THE TREATMENT OF THE COMPLICATIONS OF OTITIS MEDIA SUPPURATIVA.*

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In dealing with the treatment of the various complications of this disease, I shall endeavor to take up those pathological conditions which usually are found first affected and shall speak of them in the order in which they have been encountered clinically, following a suppuration of the middle ear.

In discussing the technique of treatment, I shall omit all the usual antiseptic details, beyond mentioning now, that in aural surgery as in all forms of general surgery, the success of the operation and the future outcome of the case—depends entirely upon our complete and absolute asepsis, both at the time of operation and during the treatment following it.

One of the first and most frequent complications following this disease, is a destruction, partial or complete, of the membrana tympani; and our first endeavor is to remove whatever cause, if there be any existing, which has produced this condition. For this reason a careful examination of the nose and naso-pharynx should be made; and, should any obstructions exist in one or both localities, they should be removed, as in children a very common cause of middle ear suppuration and the sequelæ following, is the presence of adenoid tissue in the pharyngeal vault.

For the lesions found in the drum membrane, the first cardinal principle is to maintain cleanliness of the structure to be healed, and then apply an astringent solution to the indolent edges of the perforation. The solution from which the best results are obtained is one of silver nitrate, ranging in strength from a very weak solution to one of saturation. A drying powder is then insufflated over the surface; the ones giving the best results are zeroform, boric acid, aristol, or acetanalid. Several such applications are necessary to close in the solution of continuity existing; and when healing has taken place, the impaired function of audition in adults or those nearing that age, is rapidly improved by catheter inflation and vaporization of the Eustachian tube and middle ear, while in young children the Politzer bag is found useful. In a small number

* Read at the Ninth Annual Meeting of the American Laryngological, Rhinological and Otolological Society, held at Lexington, Ky., May 1, 1903.

of the cases seen, the opening in the drum membrane remains despite treatment, and here a speedy closure is many times brought about by fitting a thin piece of sterile paper, previously dipped in vaseline, over the opening, and gumming it securely to the drum surface, thus making the ear chamber a closed cavity from without. One or two of these is usually found sufficient to promote healing. Flexible collodion applied over the perforation will accomplish the same purpose.

In a very small percentage of these cases, the opening will never close, but will remain dry except during an acute naso-pharyngeal attack.

The condition most commonly found next is the presence of granulation tissue, or a polypoid mass protruding through the opening in the drum membrane, and having its origin from the upper and inner wall of the tympanum. These masses are easily removed with a sharp curette, first cocainizing their base, and applying a solution of adrenalin to prevent hemorrhage. After the removal of the mass, the base left is cauterized, and the external auditory canal packed with a wick of gauze for twenty-four hours—at the end of which time it is removed, and the parts wiped dry and powdered, to hasten the formation of the cicatrix.

Thickened and cedematous mucous membrane is often found, and this can be reduced and rendered healthy by irrigations of a warm saline solution, or the application of an astringent to the swollen membrane.

Necrosis of one or more of the ossicles is a very frequent complication; and when this occurs they should be removed through the external auditory canal—provided there is not and never has been any infection of the mastoid. If, however, the mastoid is diseased at the same time, then the radical Schwartze-Stacke operation should be done, and the diseased bones should be removed through the posterior wound. It is rarely ever found necessary to remove the stapes; and care should be taken not to disturb its position relative to the oval window.

In many cases where the ossicles are removed, the audition can be improved if we divide the adhesive bands around the stapedial foot plate. This procedure can easily be carried out after the malleus and incus have been removed. The incus is the ossicle usually the first to be attacked by the necrotic process, on account of its limited blood supply; and many times an ossiculectomy is done, and the incus is found wanting, having been completely destroyed by the suppurative process.

