

when one tube is swollen, but it will enter on the diseased side with less force. Frequently the patient is unable to tell whether or not the air has passed. When chloroform vapor is used a sense of "heat" or "cold" is felt. In children the act of crying, or often the reflex from the impact of the air upon the soft palate, will throw the latter up and thus close the naso-pharynx; in any event Politzerization is more easily accomplished in childhood because the Eustachian tubes of children are shorter and wider than are those of adults.

Many modifications of Politzerization have been suggested. Condensation of air in the external meatus may be useful to discover perforations when other methods fail. This may be accomplished by placing the olive tip of Politzer's bag in the meatus and compressing the bag.

George C. Stout.

EAR DISEASES: NEW GROWTHS.—New growths of the ear may be divided into benign and malignant growths. Ordinary polypi and syphilitic new growths are dealt with elsewhere in this series of articles and will not be included in the present one.

BENIGN NEW GROWTHS OF THE AURICLE.

The benign new growths comprise (1) fibroma or keloid, (2) lipoma, (3) atheroma, (4) cysts, (5) angioma, and (6) papilloma; while the malignant growths include (1) carcinoma, (2) sarcoma.

FIBROMA is probably the most common new growth of the auricle. Those which have come under the observation of the author have been unilateral, and Dench holds that this is the rule, while Politzer claims that they are almost always bilateral but of different sizes in the two ears. They usually occur in the lobule, although cases have been reported in which fibromata filled the concha and partly occluded the external meatus (Habermann: *A. f. O.*, Bd. ix., p. 294; and Bürkner: *A. f. O.*, Bd. xv., p. 58).

Etiology.—A very common cause of fibroma is the piercing of the lobule for, and the wearing of, earrings. These growths are more common in the negro race.

Pathology.—They are usually smooth and hard to the touch and vary in size; Agnew and Turnbull having reported cases in which the growths were larger than the auricle itself.

Microscopically, they consist of white fibrous tissue, in which, as a rule, there are very few cells. Anton, however, reported a case in which the growth was soft and contained many cells and leucocytes. Buck examined a specimen of fibroma under the microscope, after its second or third recurrence, and found it to be composed entirely of fibrous tissue. These growths do not recur if thoroughly extirpated.

Agnew reported an interesting case of fibroma which recurred with regularity after repeated removals. Finally it changed its character and appeared as a myxo-fibroma. Strawbridge (*Trans. Am. Otol. Soc.*, July 2d, 1875) reported a case of fibro-chondroma following the irritation of earrings. Haug (*A. f. O.*, Bd. xxxii., p. 161) reported a lympho-fibroma of the tragus in a child of twelve years of age; this growth was as large as a cherry and pedunculated. The keloid cicatrices and myxo-fibromata are next in frequency to the true fibromata.

Treatment.—Thorough extirpation of the growth is the only proper plan of treatment. The incision should be made through healthy tissue, the auricle being cut through and through, and the edges of the wound stitched together. Or, if the growth be large, the lobule should be removed entire without any attempt being made to save the edges. Disfigurement should be guarded against, so far as this may be done consistently with the absolute extirpation of the tumor.

LIPOMA.—Kipp (*Trans. Am. Otol. Soc.*, vol. iii., part 3) has reported a case of fibro-lipoma of the concha.

ATHEROMA.—While atheroma is not strictly a new growth, it may be conveniently considered under this head. These tumors are really sebaceous cysts (wens,

miliun, or steatoma). They usually occur in the lobule, or at the juncture of the auricle with the head, although Moran reported a case in which the tumor was seated in the concha.

The cause is the blocking up of the duct of a sebaceous gland, causing the retention of sebum in the fundus of the gland and the consequent formation of a cystic tumor which may attain any size. If the growth should be rapid the sac may undergo a rupture, and there may be a history of recurrent discharge, which, if infected, becomes purulent. The outlet for the discharge may be situated in front of, or behind, the lobule. The contents of these sacs consist of sebum, degenerated epithelial cells, and at times cholesterol crystals. As a rule, the deformity caused by the presence of the tumor is the only symptom complained of, unless traumatism be super-added.

Treatment.—A linear incision should be made over the central part of the tumor and then the sac should be carefully dissected out. If it should be ruptured, some difficulty may be experienced in enucleating it in its entirety; but, if it should remain unbroken, the removal may easily be accomplished by the aid of a pair of strong dissecting forceps. In the case of a timid patient, the author has evacuated the contents of the cyst and then has drawn the cyst wall through an incision less than one-quarter of the diameter of the growth. The removal effected in this manner was not followed by a recurrence.

