VI.

SOME OBSERVATIONS UPON THE MODERN MASTOID OPERATION.*

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The indications for the simple or the radical mastoid operation are not always well defined, and in consequence the personal equation of the operator has much to do with the choice of time, except in those cases with symptoms well marked.

In nearly every case of mastoiditis, either acute or chronic, we have a ruptured tympanic membrane. Many surgeons have probably operated for the cure of a chronic mastoiditis in which the tympanic membrane was intact at the time of the operation. In one case I found all the cells, except one, free from any evidence of disease. The one large cell was filled with a dark exudate. This case probably belonged to the neurotic type of mastoiditis, which is rare as compared to the inflammatory or infectious type.

I have had one case of acute double mastoiditis, combined with sinus thrombosis of one side, and complete loss of caloric reaction of both labyrinths with intact drums. The history was, however, that a week previous there had been a discharge from one ear.

Cases of acute mastoiditis do go on to spontaneous recovery, and many sufferers from chronic mastoiditis die from old age; nevertheless, I think it a serious error of judgment for one to treat either condition expectantly, after symptoms indicate the disease. Intracranial complications are so fatal and danger of operation so slight that one is not justified in presuming an acute or chronic purulent mastoiditis will recover without operation. If after a week in a given case of

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acute purulent inflammation of the middle ear, there persists a slight rise of temperature, with or without swelling or tenderness of the mastoid, and pus comes pulsating from the middle ear, I think a simple mastoidectomy is indicated.

If a temperature, that is, any above 100 degrees Fahrenheit, persists for forty-eight hours after spontaneous rupture or paracentesis, it is advisable to drain the mastoid. A meningitis may come on at any minute and have its origin either in the middle ear or mastoid process. Early drainage of the mastoid is the surest preventive of meningeal complications. Preceding any surgical attack of the mastoid in which brain complication is suspected, a lumbar puncture should be made and cerebrospinal fluid examined. A case of serous meningitis may recover, but from personal experience those with a diffused purulent meningitis do not.

The one symptom in acute mastoiditis that I have come to look upon as very nearly positive, with or without rise of temperature or tenderness of the process, is a pulsating discharge of pus from the middle ear. To get this distinct sign the ear should be cleansed so that a perfect view of the drum can be had. The pulsation is an indication of tension from rapidly forming pus in the antrum and possibly the mastoid process. The more pronounced the tension and pulsation, the more positive the indication for immediate operation.

Pain and swelling of the mastoid is a variable sign. A short time ago I performed a double mastoid operation upon an infant ten months of age. In this child there was no swelling or redness of the mastoid; there was, however, a persistent discharge for a period of three months, daily exacerbation of temperature and mild general sepsis. The absence of some postauricular swelling in an infant so young is unusual. In the above case, both lateral sinuses were covered with a soft necrotic mass and the antra full of pus.

In a few acute cases we have a slight discharge, no other general symptoms other than malaise, or possibly a slight rise of temperature upon exertion. In others, pain in some portion of the affected side of the head with discharge; while exceptionally we find a case with all the classical symptoms: pain, swelling, redness, tenderness, stiffness of the neck muscles, persistent discharge and pinched countenance—symptoms which any one should interpret.

Blood examination should be of value in deep complications where we have a sinus complication or meningitis. Sometimes in a beginning sinus involvement blood cultures are negative. More than one blood culture should be made. A bacteremia indicates infection of the blood stream, and may be present in a case of mastoiditis and due to infection in some other part of the body. Clinical symptoms of a mastoiditis are far more valuable than any blood examination. Acute cases when due to pneumococcus or streptococcus mucosus capsulatus infection, alone or mixed, are as a rule more fulminating and insidious than a streptococcus pyogenes or staphylococcus infection.

It is interesting to contemplate why apparently typical cases of mastoiditis go to spontaneous recovery and others require operation. Why in one case the infection confines itself to the air spaces of the mastoid process and in others spreads to the haversian canals of the squamosa. In those cases of spontaneous recovery the organism is short lived and has a tendency to confine itself to tissues of greatest vascularity.

In operative cases the organisms have a tendency to attack bone structures, sometimes blocking the blood supply of the bone and ending in early necrosis. The morphology of the organism governs the character of the tissue change.

Mastoiditis under some favorable conditions may become epidemic, and is due to the virulence of certain organisms with a predilection to middle ear cavity and mastoid cells. In some cases I have observed the pus from the middle ear filled with microorganisms, and when the mastoid cells were opened the extravasation within contained no bacteria at all.

My one case of mastoiditis from the Klebs-Loeffler bacillus ran a very protracted course. There was much pain in mastoid, little temperature, history of previous sore throat, some tenderness of mastoid and a white bulging drum. Thick yellow pus followed a paracentesis. The mastoid wound was unusually slow in healing, and pain persisted in the mastoid for many days after operation. Pain in the mastoid region following mastoidectomy from any form of infection varies in individuals, and may persist for a number of days after the patient becomes ambulatory. Dry heat, codein and aspirin usually relieves the irritation.

As a confirmatory evidence of the existence of an acute

mastoiditis, the value of radiography cannot be overestimated. The findings are as positive as in nasal sinus disease, and even more so. Each mastoid should be photographed separately; by doing so they can be more carefully compared. Not infrequently the extent of infection and area of the mastoid involved can be ascertained. In a case in which the operator is inclined to procrastinate or feel overconservative or in doubt, a radiograph should be made.