Again, many times from our examination before operation we are confident the ossicular chain is extensively diseased, and yet when the malleus and incus are removed, they are found practically normal, the disease having been confined to the adjacent tympanic walls, and the diagnosis by exclusion, prior to operation, is practically impossible. After removal of the ossicles, the tympanic walls and vault are gone over carefully with the curette, and all granulation tissue and softened bone removed. Extreme care should be observed to thoroughly remove all diseased tissue in and around the tympanic opening of the Eustachian tube, for if we leave any vestige of disease at this point, it not only retards healing but will prevent the formation of a firm cicatricial scar at this point—a condition most essential for a perfect result.

After the tympanic cavity has been cleared of all diseased tissue, and wiped as dry as possible, it is packed with a wick of iodoform gauze, introduced through the canal. This should be removed in twenty-four hours, and the parts manipulated as little as possible thereafter; for the less the manipulation, the more quickly do we obtain healing.

When there is a perforation of the tegmen tympani, and this be discovered during an ossiculectomy, we should at once proceed to do the posterior operation, and throw the mastoid cavity (or a portion of it), the middle ear and external auditory canal all into one; as otherwise it would be impossible to remove all of the dead bone through the opening of the external auditory canal.

If this were not done, the manipulations at the tegmen might cause an irritation, and very disastrous results might follow to the patient by an infection spreading to the dura or brain.

Diffuse circumscribed external otitis or furuncle of the external auditory canal is frequently seen during a purulent discharge from the middle ear. Abortive measures, such as dry external heat, and the application of soothing ointments can be used, but a free incision followed by curetting and drainage, if deep, will relieve the condition more quickly than palliative means. After opening, warm irrigations are comfortable, and serve to keep the canal free of discharge. Quite frequently, subsequent incisions are necessary, as this condition is prone to occur in groups rather than singly.

Mastoiditis:—This may be encountered either acute or chronic. If acute, and seen during its incipency, all rational measures should be used to prevent its further progress. At the outset, a careful examination of the middle ear should be made; and, if the drum membrane is found bulging, or a rupture has taken place and the

cavity of the middle ear is being insufficiently drained,—a free incision should be made in the drum membrane so as to promote drainage. The patient should be placed in bed, and *absolute* rest enjoined.

The bowels should be moved freely, and a fluid diet prescribed. If tenderness is at all marked over the mastoid antrum or tip, a Leiter coil or an aural ice bag should be applied for twenty-four hours. The external auditory canal should be irrigated with a warm solution of bichloride of mercury, of a strength of from 1 in 4,000 to 1 in 8,000 every three hours. If, at the end of twenty-four hours, the mastoid tenderness has not diminished, then further abortive measures are, as a rule, useless. If, however, the tenderness has perceptibly lessened, we can continue the use of the cold for twelve hours longer with beneficial results; and a fair proportion of the cases so treated will go on to resolution, with no further evidence of mastoid symptoms.

Dry heat applied over the mastoid has also in many cases brought about resolution.

A word of warning may not come amiss here in reference to the application of cold or heat, and that is—neither should be applied if the case be one of several days' duration; nor if there be any œdema over the antrum or above it, or a prolapse of the posterior superior canal wall—for if these conditions exist, the mastoid cavity is probably already infected, and the use of any abortive measures only tends to mask a further development of the process.

Another point of value, and one to which, I believe, we should pay the strictest attention, is the bacteriological examination of the discharge coming from the middle ear; for, given a case with only a slight amount of tenderness over the mastoid when first seen—if the microscope shows that the preponderance of infection be that of the streptococcus, then, I believe that no matter what abortive measures are used in the attempt to stop the process, the majority of cases will go on to operation. Such an examination will certainly aid us as to future prognosis.

I shall not give in detail here every step of the mastoid operation, but will speak of some of the most important points in its performance.

A thorough exposure of the process is always necessary, and the tip should be freed from its muscular attachment. The antrum should be entered first—a free communication established between it and the middle ear cavity by way of the aditus-ad-antrum. All diseased tissue found should be removed, and the tip should never

be left untouched. Careful search should be made for infected medullary spaces or cells, and this is especially true of the cellular structure of which the root of the zygoma is formed. Should softened bone be found around the sigmoid sinus, it must be removed, as well as any portion of the inner table which may be found diseased.