CYSTOMA.—These tumors are less common than those of the atheromatous variety. Under this head Hartmann classes effusions of serum in the auricle which are due to degenerative changes. Though these effusions are probably due to some old forgotten traumatism, it is often impossible to fix the cause in a given case. Dentigerous cysts should come under this head. The only symptom complained of is the deformity, unless there has been a contusion. Cystomata are usually located on the anterior aspect of the auricle, although they sometimes occur posteriorly. They do not contain blood as do the hematomata. They usually appear suddenly and have no tendency to increase in size.

Treatment.—A cystoma should be incised along the natural folds, and horsehair or gut drainage should be introduced. If the tumor is of large size, it may be incised anteriorly and its contents thus evacuated. The incision should then be carried through and through the cartilage; after which the anterior incision should be sewed up and allowed to heal by first intention, while subsequent drainage is continued through the posterior wound.

ANGIOMA.—Angioma, or nevus, is a congenital hypertrophy of the vascular tissues of the corium and subcutaneous tissue. Growths of this nature may be flat or elevated, single or multiple; they may occur in any part of the auricle or its vicinity, and as a rule they present a bluish-black color. They are usually congenital, though Kipp has reported a case following freezing of the auricle. Their growth may be slow or rapid, and they may extend to the meatus or to the skin in the neighborhood of the auricle. When the growth is rapid there may be pain, but usually this symptom is absent. Intercurrent hemorrhages sometimes occur. They are due to the rupture of the walls of a blood-vessel which has undergone atrophy through pressure. Jungken has reported such a case which terminated fatally.

Treatment.—The treatment depends upon the size and character of the growth. If it is small and flat, coagulation of the contained blood and shrivelling of the growth as a whole may be effected by passing through its substance several aseptic silk threads which have been dipped into chloride of iron solution. If the tumor is pedunculated it may be caused to undergo atrophy by encircling the peduncle with tensely drawn india-rubber bands. In the case of larger growths the actual cautery, cautiously used on successive occasions, has been employed with marked success. Electro- or thermo-cauterics, heated to a red heat, are preferable for this purpose, although a large darning needle or similar instrument may be em-

ployed, as was done by the author in a case in which no other instruments were at hand. Dupuytren and Weirlechner have effected cures by resorting to the rather heroic method of ligating the carotid artery. When confined to the auricle these growths may be dissected out and the vessel secured while the growth is surrounded by a clamp similar to that used in operations on the eyelids.

PAPILLOMATA, or warts, are at times encountered on the auricle. They are usually slightly pedunculated, long and narrow, and may be readily removed by a cold wire snare; the point of attachment should be touched with a solution of silver nitrate (sixty grains to the ounce) to prevent recurrence. Buck has reported an interesting case of "cornu humanum" which developed as a result of excessive manipulation, parings, etc., of one of these growths by the patient. In the course of two years this horn attained a height of three-quarters of an inch and a breadth, across the base, of the same measurement. Dr. Buck excised the growth by a wedge-shaped incision which removed it in its entirety, and there was no recurrence. Burnett, Pomeroy, Roosa, and others have reported similar cases. Other rare affections of the auricle are hyperostoses, lupus, and calcareous degeneration.

BENIGN NEW GROWTHS OF THE EXTERNAL AUDITORY CANAL.

Benign growths of the external auditory canal include (1) bony growths, (2) sebaceous cysts, (3) angiomata, and (4) false membranes.

OSTEOOMA.—Bony growths are the most frequent benign tumors of the meatus. They are hyperplasias of some part of the osseous external canal and occasion no symptoms *per se*, often being discovered by chance. They may be single or multiple, may be found at the junction of the osseous and cartilaginous portions of the canal, or at any point between this and the tympanic membranes. Those which occur at the junction of the osseous and cartilaginous portions of the canal usually arise from the posterior wall, are more often single, and vary in size from small mounds to spherical masses which fill the canal. They may be sessile (hyperostoses) or pedunculated (exostoses), and they vary in density from ivory-like hardness to the consistence of cancellous bone. They are covered with skin which is thinner than that of the neighboring canal; in the larger growths this thinness is more marked. On account of its tenseness the skin is apt to be more tender over the growths than elsewhere. When small they occasion no discomfort and are often discovered by chance. When they are larger, however, epithelium and detritus are prone to collect in the canal, between them and the membrana tympani, and thus cause hardness of hearing and tinnitus. Their rate of growth is variable and in the early stages it has, for obvious reasons, seldom been observed. Later, however, they have been seen to grow rapidly for a time and then apparently to stop growing without cause. In one case observed by the author the osteoma continued to grow, for six months after it had been discovered, until it entirely closed the canal. This case was operated upon by means of the hand gouge used in mastoid work, and although the growth was situated at the above-named junction, it was found to be exceedingly hard and required forty-five minutes of most careful and diligent work for its removal. The excision of the tumor, which possessed a broad base, gave decided relief to both the tinnitus and the hardness of hearing.

