious untruthfulness is detected, the surgeon had better decline to examine the case further. After a careful examination of the affected ear, and a scrupulous analysis of the history of the case, the tuning-fork tests will be applied. The sound ear being firmly stopped with waxed wool, the malingerer will commonly declare that a loud fork placed on the vertex is not heard by him at all, and that he is quite deaf! When the wool is removed, he hears the fork loudly on the sound side! The use of the binaural stethoscope is often advantageous. Two instruments are employed, and the arm of one of them is blocked with a concealed wooden peg. Suppose a patient declares he is deaf in the right ear. The surgeon inserts the ear-pieces of the unaltered stethoscope into the patient's ears, and whispers a short sentence into the cup, which the patient is made to commit to writing. He then inserts the stethoscope blocked in the left arm, and whispers again. Should the case be genuine, the patient will hear nothing, since no

sounds can be conveyed to the left or sound ear. Supposing the subject declares that he hears, the arm connected with the left ear is then removed, the left ear closed and the same sentence whispered into the cup. The malingerer will now declare he hears nothing, for he knows that the ear he *supposed* he heard with before is closed. The patient may be placed on one side of a thick door, and two tubes placed in each ear, which pass through the door and are connected with mouthpieces. He is made to write down what he hears. The surgeon standing on the other side speaks into the tubes, occasionally compressing that which leads to the sound ear. If the patient should write down a sentence or words heard in these circumstances, he must have heard them with the alleged deaf ear. These tests, combined with accurate observation of all the symptoms described by the patient, are usually enough to decide upon the nature of the alleged unilateral deafness. The previous history must be carefully ascertained from the friends or relations without the patient's knowledge. This is especially important in alleged deafness after railway accident. The detection of an old perforation of the membrane is, of course, a point of capital importance. Feigned bilateral deafness is far more difficult to detect, and I know of no certain tests beyond great care and exact consideration of all the facts of the case. A malingerer seldom knows enough about the matter to avoid betraying himself sooner or later to an acute observer. Finally, the surgeon will do well not to appear as a witness in these cases unless he is sure of his grounds, and able to make his statements clear and comprehensive, not only to medical, but also to legal, minds.'

CHAPTER XIII.

TINNITUS AURIUM.

TINNITUS AURIUM must be looked upon as a distressing symptom, not only of aural disease, but of numerous other affections associated especially with vascular changes. Broadly speaking, this symptom may accompany and complicate almost every variety of aural disease. It is especially marked in chronic catarrh and Eustachian obstruction where the membrana tympani is shrunken and concave, and the stapes pressed inwards. The victims of chronic aural catarrh would be content to bear their deafness if only the tinnitus could be subdued. Pressure upon the drum, as by cerumen, may occasion tinnitus to a marked degree, and so may accumulation within the tympanum of secretion or discharge. In the latter case the sounds complained of are of a bubbling or rattling character. The sensation of a loud report is not uncommon where an obstructed Eustachian tube is suddenly opened. A volume might easily be filled with the descriptions of the varied sounds heard by patients suffering from this affection. Roaring, tinkling, humming, the notes of bells or music, the "boiling of a kettle," the rushing of wind through trees, are sounds commonly complained of. It is a well-known fact that persons usually liken their tinnitus to noises they have been accustomed to. An important class of cases are those where actual mental hallucinations are present, as the hearing of imaginary voices and commands. Such sounds are

commonly experienced by the insane, and are probably rather to be referred to disease of the cerebrum than to the terminal auditory apparatus. A careful examination of the ears in the insane is, however, very essential, as there may be some exciting cause that can be recognised and removed, when the hallucinations will improve. Tinnitus is usually worse at night when the sufferer is in a quiet room, and it is aggravated by such drugs as quinine or salicine, by mental worry and excitement, and by all circumstances that depress the general health of the individual. Apart from local mischief, many cases of tinnitus have their origin in altered conditions of the blood or vessels. Thus a blowing tinnitus is common in the anæmia of women after suckling, from profuse losses of blood, and the like. Doubtless many ill-understood morbid conditions of the blood may act injuriously upon the auditory nerves. Thus tinnitus is found in uræmia, and is especially common in gout and chronic alcoholism, associated with high vascular tension. Intracranial aneurism causes a peculiar tinnitus of a rushing or roaring sound synchronous with the pulse. This may sometimes be heard by the stethoscope. Again, there is no doubt that vaso-motor conditions of the small vessels of the labyrinth may play an important part in this condition. This may explain the tinnitus which accompanies cardiac disease, general vascular degeneration, and nitrite of amyl inhalation. Gross diseases of the nervous system, especially cerebral tumours, may be associated with severe tinnitus. This troublesome symptom also accompanies many functional conditions of the nervous system, as mental shock and excessive worry, hysteria, or a profound impression made upon the auditory

nerve by some unusual or distressing sound. A loud or distressing noise will often leave an impression upon the auditory nerve which may, especially in neurotic individuals, last for days. Thus Sir William Dalby relates the case of a lady who was alarmed and annoyed at night by the entrance into her ear of the little beetle called by the vulgar the "death-watch." The insect made its characteristic sounds at the meatus auditorius, and this was reproduced in the imagination of the patient perpetually, so that the sound continually haunted her. This case speaks more than pages of print could do, to illustrate the true character of many cases of tinnitus in nervous persons. In some of the worst instances of tinnitus, the sufferer has been driven to commit suicide, and, seeing the strongly-marked neurotic tendency of some of these individuals, we must always be cautious in pronouncing them incurable. Many people suffer from tinnitus to a slight degree for no perceptible reason.