A suggestion as to the too forcible use of the curette in the bend of the aditus leading to the tympanum may be of value; for in this situation, if a sharp curette be used energetically along the floor, and there be much softened bone encountered, we are liable to injure the facial nerve by the removal of a portion of the superior wall of the canal through which it passes.

Care should be taken not to leave the posterior canal wall too prominent, for if there be a deep cavity behind it, the auricle, in healing, is liable to be displaced and thrown forward into a more prominent position than it formerly occupied, causing an unsightly deformity. This can be easily avoided by removing a small portion of the superior border of the canal wall with the forceps or curette.

If the diseased bone extend posteriorly farther back than the flap can be retracted, then a transverse incision through the posterior flap should be made, so as to facilitate a further exposure for removal. If this be done, care should be taken not to injure the mastoid emissary vein which is in this region, as it will delay the operation several minutes, owing to troublesome hemorrhage at its bony entrance. In cleansing the operative field before dressing, a warm saline solution followed by alcohol, is all that is necessary. A strip of gauze should be carried through the aditus to the entrance of the tympanum, and the cavity firmly packed with gauze; should any areas of dura have been exposed during the operation, they should be packed off from the general cavity by separate pieces of gauze in order to preserve them more safely from the possibility of infection. Two or three silk or silkworm gut sutures are used in sewing the superior angle of the wound. Should the transverse incision spoken of above have been made in the posterior flap, then these edges should be brought together also.

A dressing which gives the utmost comfort to the patient, so far as its first removal is concerned, is to use a sterile piece of rubber tissue, buttonhole it in several places, and approximate it closely to the bone cavity, then applying the gauze dressings directly over this tissue. If this be done, the removal of the primary dressing will be a painless procedure for the patient, as compared to a removal when the gauze lies in contact with the bony cavity.

The first dressing in the average case, provided no complications arise, need not be disturbed before five or six days.

Subperiosteal Abscess.—This occurs very frequently in neglected cases in children, and occasionally in adults; and, when encountered, should always be evacuated under anæsthesia; but we should not stop with the simple evacuation of the external abscess, but proceed further and open the mastoid process, and remove the disease already existing there, as the abscess in the vast majority of cases is secondary to a primary mastoiditis. In the few cases in which it is not—and they are in children—the pus burrows up from the middle ear, and finds its way beneath the periosteum. But even if such a condition exists, it is always safer for the future of our patient to explore the mastoid, and thus prevent the possibility of any subsequent trouble arising.

In a personal experience of forty-one cases of subperiosteal abscess operated upon in children, ranging from five weeks to eight years of age, pus was found in the mastoid process forty times. In the one case (six years of age) where it was absent, there was a large amount of granulation tissue and softened bone found, so that I believe it very unwise to merely open the subperiosteal accumulation and trust that nature will do the rest.

Adenitis.—This occurs very frequently along the course of the lymphatics behind and below the ear and down the neck along the course of the internal jugular vein, following a suppuration of the middle ear. The inflammation can often be relieved by hot applications or the use of ointments; a very serviceable one is the Ung. Hyd. Ammon. If they persist, causing a temperature, and showing evidence of breaking down, they should be removed under anæsthesia at once. In a Betzold perforation, a number of diseased glands is usually encountered, and they should be removed, as should also any found in the neck when resecting the jugular vein.

Pachymeningitis.—Sometimes called extradural, epidural and perisinus abscess. This is the most common of all the intracranial affections arising from chronic middle ear suppuration, and is usually an accompaniment of, or complicating, mastoiditis or sinus thrombosis or brain abscess. In the experience of the writer, it has been found more frequently as a complication of mastoiditis. When it is encountered, all softened bone should be removed and the pus evacuated. Many times we find only a few drops of pus, but plenty of broken down granulation tissue covering the dura. The pus and granulations should be removed, leaving a healthy dural surface beneath. When we find the exposed dura covered by a firm layer

of healthy looking granulations, it is best to leave these unmolested, as this is nature's barrier thrown out to protect the structures beneath. As a rule, the disease is limited by adhesions easily demonstrated by the forceps or probe, and they should not be disturbed, as very rarely do we find softened bone beyond the line of adhesions.