Etiology.—Some osteomata are believed to be of congenital origin, while others are attributed to rheumatism, gout, or syphilis. It is an undoubted fact that these growths often develop in the course of chronic suppurative or non-suppurative processes involving either the middle ear or the external auditory canal. As regards the relation of osteomata to gout and syphilis, it is true that they frequently occur in gouty or syphilitic subjects, but this does not prove that the relationship between them is one of cause and effect; for many other aural dis-

eases develop in such subjects and yet nobody would think of attributing them, for this reason, to either gout or syphilis as a cause. That they occur congenitally is doubtful (Buck) from the fact that at birth the osseous canal is but a ring of bone. On the other hand, it is scarcely doubtful that a chronic inflammatory process or a traumatism is competent to cause the development of an osteoma, for either of these will produce a localized periostitis, and this in turn would be likely to result in the formation of osseous tissue. The theory that polypi occasionally become organized as osseous tissue seems also plausible. A clear history of such an origin in any given case can seldom be obtained. The reports of Sir William Dalby and others imply that exostoses occur more frequently in the better-class Englishmen than they do among the people of this country. They are said to be common in pearl divers and in the natives of Hawaii who bathe excessively, but Wyman found many in the skulls of Peruvians who lived inland.

Treatment.—In many of the recognized cases the treatment is usually restricted to the removal of the cerumen and detritus, by the most gentle means at hand, from that portion of the canal which is situated between the growth and the drum membrane. This may be accomplished by a delicate bent probe, armed with a small whisp of cotton twisted over its end. Syringing may be resorted to, but it is often both ineffectual and undesirable, for it may increase the tinnitus and hardness of hearing. The cleaning process, which is usually tedious, should be carried out in a thorough but gentle fashion. When the growth attains such dimensions as to cause complete occlusion of the canal, thus producing deafness and sometimes distressing tinnitus, or else causing retention of a purulent discharge that is escaping from the middle ear, it should be removed at least in part. This is especially true if bone conduction is good. The only two methods of operation worthy of consideration are: (1) removal by means of the hand gouge and (2) removal by means of dental drills. It is not necessary in either case to dissect off the skin. The mastoid hand gouge is a very effective instrument for the removal of an exostosis when it is located in the external portion of the canal, especially if it is composed of spongy bone. The dental drills are better for the ivory-like growths or for those located deep in the canal, though the operator's familiarity with either method is a factor in the case. Pedunculated growths may at times be readily snapped off by a prying movement of the gouge, as in a case observed by the author. The narrowness of the canal and the fact that the deeper growths are more apt to be ivory-like make the drills preferable for those so located. The shape of the drill is to be chosen according to the conditions present in the case under consideration. The number of revolutions of the dental engine per minute should also vary according to the character of the growth. The hemorrhage from these operations is usually slight but may at times be embarrassing, as it obscures the field of operation. These operations, which often require much patience, should be done under strict asepsis and with the aid of a general anæsthetic. The after-treatment consists chiefly in the maintenance of strict asepsis, and if there is no discharge from the middle ear the external auditory canal should be packed with gauze in order to prevent the cicatrix from narrowing the meatus. If there is a discharge from the deeper parts, a tube should be inserted for this purpose, as otherwise membranous bands are apt to form which may entirely close the canal.

SEBACEOUS CYSTS.—Cysts of the meatus are of rare occurrence, but they have been occasionally reported. They resemble milium or the sebaceous cysts which occur elsewhere. They vary in size from that of a millet seed to the entire diameter of the canal. When they are small they do no harm, but when large enough to occlude the canal they cause tinnitus, autophony, or deafness; and if they continue to grow, they may cause pressure atrophy or erosion, or may lead to the formation of the "molluscous tumors" mentioned by various writers (Toynbee,

Kirk and Duncanson, and others). They have been known to suppurate. They are more often found in the cartilaginous meatus, where the ceruminous glands and