It has been pointed out by various authors that tinnitus aurium may be reflex in origin. The area of the whole fifth nerve, for example, should be carefully investigated for a possible cause. Two striking cases are related by Dr. Amand Routh in the *Provincial Medical Journal*, Jan. 1, 1890, where tinnitus aurium ceased on the removal of so remote a cause as a small uterine polypus. Nasal growths or obstructions blocking the Eustachian orifices may cause tinnitus. It is not pretended that in this short sketch all the possible causes of this important symptom are enumerated. It is here only needful to impress upon the mind of the reader that tinnitus aurium is produced by the most diverse pathological conditions. A division of the causes, into two great classes of

local and constitutional, is markedly useful for clinical purposes, and also for treatment.

In the treatment of tinnitus aurium, the first duty of the surgeon is to make out the presence or absence of local ear mischief or marked disease of the nose and naso-pharynx. If he finds such, is it amenable to relief or no? On the one hand, we may quote the case of a hard plug of cerumen pressing upon the drum; on the other, the terrible and distressing tinnitus of old, incurable catarrh of the middle ear, which is most difficult to ameliorate. No local conditions to explain the occurrence of tinnitus being observable, the case resolves itself into a careful general medical examination of the patient. The condition of the nervous and vascular systems must receive special consideration. Particular attention must be drawn to the association of the tinnitus with the beats of the pulse, and whether it is modified by pressure on the carotid. The general habits of life will receive due attention. Is the patient unduly worried by business cares and anxieties? Is he addicted to chronic alcoholism or sexual excesses? Is he gouty and plethoric, or weak and markedly anæmic? Some of the worst cases of tinnitus I have seen have been in middle-aged men excessively harassed by the fatigues of a large business involving great pecuniary risk, who take no exercise, eat their meals hurriedly and irregularly, and "keep themselves up" with frequent doses of alcohol.

According to the conditions found, so will the treatment be directed, and many cases may be greatly improved by detecting and removing some circumstances or conditions that aggravate or produce the malady. Cases associated with gout and plethora will

be benefited by treatment directed towards those conditions, especially care in diet, with occasional free watery purgation. Too much stress can hardly be laid on the importance of purgation, in cases of tinnitus and vertigo, associated with high vascular tension. Cases where the condition of vascular tension appears to predominate may also be benefited by vaso-dilator agents as nitro-glycerine, but always accompanied with free saline purgation and restricted diet. Where cardiac irregularity or weakness exists, digitalis is sometimes useful. In anæmic cases ferruginous tonics, or the waters of Pyrmont Spa and Swalbach, are to be recommended, and it is especially important that any undue loss of blood from the rectum or genital organs of women be detected and remedied. I have repeatedly found that anæmic women suffering from bleeding hæmorrhoids, suffer from tinnitus, and the same is the case in profuse menorrhagia. I have known strychnia or nux vomica in increasing doses to be more useful in the tinnitus of anæmia than any other remedy. In tinnitus associated with great plethora, in addition to purgation, free abstraction of blood by one or two leeches over the mastoid is often of benefit. In cases of tinnitus associated with mental worry, irritability, sleeplessness, and the like, the bromides are markedly useful, and seldom fail to give relief. The action of galvanism in relieving tinnitus aurium is vague and uncertain. When deafness co-exists, galvanism seems of use, and several cases of tinnitus with deafness treated by my friend Dr. Lewis Jones were certainly improved. Galvanism should always be tried in obstinate cases. To do this properly requires a more profound and more thorough knowledge of electro-therapeutics than is usually possessed by

medical men. The haphazard application of the remedy must be worse than useless, and, unless the patient and surgeon can obtain the services and co-operation of a judicious physician well versed in electro-therapeutics, in my judgment the remedy had best not be employed. Cases of tinnitus aurium which are going to be benefited by galvanism, usually respond favourably to the first or second application. The conditions I have noted as most favourable for this plan of treatment are—(1) absence of advanced middle-ear disease; (2) the presence of slight nerve-deafness; (3) a markedly neurotic habit on the part of the patient.

For the following account of the application of electricity to cases of tinnitus I am indebted to Dr Lewis Jones and Dr. H. M. Tickell :—

The battery should consist of at least six cells, and it is better to have ten or twelve. The exact number of cells is of little consequence when a galvanometer and rheostat are included in the circuit. The graphite rheostat is the most convenient form of instrument, and it should have a maximum resistance of from ten to twenty thousand ohms. The form of electrode which gives the most satisfactory results is one which is designed to treat both ears simultaneously with the same pole. This electrode resembles in shape the binaural stethoscope, but with metal discs the size of a sixpenny-piece substituted for the ear-pieces. These are maintained in position in front of the tragus by means of the spring. The two discs are covered with small pads of moistened absorbent wool, so as to diminish the risk of producing sores by electrolysis of the skin. The indifferent electrode consists of a pad, and is kept in position against the back by the pressure of the clothes. The aural electrode being connected with the anode, and the pad with the cathode, the cells are turned on into circuit, and the current is slowly raised from zero, by reducing the resistance of the rheostat until the galvanometer indicates about eight milliampères. It is to be kept constant for eight minutes. In cutting off all the current, care must be taken that the strength is very

gradually reduced, as the tinnitus is apt to be increased by the sudden opening of the anode. This treatment should be carried out three times a week.