When a perisinus abscess is found, the utmost care should be exercised in working around it, so as not to injure the sinus wall or make an accidental opening causing hemorrhage. Should such an accident occur, the bleeding is easily controlled by pressing iodoform gauze over the point of injury, and the work of removing the remaining diseased tissue is resumed. The operative field is flushed with a hot saline solution, followed by flushing with absolute alcohol; the latter is a good hæmostat as well as one of the best disinfectants we have.

In dressing an epidural abscess, separate pieces of gauze should be placed over the exposed dura so as to wall off this area from any discharge which might come in contact with it from the surrounding cavity. As a rule, the dressings are removed and the field of operation inspected on the third or fourth day.

Sinus Thrombosis is met with as the next most frequent complication; and the lateral or sigmoid sinus is the one most frequently involved, and this involvement is usually accompanied by a pachymeningitis over or around the sinus, and is generally referred to as a perisinus abscess.

In dealing with this complication, the treatment of the sinus will be spoken of first—and secondly, that of the vein when involved.

In treating this disease, as in many other surgical cases, each individual case is a law unto itself. The first step is a complete and thorough exposure of the sinus, followed by a flushing of the operative field with alcohol to insure sterilization before opening the vessel. The part usually opened first is that lying above the bend or knee. Where formerly an aspirating needle was used to explore the sinus, we now incise the anterior wall with a scalpel. The reason for abandoning the use of the aspirating needle as a diagnostic aid in these cases is because many times a thrombosed sinus might contain a small clot, while the remainder of the vessel would be filled with fluid blood; and unless the point of the needle engaged the clot, fluid blood would be drawn into the syringe, thus giving a wrong impression of the condition existing within—or a small parietal clot might be present, and the needle would pierce this clot, and then go on into the lumen of the vessel, and draw blood into

the barrel of the syringe—whereas, if we use a scalpel to open the sinus, and a rather free incision is made, and the clot be a small one, it is washed out through the opening by the blood pressure from within. If a clot be present, then the dura covering the sinus should be more freely incised, and the clot, if large, removed with the curette, together with any pus and disintegrated material that may be found.

When the thrombus is removed and the blood flow established from the proximal end, hemorrhage should be allowed to continue for a few seconds, so as to remove any small clot or septic material that may be present farther back in the vessel. This hemorrhage is then easily controlled by packing a small piece of folded gauze directly against the opening in the vessel. The lower portion of the sinus is proceeded with in the same manner; and, after the removal of the clot and whatever pus and broken down material may be present, an attempt should be made to restore the circulation at the bulb. In about half the number of uncomplicated cases coming under our observation, this can be done quite easily; but in others, it becomes impossible without dangerous manipulation—by this I mean if very much time or effort be consumed by our attempt to restore the return circulation at the bulb, we run the chance of dislodging some foci of septic material from within the bulb; and having it thrown at once into the general circulation, thus increasing our systemic poisoning.

In those cases where the sinus does not contain pus, and the other symptoms have not pointed to a jugular involvement, it is better to cease our manipulations even though a return current of blood be not established. Cleanse the operative field and pack the sinus firmly at the bulb with gauze, rather than proceed any farther, as experience has taught us that a large number of these cases recover without resort to further surgical procedure. In all of the cases encountered, whether of the septic or non-septic variety, we should thoroughly expose the lower end of the sinus at the bulb, as here quite frequently lies the trouble, and not above; owing to its close proximity to the floor of the tympanic cavity; and this is especially true where we have a large jugular bulb to deal with. Care should be taken that no sloughing edges of dura be left, as they will only retard the healing process.