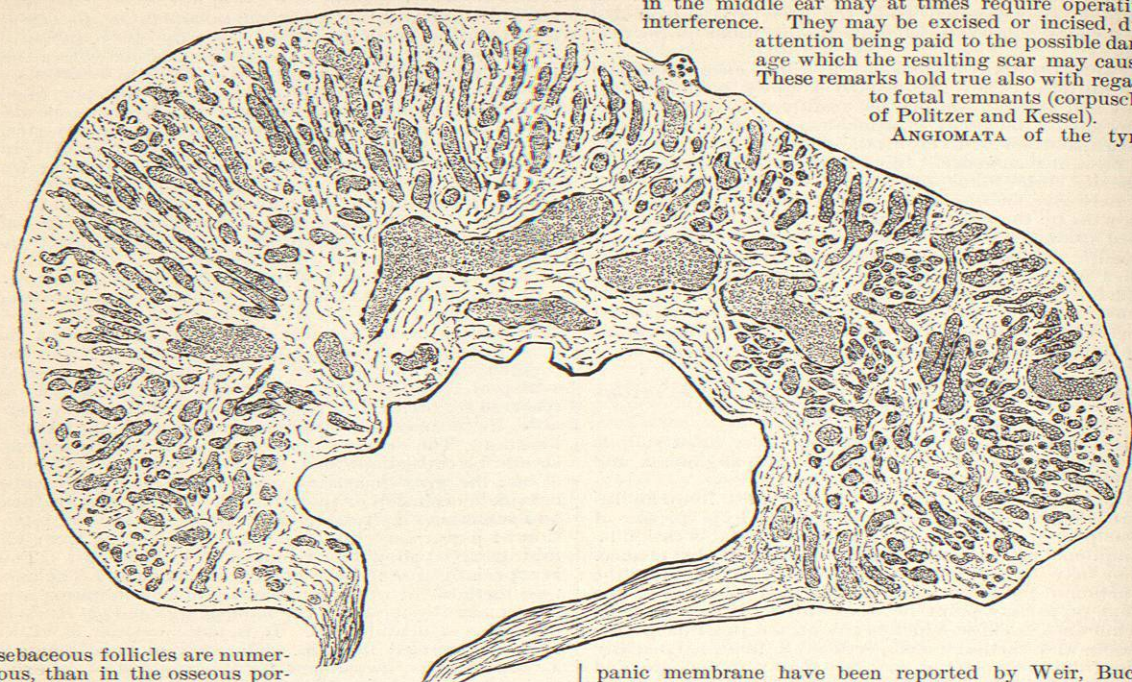


FIG. 1801.—Cross Section of Angiomatous Polypus, as seen under a low power. (Buck's case.) From a drawing made by Dr. Ira Van Gieson.

sebaceous follicles are numerous, than in the osseous portion.

As regards the pathology of these sebaceous cysts it is sufficient to say that they are simply retention cysts, containing cheesy or atheromatous material.

Treatment.—These cysts should be incised with a small sharp-pointed bistoury, their contents evacuated, and a solution of iodine, potassium iodide, and glycerin applied to the open wound.

ANGIOMA.—A few cases of angioma of the external auditory canal have been reported, and under this head aneurismal tumors like that reported by Todd, of St. Louis (*Amer. Journal of Otol.*, vol. iv., p. 187, 1882), would be classed. As regards their pathology and treatment, nothing need be added to what was stated under the head of angioma of the auricle.

FALSE MEMBRANES or bands are at times found in the external auditory canal, and if they cause symptoms they may be excised or incised, great care being taken to prevent the subsequent narrowing of the canal.

ENCHONDROMA.—A few cases of enchondroma of the external auditory canal have been reported. These growths should be dealt with on lines similar to those mentioned under the head of exostoses.

BENIGN NEW GROWTHS OF THE MIDDLE EAR.

Ordinary polypi, cholesteatomata, and new growths of a syphilitic or tuberculous character will be dealt with elsewhere in the HANDBOOK.

PAPILLOMATA or wart-like growths are at times found on the tympanic membrane; they are possibly due to the instillation of irritating fluids into the external auditory canal.

PEARLY GROWTHS, according to Gruber, have been

found in the tympanic membrane. They consist of cholesterol crystals, epithelial cells, and debris.

GROWTHS COMPOSED OF FIBROUS TISSUE.—Newly formed membranes and bands which are observed in the middle ear may at times require operative interference. They may be excised or incised, due attention being paid to the possible damage which the resulting scar may cause. These remarks hold true also with regard to fetal remnants (corpuscles of Politzer and Kessel).

ANGIOMATA of the tym-

panic membrane have been reported by Weir, Buck, and others. They may be detected by the abnormally red appearance of the tympanic membrane or of the growth itself, should the tympanic membrane be absent. Redness may extend over the lower half of the membrane or may present itself in irregular splotches; the membrane itself may be bulged outward from pressure, and it may pulsate synchronously with the radial pulse; tinnitus is often present; and, finally, the hardness of hearing may be extreme. These growths occur at times without apparent cause and develop slowly; they are composed almost entirely of blood-vessels, and if removed by cutting may recur (Buck) (Fig. 1801). Paracentesis may be followed by a severe hemorrhage in which an ounce or more of blood is quickly lost.

The **treatment** consists in the application of chromic acid, the acid nitrate of mercury, or pure nitric acid on the tip of the delicately wrapped cotton carrier; or a small ignipuncture may be made by means of a fine electro-cautery.

Exostoses or echondroses of the ossicles have been reported.

Fibroma and osteoma of the middle ear have been found post mortem.