In cases which respond to treatment there is usually a cessation of tinnitus for some hours after the first application, and after each successive application this period is progressively increased until complete freedom is experienced. If any return of trouble should subsequently take place, it may again be relieved by treatment.

The results obtained by this method of treatment by Dr. Tickell in the out-patient department of St. Bartholomew's Hospital are peculiarly important, as furnishing a guide to the value of electrical treatment in this disorder.

Two hundred cases were admitted to treatment; sixty-one cases rejected on account of brief attendance.

Tinnitus.—Seventy-two per cent. obtained relief. Fifty per cent. of the cases obtained lasting relief.

Three cases are reported as cured.

Auditory vertigo.—Eight cases of auditory vertigo in association with tinnitus were treated in the same manner; all were relieved of vertigo, and all but one of tinnitus.

Galvanism applied to the sympathetic in the neck is highly spoken of in cases due to vaso-motor dilatation. Considering the number of nerves that must at the same time be stimulated, this treatment would appear to be highly theoretical.

Lastly, the surgeon will find, to his chagrin, that a considerable number of these unhappy cases are not materially benefited by any scheme of treatment he may devise, however sensible and judicious. For these, various remedies have been more or less empirically prescribed. Some authorities strongly recommend hydrobromic acid in full doses. The administration of morphia is certainly sometimes efficacious, and so are bromide of potassium and chloride of ammonium in full doses. Smart counter-irritation behind the

ears sometimes relieves. The application of dilute hydrocyanic acid, or solution of atropine, to the meatus and canal may also be tried. In cases of extreme deafness from old catarrh, where the membrane is shrunken, and the distressing tinnitus is deemed due to the pressure excited by the contracted tissue on the ossicles, it has been advised to remove the tympanic membrane and the stapes by operation. This has been already alluded to in the chapter on chronic aural catarrh. The subjects of incurable tinnitus should be comforted by assuring them that the intolerable annoyance caused by this symptom will lessen in time. Several sufferers have informed me that they now have become used to the noises which formerly annoyed them excessively. I would, in conclusion, urge upon the practitioner the importance of general medical treatment in cases of tinnitus aurium. Even in those dependent upon old aural catarrh, careful regulation of life and diet, of travel and climate, and of appropriate medicinal remedies, will often do much to ameliorate and relieve.

CHAPTER XIV.

DEAF-MUTISM AND AIDS TO HEARING.

UNDER this heading are included a large number of conditions, varying from imperfect hearing and articulation, down to complete absence of hearing-power. The child is dumb, or expresses his meaning by inarticulate sounds, because he has never heard the conversation of others, and is unable, by imitation, to frame his words. The same result obtains in children who have learnt to speak, but who subsequently become deaf. Such will rapidly forget their articulate language. In all this wide class of cases, it is very important to make out clearly whether there is imperfection of the conducting media, of the perceptive apparatus, or general imperfection of the cerebral centres and understanding, as obtains in the lower grade of idiot. In the latter class of unfortunates education is usually hopeless.

A number of cases of deaf-mutism will be found as sequels of the severe and destructive inflammatory processes which accompany and follow acute suppurative inflammation of the tympanum from scarlet fever or measles in early life. In such the tuning-fork is plainly heard on the mastoid, especially when the meatus is stopped with wool. In rare cases congenital occlusion of the canal may produce deaf-mutism, and this may or may not be associated with imperfection of development of the internal ear. Cases where the internal ear is at fault, if not due to congenital imperfection of formation, are generally

dependent upon hæmorrhagic or inflammatory exudations into the tissues of the labyrinth. Such cases are especially found in congenital syphilis, after recovery from cerebro-spinal meningitis, or severe convulsions in infancy, and in some cases of mumps. In these the child may be "stone-deaf," and a loud tuning-fork placed on the mastoid gives rise to no perception of sound.* Certain cases of deaf-mutism are found in the offspring of marriages of consanguinity. The true pathology of this is obscure, but the tuning-fork usually shows that the nerve apparatus is at fault.