Thrombus of the Internal Jugular Vein.—If we find upon opening the sinus a disintegrated clot, or pus, or both present, we should without further delay expose, ligate at the clavicle, resect and remove the internal jugular vein of that side to its commencement at

the bulb, provided always at this time, the patient's physical condition will permit it. This prevents the possibility of any further infection being thrown into the general circulation through the medium of this vessel. To be sure, a still further infection can take place even after the vein has been resected, through the medium of the anterior and posterior condyloid veins, or the occipital sinus.

If the facial, maxillary, thyroids, or any other veins, be involved, they should be ligated beyond their point of infection, and removed also. Enlarged glands likewise, if found in the course of dissection, should be removed so as not to leave any field for subsequent infection. Care should be taken to separate the pneumogastric nerve from the vein at the lower point of ligation, as here the nerve and vein lie very close to each other, and are often matted firmly together, and are difficult to separate owing to the inflammatory exudate present in the severer grade of cases met with.

The wound in the neck should be flushed with a hot saline solution, and closed by a continuous silk suture to within a short distance of the bulb. A small piece of rubber tissue should be inserted in the lower angle of the incision for the first forty-eight hours to promote drainage. In our septic cases, when, after operation the patient does not progress as favorably as we think he should, the temperature remaining high, and there being only a partial subsidence of the general symptoms, and when we are doubtful whether any further operative procedure is demanded, it is wise to wait for a time before any other radical measures are taken; for we must remember the fact that we are dealing with a septic case which took several days to develop, with a gradual absorption into the system of a virulent poison.

In the experience of the writer it would be strange did not the case show, following operation, some evidence of this infection, so it is well to bear in mind in these cases that it takes time to eliminate the poisonous element absorbed, even though the source from which the infection emanated has been eradicated.

Should it be necessary to use stimulation during or following our operation, and the patient does not respond to the usual hypodermic stimulants in use, very beneficial results are derived from a direct transfusion of a normal salt solution into one of the veins.

If a thrombus of either the superior or inferior petrosal sinus take place, they should be exposed, the dura covering them incised, and the clot removed in the manner spoken of when dealing with the sigmoid sinus. The inferior petrosal is quite frequently thrombosed in connection with thrombosis of the bulbous portion of the sigmoid.

When this occurs, the clot is undoubtedly one of extension from the sigmoid sinus, and is very frequently removed while curetting the lower end of the sinus.

A thrombus of the cavernous sinus is almost always fatal although Dr. E. W. Day (Trans. of the Am. L. R. & O. Society, 1902) reports recovery from this disease in a case under observation in 1901.

Brain Abscess.—About 37 per cent of all cases of brain abscess are otitic in origin. The most common site for a subdural accumulation of pus is in the inferior and posterior portion of the temporo-sphenoidal lobe. While the treatment of this condition is the same, the mode of entrance into the skull differs, as many of the abscesses are discovered secondary to the opening of the mastoid; and in these cases the roof of the mastoid antrum, and the floor of the middle fossa are removed, exposing the dura through which entrance is made to the brain. A sufficient exposure of the dura is always essential, and all bleeding points should be stopped, and the dura sterilized prior to opening.

When there is an accumulation of pus just beneath the dura, or a short distance from it, the dura will be found somewhat darker in color, and at times slightly bulging.

The dura is incised with a scalpel sufficiently for exploration purposes, and care should be taken in making this opening not to cut any large dural vessels, as the hemorrhage is troublesome, and will prove a source of delay in operating. After opening the dura, a silk suture is passed through both flaps and is a distinct aid in retracting them, and injures the tissues less than when retractors are used.