MALIGNANT GROWTHS OF THE AURICLE.

Epithelioma and **sarcoma** are the most common malignant growths of the auricle, epithelioma being far the more common. Minor, in 104,412 ear cases collected in the service of nine American hospitals, found that epithelioma occurred eighty times while there were no cases of sarcoma in this list. This in a measure agrees with the general statistics, which show that epithelioma is far more common than any other malignant growth of the auricle. Cases of epithelioma have been reported by Buck, Orne Green, Gruber, Sacke, Habermann, Burnett, Wilde, Schubert, Kipp, Kramer, Moos, Marian, Kretschmann,

Seely, Haug, Bruner, Bryant, Demarquay, and others. So far as one can infer from the accounts of the cases mentioned above, epithelial cancer is much the same when occurring in the auricle as when it involves other parts of the body. In many cases there is at first a wart-like growth, which is subjected to traumatism, scratched, pinched, touched with strong acids, or removed by the knife, and which then grows more and more rapidly the more it is disturbed, until finally the affected part becomes covered with scabs under which will be found ulcers that are more or less deep and that may or may not show a tendency to bleed. There may also be severe pain, but this symptom is not common. More often the patient applies for relief simply on account of a long-standing or obstinate "sore." In some cases, as in that reported by Valpau, the growth seems to have been rapid. Epitheliomata are more apt to occur in those past middle life. They tend to spread to the external auditory canal and neighboring parts of the head. On the other hand, they are often secondary to growths in these neighboring parts. The term epithelial carcinoma is usually applied to these growths, Gruber claiming that this is the only form of malignant tumor which attacks the auricle primarily. When the disease is allowed to spread to the head—the meatus, middle and internal ears becoming affected in turn—death results from debility or from meningeal or brain involvement; the glands of the neck or the parotid gland may also in some instances become involved.

Treatment.—Here as elsewhere the only rational treatment is complete extirpation. All of the diseased and suspected tissues—including the entire auricle, cutaneous walls of the external auditory canal, the lymph glands of the neck, and the parotid gland if necessary—should be removed. If the case is seen early the removal of the growth by a V-shaped incision may suffice. The entire auricle has been removed a number of times, and in one case at least this was done by means of the cautery snare. Dench and others have removed the entire cartilaginous canal. When the operative interference involves the canal, a tube should be introduced and kept in position until the wound is entirely healed; otherwise cicatricial closure is to be feared.

SARCOMA.—Although sarcomata are of relatively infrequent occurrence, they have been reported by Roudout, Stacke and Kretschmann, Schabert, and others. In the case reported by Roudout the growth had existed for twenty years, but its complete extirpation resulted in a cure. In the case of Stacke and Kretschmann the growth was removed by the galvano-cautery snare and the result proved to be an entire success.

MALIGNANT GROWTHS OF THE EXTERNAL AUDITORY CANAL.

Primary malignant growths in this region are more rare even than those of a secondary nature, carcinoma predominating here as in the auricle. Buck reports two cases of secondary carcinoma, one of which originated in the middle ear and the other in the cervical glands behind the ear. Kessel, Delstanche, and others have reported cases of carcinoma. In most cases it is doubtful whether they are primary or secondary. Buck also reports a case of primary sarcoma occurring in the external canal of a

young girl fourteen years of age. This latter—an osteo-sarcoma—recurred repeatedly until it was finally thoroughly removed, the neighboring parts having been well scraped, and a strong solution of chloride of zinc applied to the wound.

MALIGNANT GROWTHS OF THE MIDDLE EAR.

Here also the malignant growths which have been reported were, as a rule, carcinomatous in character. Apparently, they occur only rarely. In most instances they develop in the course of a neglected chronic suppurative inflammation of the middle ear or a necrotic process of the temporal bone. They may also appear in the middle ear secondarily to their development in some neighboring part; and this undoubtedly is the more common course of events. These growths usually occur in patients of from forty to sixty years of age.

Symptoms.—These include pain, which is often severe, paralysis of the facial nerve from its involvement in the malignant disease, hemorrhage, which may be frequent and profuse, induration of the cervical glands, meningitis, abscess of the brain, sinus thrombosis, or hemorrhage from the lateral sinus. Death, which is the usual ter-