It is most important to estimate the degree of deafness of a deaf-and-dumb child, and also the probable pathological condition, and the question of possession of full intelligence. This can seldom be done with full satisfaction until the child is three or four years old. By a careful consideration of the above-considered causes, a sufficiently accurate diagnosis can be in most cases arrived at. The idiot will declare his true character by his appearance and cranial formation, his disgusting and offensive habits, as slobbering, protruding the tongue, and uttering strange cries, with bursts of uncontrollable passion. Such cases, when deafness co-exists, are not hopeful for educational purposes. The amount of intelligence possessed by a child is a powerful factor in determining the length of time of its special education, and the degree of its deafness is another. The length of time advocated by the best authorities is eight years. Those cases are favourable (1) where the

* See especially the tabular view of the condition of the ear in thirty-six dissections of deaf mutes. (Toynbee: "Diseases of the Ear," p. 405.)

power of hearing loud sounds through the bones is not lost—in other words, where the perceptive apparatus is healthy ; (2) where the intelligence and, therefore, power of imitation, are well developed ; (3) where the child has learnt to speak, but is forgetting articulate language on account of the onset of deafness. A large number of these latter are due to scarlatinal otitis media. The education of such children extends over six or eight years, and should be entirely confined to the "lip method." It is often observable in aural practice that an intelligent deaf person, on watching the lips of the speaker, will appreciate all that is said, but if ordered to look away from the speaker he is found to be almost "stone-deaf." This principle, used for the education of the deaf-mute, has been productive of the happiest results. It is not in the scope of this work to enter into full details of the method of teaching. Suffice it to say that the children are divided into classes according to their progress, which naturally depends upon their degree of intelligence and the length of time they have been under treatment ; that daily lessons of a progressive nature are persevered in, the children watching the lips of the teacher, who illustrates his words by common objects. In the better class of cases the results of this treatment are so satisfactory that many of the supposed incurably deaf are practically restored to their places in society. Few cases are there where nothing can be done, and even in the deaf-and-dumb idiot, unless he is merely fitted for a vegetable existence, there are frequently some faculties developed, which, if steadily encouraged, may lead to striking competence in some manual art, as carving, gilding, or the like.

It is needful to add that the successful treatment

of a case of deaf-mutism depends largely upon the skill and perseverance of the teacher, and the length of time over which the education extends. The period of education should, indeed, be measured by years rather than months, and parents and guardians should distinctly understand this.

To sum up the question of diagnosis of a case of supposed deaf-mutism. The surgeon should, in the majority of cases, not be satisfied with one or two visits of his patient. He should record and estimate the parents' account of the deafness of their child. The child should then be placed on the nurse's lap, with the face turned away from the surgeon. The latter, standing at a moderate distance from the child, sounds a musical note, as the tinkle of a bell. The hands may be clapped forcibly.* Should no result be obtained, the surgeon approaches nearer, and should the child still remain unconscious of his approach and of the noises created, considerable deafness will be with reason apprehended. The feeling of touch being very much developed in a deaf child, the surgeon must be careful not to mistake the vibrations caused by compression of the air for hearing. A totally deaf child will *feel* any very loud noise. The parents will usually corroborate the opinion of the surgeon by stating that the child does not hear even when shouted at. Each ear may now be stopped with wool, and a large tuning-fork applied to the mastoid, when a child not entirely deaf will usually by a sudden smile, intelligent gesture, or other expression, signify that he hears the sound. In minor degrees of deafness, the statements

* A small musical-box is very useful in these cases. Children who hear the sounds at all will quickly turn round, attracted by the melody.

of an intelligent nurse or mother must be taken into consideration. The observation that a "child is deaf" is usually a correct one, and though such an one may be conscious of loud sounds and musical notes, he may yet be unable to hear finer sounds, and hence the modulations of articulate speech. In this latter class of cases early education is most important. In cases of acquired deafness, when articulation is normal, the hearing should at once be supplemented by lip-reading. It is lamentable and astonishing how quickly the child will lose its speech and become dumb. It need hardly be pointed out that a careful examination of the ears, after the methods described in chapter i., is most essential, and no reputable attempts at improving the hearing should be neglected. Especially we may mention in this connection the use of the cotton-wool support in perforation of the drum, and careful investigation and treatment of the naso-pharynx.

Before declaring the case to be one of congenital nerve-deafness, the surgeon must assure himself that the membrana tympani is normal, and that no disease of the canal exists; that the nose is pervious and the pharynx not obstructed by growths; that the tuning-fork is not heard on the mastoid. The question of congenital syphilis must be carefully considered, and this is especially aided by a careful ophthalmoscopic examination, and inspection of the teeth, skin, and margin of the anus. The condition of the other children, and judicious inquiries into the health of the parents, are also essential in this respect.*

* Mr. Van Praagh, so well known as an expert on this subject, has kindly revised this chapter, and has added a short summary of the methods he employs in the education of these children.

"All deaf children," writes Mr. Van Praagh, "from the stone-deaf to the hard-of-hearing, should be taught on the pure oral system by well-qualified teachers. The child is, in the first instance, taught to use his respiratory organs—learns to imitate sounds by sight and touch. The teacher is placed so that the light always falls on his or her face; the child can then watch every movement of the face and lips. From the vowel sounds the teacher proceeds to consonants, combines the vowel sounds and consonants into monosyllables of common objects, easily shown. The single words are extended to simple sentences, and so he proceeds to give the child a knowledge of the English tongue. Other subjects are added, and after a course of eight years the deaf child ought to be able to lip-read well (to hear with his eyes), and to have sufficient knowledge of language to express himself well, both orally and in written language. Lip-reading—that is, the power of understanding what people say—is the backbone of the system, and must be practised to its fullest extent.