There are several methods of exploring the brain, and all have their advocates. An aspirating needle of large size can be used, or the index finger, or a scalpel can be thrust into the brain substance, or especially devised forceps have been used. My own experience has led me to rely upon the scalpel and finger. When pus is found a sufficiently large opening is made to admit of its removal. The cavity can be cleansed by one of two methods; either very gentle irrigation with a warm saline solution, or a gentle mopping of the cavity with gauze. The less manipulation we do, and the more rapidly our work is finished after the brain has been opened, just so much the better are the chances of our patient for recovery.

Where a limiting membrane is present, the encephaloscope, devised by Whiting, is of advantage in exploring the cavity. Drainage can be accomplished either by tubes or gauze wicks—the use of the latter has been more successful in my hands. The method of using them is to fold a piece of sterilized gauze into a wick about a

third of an inch in thickness, moisten with a saline solution, and roll in a powder composed of equal parts of iodoform and boric acid, after the manner advised by Macewen. The end of this wick is then placed in the bottom of the abscess cavity, and the brain tissue allowed to collapse around it. Sufficient soft gauze dressings are placed around the exterior so that any material reaching them through the gauze wick will be absorbed. Such a dressing is left in place from one to four days, depending entirely upon the size and condition of the cavity, and how the case does. At the second dressing, the cavity will be found very much contracted, and is cleansed in the same manner as before, and a much smaller drain or wick is introduced than at first, as our object is to help the cavity contract and grow small as rapidly as possible. Should any pocketing take place, its free drainage is called for at once.

When it is deemed advisable to explore the temporo-sphenoidal region first, an exposure of the bone is made $1\frac{1}{4}$ inches behind and $1\frac{1}{4}$ inches above the centre of the bony meatus. This can be accomplished in one of two ways—first, if we wish to explore only the temporo-sphenoidal region, a curved incision beginning at the root of the zygoma and extending backward for about two inches, will explore the above area; or, if our explorations are to be extensive and embrace other regions where pus is likely to be found, it is best to make an incision that will explore all the cranial cavities on that side, and this is done by displacing a semi-circular flap beginning over the zygoma just above the auricular attachment, and extending backward to the occipital protuberance. The periosteum is undisturbed except at the point we wish to enter the skull.

All bleeding points are stopped and the skull entered rapidly by means of the trephine or chisel, and sufficient space should be made to allow a thorough exploration, as the removal of a small button of bone is not sufficient.

When no definite localized symptoms are present, a favorable site for entering the skull is one inch above the centre of the bony meatus. This will enable one to explore the dura lying directly over the tegmen, as here its close proximity to the roof of the tympanum very frequently exposes to our view an epidural or subdural collection of pus; and many times we are enabled to discover a fistulous tract leading directly from the roof of the tympanum to a collection of pus in this region.

The utmost care should be exercised in searching for multiple abscess cavities, as they occur frequently, and are many times overlooked and found only at subsequent operations or upon autopsy.

Other regions of the temporo-sphenoidal or frontal lobe can be explored in the manner already described. The one principal point to bear in mind in opening into these various regions is that we should enter the skull at a point corresponding as nearly as possible to the floor of the lobe we are about to explore, in order that we may secure free drainage. Then, too, care should be taken not to injure unnecessarily the dura, as we need to retain all of this in as good a condition as possible so as to prevent a hernia cerebri forming, and to promote rapid healing.

In opening a cerebellar abscess the site of the opening depends on whether the mastoid has been previously operated upon, and the sinus exposed, or whether sufficient evidence be present to warrant our going directly into the cerebellum. If a mastoid operation has previously been done with or without exposure of the sinus, then the cerebellum is usually entered by removing sufficient bone directly behind and below the sinus. This removal is accomplished with the Rongeur forceps, and can be effected rapidly.

The cerebellar lobe is entered in the same manner as that already described in opening an abscess of the other cranial regions, and care should be taken to remove the bone sufficiently low to promote free drainage of the cavity.

Should we deem it advisable to explore the cerebellum primarily, the point of election for entrance would be in an average adult case $1\frac{1}{2}$ inches behind the centre of the bony meatus, and about one-third of an inch below this horizontal plane. An opening here would insure drainage at the lowest point of the cerebellum. The exposure and opening of the dura would be carried out in the same manner as that already described in exploring other regions of the cranium.