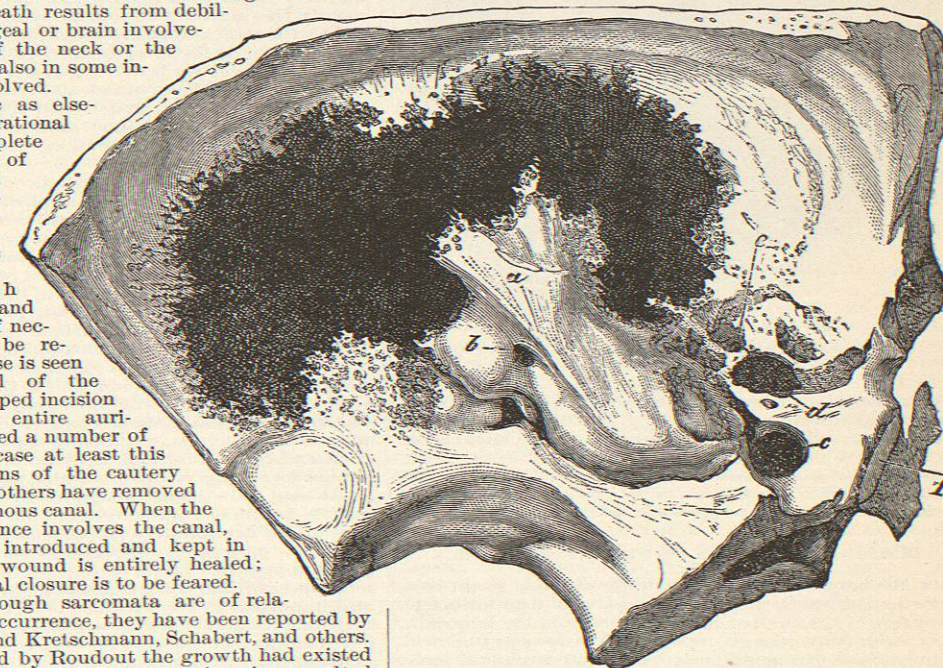


FIG. 1802.—Destruction of the Temporal Bone by Epithelial Cancer. a, Median remnant of the pars petrosa; on the surface of its apex the bone is also destroyed by the new growth; b, porus acusticus internus; c, foramen lacerum anterius; d, foramen ovale, enlarged by destruction of its edges to twice its natural circumference; e, foramen spinosum; f, sphenoid articulation. (After Schwartz.)

mination, is due to exhaustion or to one of the four events just mentioned.

Diagnosis.—The gradual development of a malignant growth in the middle ear, in the course of some chronic affection of that region, renders it practically impossible to make a correct diagnosis until the frequent recurrences after removal and perhaps the behavior of the growth in other respects arouse the surgeon's suspicions and lead him to examine the tissues with the microscope.

Treatment.—This is usually palliative only, although

as a last resort the mastoid may be opened (Schwartz), in cases in which the disease is pent up in the tympanum or in which it is apparently extending inward.

SARCOMA.—Cases are on record in which sarcomatous growths, both primary and secondary, have been observed in the middle ear. They are more apt to be found in childhood, and are usually of rapid growth. In their early stages they generally resemble ordinary polypi, but, unlike them, they recur quickly after repeated excision.



Fig. 1838.—Carcinoma of the Temporal Bone. (Case of Dr. Gorham Bacon.) From a photograph.

As in the case of carcinomata they are apt to follow chronic inflammatory conditions. The discharge may be bloody, very offensive, and purulent. In the later stages there may be paralysis of the facial, the abducens, or the first division of the fifth nerve, in association with meningeal or brain symptoms or severe hemorrhage from erosion of the large blood-vessels in the neighborhood.

MALIGNANT GROWTHS OF THE INTERNAL EAR.

In the labyrinth, as in the middle ear, malignant new growths are more apt to be secondary than primary. Very few of the cases of primary growth in the labyrinth have been fully enough reported to possess any clinical value. Sarcoma, neuroma (glioma), and carcinoma have been reported. Virchow has shown that the auditory nerve is more often the seat of new growths than is any other of the cranial nerves. Politzer reports a case of carcinoma of the labyrinth in a man aged forty-seven years. In this case the growth originated in the mastoid region, spread through the middle ear to the cochlea, and thence through the internal meatus to the brain. Death occurred through erysipelas. New growths, however, are more apt to reach the auditory nerve and labyrinth from the cranial cavity, and in most instances they are primarily carcinomata of the dura or of the brain itself. Burkhardt-Merian (*A. f. O.*, Bd. xii.) reported the finding, post mortem, of a fibro-sarcoma in a man, aged sixty-six, who had died of pneumonia. This had originated in the termination of the inferior petrosal sinus and had passed thence by two tracks into the labyrinth—one through the aquæductus cochleæ and the other below

the internal auditory meatus, around the cochlea, to the tunica adventitia of the carotid artery. Field has reported a sarcoma, the size of an orange, on the posterior surface of the petrous bone, which had originated in the dura and had destroyed the auditory nerve.