"Adults, too, who have become incurably deaf, can acquire lip-reading, but the lip-reading taught to an adult is entirely different to the lip-reading acquired by a deaf child. The adult being in full possession of language, it takes him but a few months to acquire what it takes a deaf child years to do. The question of educating deaf mutes is a very large one, and cannot easily be explained in a brief essay."

The extraordinary improvement to hearing which can be sometimes brought about by the judicious adoption of Yearsley's method of applying the wool-pad in cases of perforative otorrhœa, has been already dwelt upon, and a warning voice raised against the

unjustifiable adoption of a sound principle by the unscrupulous and ignorant. The same remarks apply with equal force to the various "aids to hearing" which are in vogue. A large number of these are more or less fanciful inventions, and are seldom of great utility to the purchaser. In a few of the aged deaf the hardness of hearing is aggravated by the "collapse" and approximation of the flaccid walls of the auditory canal. In such cases, and in those also who have occlusion from eczematous conditions or inflammation, the wearing of a small tube in the canal may be associated with considerable improvement. We find in practice that a large number of "small tubes" of fanciful sizes and shapes are in vogue which the deaf public buy wholesale, regardless of cause or effect. In a very small proportion of cases is hearing improved by them, and they are often used unwisely and improperly. In all cases of deafness where the tuning-fork shows that the auditory nerve is healthy, the sound of the voice can usually be heard through the bones by shouting loudly, and it is in these cases especially, that improvement is to be expected from the employment of instruments, intended to convey sounds directly through the bones to the perceptive apparatus.

Audiphone.—The audiphone is an instrument of American invention. It consists essentially of a thin vulcanite disc, made convex on one surface by means of fine strings stretched across the other. The edge of the plate is pressed closely against the upper teeth, the patient bending the plate somewhat, and keeping the mouth a little open. The voice of one speaking in front of the deaf person will then, not infrequently, be heard with remarkable clearness.

Dentaphone.—The dentaphone consists of a circular wooden box having a plate of vulcanite or metal at the bottom. A wire extends from this, terminating in a wooden plate held between the teeth of the patient. This instrument has appeared to me to give markedly inferior results to the former, and I believe its use may well be abandoned.

Telephone.—Theiler and Sons, the electricians, were good enough to provide me with an instrument of their construction in 1892 for trial. It consists of an ordinary telephone apparatus and an "ear-piece," which is held against the side of the head and against the ear. I found this instrument useful in some cases of middle-ear deafness, and it might be advantageous to a deaf person who worked in an office, as that of a solicitor or merchant. The apparatus is a little cumbrous, and must be fixed on a table near the user.

It may generally be said regarding these and similar instruments that the results obtained by them can be obtained by a well-adapted "speaking-trumpet," and for purposes of diagnosis they do not supplant the tuning-fork. Furthermore, they are open to the inevitable disadvantage of unsightly "appearance" which the deaf are often so anxious to conceal.

The scope of this work will not allow of a dissertation on the numerous kinds of "ear-trumpets" and speaking-tubes. Generally speaking, the most useful are those which fit well into the meatus, and have a sufficient surface to "catch" the waves of sound, and so convey them to the auditory canal (Fig. 34). It need hardly be pointed out that patients have to choose between utility and appearance. Small tubes