Meningitis.—When this is present as a complication, of aural suppuration, and we are unable to find a localized area of infection, as in a pachymeningitis or general infection to which we may attribute the cause, then little or nothing is to be gained by surgical procedure. In such a condition, an ice cap placed over the head is of some advantage in allaying the pain, and renders the patient more comfortable. Large doses of the iodide of potassium are used internally; this drug is of especial value owing to the fact that there is always the possibility of a specific lesion, either hereditary or acquired. A meningeal complication is almost always a fatal one, although Macuen (*Pyogenic Diseases of Brain and Spinal Cord*) has reported several cases as cured, following an early operation.

Lepto-Meningitis is almost invariably fatal, although it would seem rational, when this condition is recognized early, to operate by exploring the infected area, cleanse with a warm saline or other solution, and freely drain the affected region. But even where this has been done, recovery has seldom followed.

Metastatic Abscesses.—When present in different parts of the body, should be evacuated, curetted, cleansed, drained and packed, and treated according to general surgical principles. When a metastasis of the intestines takes place, large doses of the bichloride of mercury should be given internally, and frequent flushing of the colon with a hot saline or warm boric acid solution should be given. I have seen three such metastases of the intestinal tract which owed their origin to one or more of the complications of aural suppuration, brought to a favorable issue under this method of medication.

Pyæmia is also largely treated in the same manner by evacuating any pus collections that may be present, and by the most rigid supporting treatment of the general condition. Injections of the anti-streptococcus serum are also of value in the treatment of this condition, and some very favorable results are ascribed to its use.

Facial Paralysis following a middle ear suppuration, is by no means uncommon. It is occasionally met with as the result of an attic suppuration, and here the indication would be to relieve pressure as speedily as possible, by making a free incision in the drum membrane, carrying it well upward so as to relieve the pressure in the vault. This should be followed by warm irrigations so as to diminish as rapidly as possible the existing swelling, and remove the inflammatory deposit. Absolute rest should be enjoined, free purgation established, and a fluid diet ordered. Should there be much pain accompanying this condition, dry heat, applied externally, will add greatly to the comfort of the patient. When such a condition does arise, it is probably caused by an inflammation of the chorda-tympani branch of the facial with an extension backward of the inflammatory process to the main trunk of the nerve. Should resolution be slow in taking place the interrupted galvanic current will hasten the restoration of nerve function. Paralysis of this nerve may also take place, caused by a suppuration of the structure within or adjacent to the middle ear. In this condition the removal of any diseased bone, granulation tissue or other inflammatory product, such as a cholesteatomatous mass that has produced pressure, will enable the nerve to again perform its function, and if the resumption of function be delayed after pressure has been removed, the use of the current as already spoken of, will in nearly all cases bring about speedy relief.

When paralysis occurs several days after an operation for the removal of dead bone, as in the so-called Stacke or radical operation, and there is no solution of continuity over or around the facial canal, the cause of such paralysis can, I believe, be explained in one of two ways:—either concussion over the canal at the time of operation, and later, an inflammation arising in the nerve trunk—the result of this concussion—, or it is due to the destruction of the facial branch of the chorda-tympani in the tympanic cavity; and from the point of severance of this branch an inflammation, the result of this trauma, may travel backward through the bony opening, and in this way cause a temporary swelling and infiltration of the sheath, exerting pressure on the main trunk of the nerve, thus temporarily suspending its function.

All of these types of paralysis will get well without any treatment whatever, but the restoration of function can be hastened by bringing to its aid the use of the electric current.