Moos (*A. f. O.*, Bd. iv.) has reported a case of spindle-cell sarcoma which was as large as a walnut and situated externally to the left internal auditory canal. It was connected with the cerebellum and pushed the medulla oblongata over toward the right; the auditory nerve entered into the tumor but was speedily lost among its component tissues; and a second tumor, the size of a pea, was found in the dilated internal auditory canal. The cervical and dorsal portions of the spinal cord were degenerated, as was also the labyrinthine portion of the auditory nerve. This case occurred in a woman, aged forty-five, who died of suffocation one year after a sudden attack of vertigo, deafness, ptosis, lachrymation, and headache. *George C. Stout.*

EAR DISEASES: OPERATIONS UPON THE TYMPANIC MEMBRANE AND OSSICLES.—Operations upon the drumhead and ossicles and within the middle ear are usually done through the natural channel of the external auditory canal: when this canal does not permit a sufficiently free access to the operative field, it is necessary to reflect the auricle forward by means of a curvilinear incision through the integument and underlying soft tissues; this necessity is of comparatively rare occurrence, for, even when the external auditory canal is much narrowed, it is possible, under good illumination and with the exercise of an educated tactile sense, to do the majority of middle-ear operations through the natural channel.

In all operations involving the opening of the tympanic cavity, especially those applied to the relief of conditions incident to non-suppurative disease, sterilization of the canal, of the auricle, and of such parts of the head and neck of the patient as may come in contact with the hand of the surgeon, is an important prerequisite. To this end, the auricle, and the skin about it, should be thoroughly washed with soapsuds (green soap) and afterward with alcohol, and, if the sterilization is done the night before operation, the parts mentioned should be covered with dry baked gauze; at the time of operation, a sterilized towel should be pinned over the head and another over the neck and shoulders of the patient. The external auditory canal should be carefully cleansed of cerumen and epidermis, preferably by means of a moist, cotton-tipped probe, and this should be followed by a similar swabbing with either the peroxide of hydrogen or alcohol, care being taken, if this cleansing is done shortly before operation, to avoid maceration of the outer coat of the drumhead, or to increase unduly the circulation. In emergency operations, such as incisions for phlebotomy or to give exit to fluid, when the more thorough precautions of sterilization are not possible, it is still important to have the hands of the operator and the instruments and dressings which he uses sterile, and to avoid contact of the former with the patient and of the instruments with the walls of the canal.

The simple operation of incising the drumhead is usually done for the purpose of relieving blood pressure or of evacuating the fluid contents of the middle ear, contents which may vary in quantity from a few drops to a body of fluid sufficing to fill the whole tympanum, and in consistence from the thinness of fresh serum to the thickness of inspissated mucus.

The point usually chosen for paracentesis, for the evacuation of fluid, is the posterior inferior quadrant of the drumhead, the incision varying in size from that of a simple puncture to a cut of two or more millimetres in length made from below upward and parallel to the peripheral line of the drumhead. For purposes of phlebotomy, in cases of acute congestion in the epitympanum, the incision is usually made along the posterior superior periphery, from below upward, ending at or near the short process of the hammer and capable of penetrating

to the deeper layer of blood-vessels in the inner tympanic fold.

After incision, in such cases, the ear should be wiped dry and plugged at the meatus with a piece of sterile cotton, or the canal should be filled with a loosely rolled absorbent cotton wick extending as far out as the entrance of the canal; over this and filling the concha, a second piece of cotton should be placed, directions being given for its renewal when thoroughly moistened by the outflow from the ear, fresh cotton then being applied externally but the drainage wick being allowed to remain in place for several hours at a time and changed only under conditions of careful sterilization of the hands which roll the wick and of the instruments which introduce it.*

If the fluid to be released from the middle ear is thick and tenacious, a larger incision in the drumhead is required than when it is thin and flows freely; evacuation may be assisted by auto-inflation of the middle ear, by Politzerization, by the use of the catheter, or by means of the pneumatic speculum and suction. When the secretion is so thick that only a small bead-like portion extrudes, this may be touched with a weak solution of nitrate of silver on a cotton-tipped probe, the resulting coagulum affording a hold to the forceps by means of which the tenacious mass may be withdrawn.

Forcible inflation of the middle ear after paracentesis for the relief of acute congestion or the release of the products of acute suppurative inflammation is contraindicated.

In the two classes of cases demanding the more extensive operations upon the drumhead and within the middle ear, the operations are more distinctly differentiated in their purpose than in their method of procedure.

In suppurative middle-ear disease, operation is usually undertaken with a view to affording exit to morbid products and permitting access to diseased parts for purposes of removal or of curative application, the betterment of the hearing being a secondary consideration. In non-suppurative middle ear disease, operative interference is usually undertaken as a measure of last resort, for the relief of a high grade of impairment of hearing or of the concomitant symptoms due to immobility of the sound-transmitting apparatus in the middle ear.