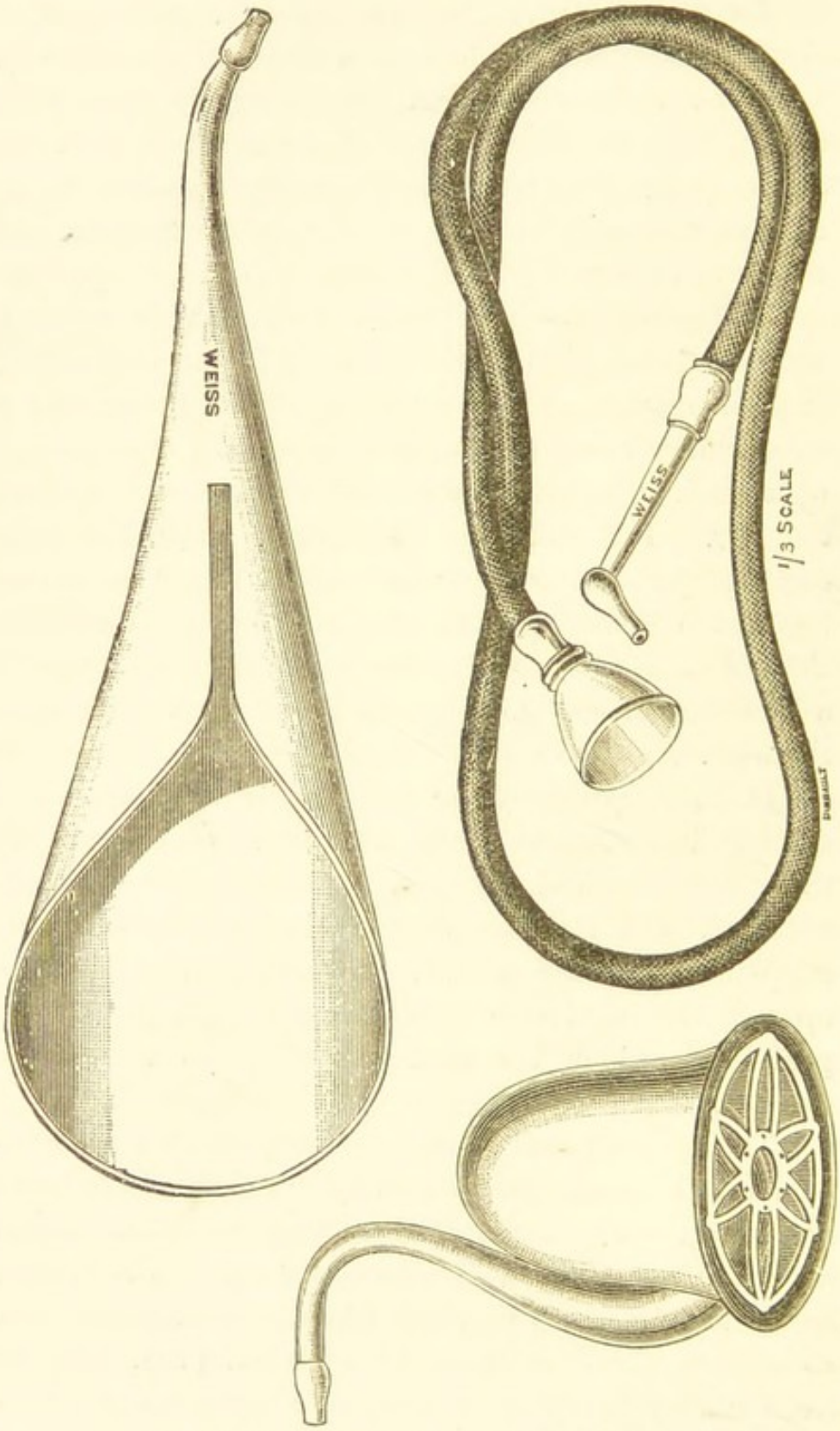

Fig 34.—Some Useful Kinds of Ear-Trumpets.

worn in the canals, with concave outer extremities designed to lie in the "hollow of the ear" are of little use, however pleasing their concealment may be to the patient. As regards the choice of the larger tubes, it is frequently needful for a patient to make trial of several kinds, under the guidance of a competent and reputable instrument-maker, before he is able to judge which suits him the best.

Numbers of the incurably deaf, however, will not consult a reputable surgeon or believe advice thus obtained. Misled by the solicitations of ignorant and well-meaning friends, by numerous advertisements, and false testimonials inserted in the lay press, they are tempted to obtain inventions of all kinds, which are always costly, usually disappointing, and sometimes harmful. Even among the poorer hospital classes it is quite common to be informed that the patient, through "pinching and saving" and the aid of friends, has been able to expend several pounds in the purchase of some bogus "professor's" tubes or drums. It is too much to hope that quackery in all its forms will cease from among us. It is not too much to hope that medical men generally will set their faces against allowing their incurably deaf patients to "try" this and that novelty. By counselling the incurably deaf to rely upon the advice of surgeons of repute and respectable instrument-makers, as to the adoption and selection of any kind of aid to hearing, they will be carrying out the ordinary principles of sound practice, and will lessen the nefarious trade in "instruments for the deaf" at present extensively carried on in London and other large cities.

APPENDIX.

AURAL THERAPEUTICS AND PRESCRIPTIONS.

A CAREFUL perusal of this work will indicate to the reader that affections of the organ of hearing, like all other diseases, can only be well treated by those who take a comprehensive view of the subject from the general standpoint of surgery and medicine. It is also obvious that a sound estimate of pathological changes is requisite for prognosis, and especially for the prognosis of those affections which depend upon chronic inflammatory changes. Empirical treatment of deafness is generally unwise. The numerous operations upon the naso-pharynx, mastoid, venous sinuses, and contents of the cranium render it essential that anyone who practises aural surgery according to modern methods, must be a good diagnostician, and a skilled operator. It is none the less needful that he should possess a knowledge of the principles of medicine. In the most simple cases of ear disease, local measures are always aided by general medicinal and dietetic treatment and considerations. Nothing is more common, for instance, than for one to see a case of eczema of the canal over which local treatment of all kinds has been vainly expended, while the patient is regularly "dining out" or drinking a bottle of sweet champagne for lunch! Much care may have been given to the local treatment of the throat and nose, in a case of Eustachian obstruction and catarrh, when the recognition

of a few faintly-coloured "coppery" tubercles at the root of the hair points out that a week's mercurial treatment would clear up the malady with celerity. The surgeon cannot understand why a given case of mastoid disease continues to necrose, despite his incisions and operations. A medical examination would have shown him that his patient was suffering from diabetes or congenital syphilis! Such instances might be extended indefinitely. Even such trivial maladies as "wax in the ear" need the hygienic precautions of not allowing the cold water of the morning bath to trickle into the meatus.