When a facial paralysis takes place immediately following an operation on the mastoid or middle ear, it is a fair presumption that the nerve has either been slightly injured, or partially or completely severed. Here the treatment would be, if injured, the same as if due to the causes before enumerated; but the re-establishment of function would not be nearly so rapid, and would entail constant treatment over a period of several weeks or months. If the nerve has been severed, and we are fortunate enough to find the divided ends, an attempt can be made to splice them together, and, if successful, the nerve may be stimulated later in the manner already spoken of. If the nerve be cut low down in the soft tissue, it can be sutured to the spinal accessory; this has been done a few times, but the result is not entirely satisfactory.

In all cases of paresis of this nerve following operation, we should use all means at our command to try and re-establish partial if not complete function; and, I believe, the best means to enable us to accomplish this is by the use of the interrupted galvanic current, together with systematic massage of the affected muscles, and appropriate tonic treatment.

Labyrinth.—Its invasion as a complication of this disease is not uncommon, and when it exists the treatment should be both surgical and medical. The surgical part of the treatment consists in the relief of all pressure around the stapes, oval and round windows, as bands, adhesions or cholesteatomatous deposits. When adhesions or bands are present, they should be divided, and, if possible, removed until all pressure in this region has been relieved.

The medical treatment consists in placing the patient in bed if possible, and administering pilocarpine muriate hypodermically in full doses, for a period of at least six weeks, two months or longer. If it be impracticable to place the patient in bed, then the drug can be given internally in an aqueous solution two or three times a day, and the patient still be allowed to go about and perform his duties. If given by the mouth, it is well to start with four to six drops of a two per cent solution, and increase the dosage as we find our patient can tolerate the drug. The cases in which it is given, should be cautioned against taking cold during the sweating stage. Strychnine in full doses is also of benefit, and can be advantageously combined with pilocarpine. If there be a history of acquired or hereditary syphilis, or this condition be suspected, iodides should be given to the physiological limit.

For the temporary relief of the distressing subjective sounds accompanying this condition, potassium bromide can be given in full doses; likewise large doses of hydrobromic acid will often diminish these sounds.

All drugs or stimulants that cause even a temporary congestion of the labyrinth should be prohibited, and the general health maintained as near the normal standard as possible.

The upper respiratory tract should receive attention, if needed, so as to avoid any sudden variations in the circulation which might affect the labyrinth. Should both sides be involved in the same patient, then but little benefit is derived, no matter what measures are instituted for relief, whether surgical or medical. Vibratory treatment for this condition by means of forks, tubes, and variously devised instruments, has been advocated and used, and some report favorably upon their results. Personally I have had little if any success in using them.

There is one form of vertigo associated with this disease that yields readily to mechanical treatment. I refer to the vertigo caused by a partial occlusion of the Eustachian tube in residual cases. Here inflation and vaporization improve the cases rapidly, and after one or two treatments, the patient may go for several months without another attack.

Cholesteatoma.—These masses are of frequent occurrence following middle ear suppuration, and their treatment consists in their complete removal.

If the mass be small in amount, it can sometimes be entirely removed from the tympanum through the external auditory canal; but a safer and much more complete method of removal is to perform a

typical Stacke operation, as here we have the whole tympanic cavity exposed, and can remove every vestige of this deposit, and, at the same time, see what we are doing.

After the middle ear chamber has been freed from all disease, skin grafts can be applied through the external auditory canal to the bony cavity within; and when so applied, they hasten the healing process, and cut short the period of convalescence.

Septic Synovitis.—When present, should be treated from a general surgical standpoint.

Septic Pneumonia or Pleurisy should receive the appropriate treatment usually followed out in such cases.

Ulceration of the Carotid Artery has been caused as a direct result of a chronic purulent ear discharge. Should such a condition occur, the treatment would be, of course, ligation.

To the general practitioner of the future will belong the credit of a decrease in the number of cases of chronic purulent ear disease and their sequelæ; for, if recognized and treated early, an acute otitis need never reach the chronic stage. When, however, this stage of middle ear disease is encountered, no time should be lost in rectifying the pathological conditions found, so that the patient may retain his audition, and also to prevent the possibility of any of the complications, enumerated in this paper, taking place.

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