In all middle-ear operations, but especially, of course, in non-suppurative cases, conditions of sterilization should be strictly observed, and the more uniformly these are insisted upon by the surgeon, both for himself and his assistants, the more definitely do they become fixed as an important and necessary habit.

A common result of suppurative middle-ear disease is a persistent opening in the drumhead, and if the middle ear has become dry and the mobility of the ossicular chain is comparatively unimpaired, closure of the opening effects an improvement in the hearing. This is easily tested by covering the perforation with a disc of moistened paper, and if the result is favorable, the paper may be used to assist in the permanent closure of the opening.

The edge of an old perforation of the drumhead consists of a thin line of cicatricial tissue or of a union of the outer, dermoid, and inner, mucous, coats in the form of a transition membrane; both of these structures are inimical to proliferative growth and must, therefore, be removed. This is done preferably by means of a thin-bladed knife, the cut edges are then wiped dry, and a disc of thin, sized paper is floated and moistened in a weak corrosive solution, picked up on a cotton-tipped probe, and gently applied over the opening; immediately upon contact with the dry, warm surface of the drumhead the paper leaves the wet cotton tip and adheres to the membrane. By manipulation and by patting with a dry, cotton-tipped probe adhesion is favored and the superfluous moisture is absorbed. Inflation of the ear for

* A convenient method of preparation and of carrying sterile absorbent cotton to be used for these and similar purposes in middle-ear operations is to roll the cotton into balls, place these on top of each other, in a small, tubular, screw-top glass bottle, bake from two to four hours at a temperature of 140° F., and open the bottle only when required for use.

at least twenty-four hours after application of the paper should be avoided.

The stiff, adherent paper not only pulls upon the rim of the perforation with every major vibration of the drumhead, causing an irritation which stimulates new growth, but serves as a protection and a guide along which the nascent tissue progresses. This application has been found serviceable not only in the healing of smaller perforations (one dressing alone sometimes sufficing), but also in the building up of larger cicatrices when a principal portion of a drumhead has been destroyed, and when it has been necessary to apply the paper to successive portions of the perforation rim and to occupy several months in the entire healing.

As after-results of suppurative middle-ear disease, there may be thickening of the mucous folds in the epitympanum, the formation of adhesions limiting the movements of the ossicles, and of cicatricial membranes growing inward from the edges of the perforation of the drumhead and interfering with the transmission of sound. The common locations of adhesions are between the long process of the malleus and the inner tympanic wall and around the stapes and into the fenestral niche, while the thickening of the reduplications of mucous membrane, normal in a large majority of middle ears and often filling the lower limit of the epitympanum, serves to keep the ossicles in the abnormal position into which they are drawn by contraction of the tensor tympani muscle exerted when the counter-balancing tension of the drumhead is removed by perforation.

The extension of a cicatrix from the posterior edge of a large perforation of the drumhead inward upon the inner tympanic wall will sometimes enclose the round window in an individual space. Under this condition, absorption of air in the enclosed space or the exudation of fluid into it will so far impair the movement of the membrane of the round window as to still further decrease the hearing, puncture or incision of the cicatrix being required.

In all tentative operations for improvement of hearing by division of adhesions and mobilization of the ossicles, if the suppurative process has run its course and the ear has become dry, it should be remembered that there is a possibility of awakening acute trouble, and that, unless complete evulsion of the larger ossicles is intended, mobilization had best be gradually effected in successive stages, and preferably without general anaesthesia, in order that the effect upon the hearing may be progressively tested.

In a case, for instance, of a large perforation of the drumhead with the tip of the malleus adherent to the promontory and adhesions or cicatricial bands obstructing the movements of other members of the ossicular chain, the first step should be the division of the adhesions at the tip of the malleus and gentle mobilization of that bone by means of a blunt hook. If it is decided to suspend interference at this point, the middle ear should be carefully dried and lightly packed with sterile, absorbent cotton, a dossil of cotton being placed behind the malleus to prevent recurrence of adhesion. At subsequent sittings, other bands and adhesions should be divided, circumcision of the stapes done, and tenotomy of either the tensor tympani or the stapedius muscles. It is occasionally possible, in cases of ankylosis of the ossicles, without fixation of the stapes, to utilize the ossicular chain as a columella by dividing the tendons of both the stapedius and tensor tympani muscles, and inserting an artificial drumhead.

If the chronic suppurative disease is in progress, and there are present the redundant granulatoma which almost invariably indicate the existence of areas of necrotic bone, such surfaces should be carefully sought for and curetted either by means of the cup-shaped middle-ear or wire-ring curettes.*

* These curettes are made of stout steel wire drawn to a point, the point flattened into a disc, and the disc bored in the centre and filed at the edges to make a ring; the larger end of the wire is bent at an angle of forty-five degrees and made into a ring-shaped handle. They are simple in construction, easily made, and inexpensive.