Bearing these indications most strictly in view, it must next be pointed out that the first essential in treatment is to make a diagnosis. Difficult as this may be to those who have never had time or opportunity to study the subject, it is not the less important that no surgeon should attempt to treat cases of aural disease without having some idea of their nature.

It is still too common to find the syringe used for all sorts of deafness, on the "off chance" that it may bring away cerumen. Lotions, drops, and the like are freely prescribed to be dropped into the meatus, or blisters are applied over the mastoid, when the seat of mischief is perhaps adenoid growth in the pharynx. The miserably short space of time which is given to the student for pure clinical study explains much of this. Common aural diseases, like the ordinary diseases of the eye, are so easily recognised, and so amenable to well-directed treatment, that a few months expended in their consideration will prove of the highest utility to the practitioner, and of the utmost benefit to his prospective patients.

With these preliminary remarks, we may first observe that all applications to the ear should be warm, and all astringents and antiseptics freshly prepared, and generally very dilute. The sensibility of different ears varies in an extraordinary manner to the action of astringents, and it is easy to do harm with these agents. This explains the popular notion, "that it is dangerous to check a discharge from the ear!" The ice-bag applied to the side of the head is often grateful in aural inflammation. It is a remedy which should always be avoided, as it must tend to congest the deeper vessels. Heat, on the contrary, dilates the superficial vessels, and so depletes the deeper ones. The local abstraction of blood by leeches is of the greatest value in all deeply-seated aural inflammations of any acuteness. I formerly advocated the application of such substances as iodoform and boric acid to the ear in aural pellets made of cacao-butter. Extended experience has taught me that greasy applications of any kind are not very applicable for the deeper parts of the auditory canal, since they tend to become rancid and decomposed. A basis of gelatine in aural pellets containing antiseptics or astringents is far more advantageous. The use of anodynes in painful aural affections must be approached with much caution. It is the height of bad practice to subdue the agonising pains of acute aural inflammations or pent-up pus, by large doses of morphia. As a general rule, severe aural pain indicates local abstraction of blood and general antiphlogistic treatment, or the immediate application of some surgical measure, as opening the mastoid. There is no contra-indication to the use of warm anodyne applications to the canal. It must be

remembered that, if the drum is perforated, fluids will flow down the Eustachian tube into the pharynx, and thus be swallowed. Strong atropia or laudanum lotions will thus be used with caution in young children. Purgatives are often of the greatest utility in congestive and inflammatory affections. Mercury is a most useful drug in many conditions, where inflammatory action has to be checked, or the products of inflammation removed. Tonics are often useful in the various stages of anæmia found in perforative otorrhœa or in association with loss of nerve-power.

It cannot be too strongly pointed out that quinine in all forms must be carefully avoided. Mild ferruginous and bitter tonics are indicated, or cod-liver oil, and strychnia in some form or other is often of the highest utility. Here, again, it is useless to give such remedies when the patient is daily losing large quantities of blood from piles or is addicted to sexual excesses.

General hygienic treatment and dietary will receive the closest attention. Dry mountain air is very beneficial in catarrhal deafness and in perforative otorrhœa ; and desperate cases of mastoid necrosis in the tuberculous soon heal and get well under the simple measures of continuous fresh air, and abundant plain diet. Sea-bathing in all forms must be strictly interdicted in ear disease generally. The cold bath should, if the patient can bear it, be used in the morning, the chest and body being well rubbed with a hard towel to promote reaction. Cold water should never be splashed over or down the ears, and the head should be well brushed and not washed. All "screwing out" of the ears with towels, "aurilaves," and the like should be strictly forbidden, especially in the nursery.

In the following pages a few selected simple prescriptions will be given, mainly for local application.

I. For maceration of ceruminous plugs, or desquamation plugs.

(*a*) ℞ Sodæ bicarbonatis ... ... ℥jss.
Acidi borici pulveris ... ... ℥jss.
Glycerini ... ... ℥j.
Aquæ rosæ ... ... ℥iij.

This lotion, mixed with equal parts of warm water, to be soaked into the affected ear night and morning.

(*b*) ℞ Acid. salicyl. pulv. ... ... ℥ss.
Spirit. rect. ... ... ℥ij.
Glycerin. boracis ... ... ℥j.
Aquæ ... ... ℥iij.

To be soaked warm into the affected ear.

II. Antiseptic lotions.

℞ (*a*) Lotio acidi carbolici (1 in 40).
To be used with equal parts of warm water.

(*b*) A saturated solution of boracic acid. q.s.
To be used with equal parts of warm water.

(*c*) Lotio hydrargyri perchloridi (1 in 2,000).
To be used with equal parts of warm water.

(*d*) Lotio zinci sulphocarbolatis (gr. ij ad ℥j).
To be used with equal parts of warm water.

III. Astringent antiseptic and anodyne.

℞ Zinci chloridi ... ... gr. ij.
Acid. borac. pulv. ... ... gr. x.
Tinct. belladonnæ ... ... ℥j.
Aquæ ... ... ℥j.

To be mixed with equal parts of warm water, and dropped into the ear night and morning.

IV. Parasiticide.

℞ Hydrargyri perchloridi ... ... gr. viij.
Alcohol ... ... ℥iij.
Aquæ ... ... Oss.

To be used, mixed with equal parts of warm water, to syringe the ear.

V. Anodyne.

(*a*) ℞ Extract. opii liquid. ... ... ℥iij.
Glycerini ... ... ℥j.
Liq. plumbi dil. ... ... ℥j.

To be soaked, warm, into the meatus.

(*b*) ℞ Atropinæ ... ... gr. j.
Glycerini ... ... ℥ss.
Aquæ ... ... ℥j.

To be dropped, warm, into the affected ear.

(*c*) ℞ Morphinæ ... ... gr. iij.
Glycerini ... ... ℥j.
Aquæ ... ... ℥j.

A few drops of this lotion, warmed, to be dropped into the ear.

(*d*) ℞ Atropinæ ... ... gr. j.
Morphinæ ... ... gr. iij.
Ol. eucalypt. ... ... ℥ss.
Aquæ ... ... ℥ij.

A pledget of cotton-wool, soaked in this solution, warmed, to be placed in the canal.

VI. Eczematous inflammations of a chronic nature.

(*a*) ℞ Liq. carbonis detergens ... ... ℥ij.
Liq. plumbi dil. ... ... ℥jss.
Acid. carbolici ... ... gr. xv.
Aquæ ... ... Oss.

This lotion, mixed with equal parts of warm water, to be used to syringe the canal.

Ointments.

(*b*) ℞ Ung. hydrarg. oxid. flav. ... 5 to 10 per cent.
(Pagenstecher's ointment.)

(*c*) ℞ Ung. hydrarg. oxid. rub. ... ... ʒj.
Lanoline ... ... ℥j.

(*d*) ℞ Ichthyol ointment ... ... 5 per cent.

VII. Profuse suppuration.

(*a*) ℞ 10 vol. solution of hydrogen peroxide.

(*b*) ℞ Boroglyceridi ... ... ℥j.
Aquæ ... ... Oss.

To be mixed with equal parts of warm water, and used to syringe the ear.

(*c*) ℞ Acidi carbolici ... ... gr. xxx.
Glycerini ... ... ℥ss.
Alcohol ... ... ℥iij.
Aquæ ... ... Oj.

A tablespoonful of this lotion to be added to a glass of warm water, and used to syringe out the ear.

VIII. Powders, astringent and antiseptic.

℞ (*a*) Pulv. iodoformi.
(*b*) Pulv. acid. borici.
(*c*) Pulv. zinci oxidi.
(*d*) Pulv. acidi tannici.
(*e*) Pulv. ferri sulphatis.
Combinations of above.

Anodyne powder.

℞ Morphinæ ... ... gr. ij.
Pulv. acid. borici ... ... ʒss.
Pulv. calaminæ ... ... ʒj.

All powders to be very finely triturated and mixed, and used with insufflators.

IX. Caustics and powerful astringents.

℞ (*a*) Chromic acid.

(*b*) Perchloride of iron.

(*c*) Potassa fusa.

(*d*) Nitrate of silver.

(*e*) Sulphate of zinc.

(*f*) Chloride of zinc.

(*g*) Pure carbolic acid.

(*h*) Liq. plumbi fort.

The above applications may be used pure, or made into pigments of various strengths with glycerine and water. They are applicable for granulations, polypi, etc., and must be applied with the utmost caution to the diseased tissues only.

X. Nasal washes. Alkaline and antiseptic.

(*a*) ℞ Pulv. sodæ bicarb. ... ... ʒij.
Pulv. acid. borici ... ... ʒj.

As much of this powder as will lie on a shilling to be dissolved in a tumbler of warm water, and used as a nasal douche.

Antiseptic.

(*b*) ℞ Liq. sodæ chlorinatæ. q.s.

ʒj to be added to a pint of warm water, and used to syringe the nose.

(*c*) ℞ Menthol ... ... gr. ij.
Camphor ... ... gr. j.
Ol. eucalypt. ... ... ʒij.
Parolein ... ... ʒj.

To be used with a spray "atomiser" in nasal catarrh.

XI. Vapours.

(*a*) ℞ Vapour of chloride of ammonium.

(*b*) ℞ Tinct. iodi. q.s.

ʒij to be added to a pint of boiling water, and the steam inhaled or used in a Politzer bag.

(*c*) ℞ Vapours of ether or chloroform.

To be used with a Politzer bag; the bag, being emptied, is allowed to fill over the agents, and the vapours are thus drawn into the bag.

(*d*) ℞ Oil of pine wood. q.s.

A few drops to be placed in the "chamber" of a Politzer bag.

(*e*) ℞ Tinct. benzoini comp.

℥iij to be added to a pint of boiling water, and the steam inhaled.

XII. Injections. In labyrinthine deafness due to syphilis.

(*a*) ℞ Injections of nitrate of pilocarpine.

2 minims of a 4 per cent. solution to be injected daily, and increased gradually up to 8 or 10 minims.

For syphilitic deafness.

(*b*) ℞ Injection of sal alembroth.
(Ammonio mercuric chloride.)

$\frac{1}{3}$ grain in 10 minims of water injected into the buttocks once or twice weekly.

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