The symptoms indicating a radical mastoid operation are not always as well defined as those indicating the simple operation. One symptom, however, stands out preeminent, and that is a chronic foul discharge from the ear. This is indicative, as a rule, of caries, necrosis or cholesteatomata. It may be taken as an axiom that in all cases of a chronic discharging middle ear, regardless of the character of the discharge, a meningitis is always a possibility. Other indicative signs are labyrinthine symptoms, periodical or constant pain on the affected side, exacerbation of temperature and desire for life insurance.

In many cases the pathologic process is confined to the middle ear and antrum and may be relieved by curettement, ossiculectomy or medication. These cases are the exception, and the treatment cannot be other than empirical. With no indications to the contrary, it is a safe rule to do the radical operation in all cases of a chronic discharging ear.

There are only two or three conditions that may counter-indicate a radical or semiradical operation in a chronic middle ear and mastoid suppuration. Patients in an advanced stage of pulmonary tuberculosis usually die following either a simple or radical operation. The vitality of the patient at such a time is too low to withstand the shock of the anesthetic, or repair the wound. Infusion anesthesia may be indicated in such cases rather than the American or drop method.

In preparing the patient previous to the operation, more care should be observed in women than in men, on account of the greater tendency to gastrointestinal disorders, especially diseases of the colon.

In the preparation of the site of the operation, it is needless to shave the side of the scalp in proximity to the line of intended incision. We should try to preserve the hair; and

not render our patients unnecessarily conspicuous. The postauricular wound usually heals in from one to five weeks; long before the hair, if clipped or shaved from the scalp, reaches its length worn by the patient.

It is a custom with me to paint the pinna and auditory canal and postauricular region well into the scalp with tincture of iodine. If the case is seen the day or a few hours previous to the time set for operation, the iodine solution is then applied. When the case comes to the operating table, if the skin is not unusually sensitive, the iodine solution is again applied. This is the only external preparation. Scrubbing, shaving, bichlorid packs, etc., I think unnecessary.

To prevent the hair from getting into the wound at the time of operation, strips of gauze are cemented along the edge of the scalp with collodion. These strips are easily removed, after the operation is completed, by moistening with ether. After the collodion strips have firmly adhered, sterile towels are bound about the head.

The auditory canal is now, as far as possible, cleansed by irrigating with a warm bichlorid solution (1/5000). Afterward the canal is filled with pure alcohol and plugged with cotton.

The anesthetic used is invariably ether, preceded sometimes one-half hour, if in extremely nervous adults, by one-fourth grain morphine and one-one-hundred-and-fiftieth grain sulphate of atropine. Ether is administered by the American or drop method. On two occasions I have given ether by intravenous infusion with happy results. The solution used was seven per cent ether and ninety-three per cent normal salt solution. We do not like gas-oxygen anesthesia, and this is not said to disparage those who favor this method of anesthesia. Our opinion of this form of anesthesia has been influenced by two nearly fatal results, and bad results frequently observed in medical literature. In an experience of over fifteen years we have had but two deaths from ether anesthesia. Postmortem disclosed one case to be a typical condition of status lymphaticus. We have exercised, however, the greatest care, and in only a few cases have we ever trusted a patient to a man who has not had some experience in the administration of anesthetics. It is only in the beginning that a deep anesthesia is necessary. If the anesthesia has been a prolonged one, we

sometimes use oxygen after the operation is completed, to hurry the elimination of residual ether in the lungs. A light anesthesia and rapidity in operating is the *sine qua non* of a mastoid operation. The less shock the more rapid the recovery.

Speed, consistent with safety, is essential to success. The antrum is reached, we think, more quickly with gouges designed by Alexander and driven by a mallet. The chipping away of bone should be begun with the largest size gouge and in the direction of the spine of Henle, and as we approach the antrum a smaller sized gouge may be substituted; in the hands of the skilled the operation upon the bony structure may sometimes be completed with a mallet and gouges. We should in this operation, or in any other, try to simplify our armamentarium. In the simple mastoid operation, after the cells are completely removed, the posterior bony wall of the auditory canal should be shaved down nearly to the annulus tympanica. In very young children this is not indicated. In adults the healing is simplified by allowing the membranous posterior wall of the auditory canal to drop back into the wound. Previously, however, and to prevent deformity, as much of the external wall of the tip is saved as is consistent with thorough exposure of all the tip cells. Previous to closure, the wound is thoroughly cleansed with peroxid of hydrogen, followed with alcohol. Afterward the periosteum and subcutaneous structures are firmly united with a No. 2 plain cat gut suture, except near the inferior angle of the wound. By careful attention to apposition of subcutaneous structures we avoid, in most cases, a depressed scar. At the inferior angle one or two stitches are usually taken, leaving an opening near the most dependent portion of the mastoid wound, and not larger than one-quarter of an inch, through which a strip of a five per cent iodoform gauze drain or small cigarette drain is gently passed into the wound in the direction of the aditus and antrum. Sometimes the gauze is softened by dipping in warm vaselin, which prevents adhesion to the exposed bone and tissues. We can see no good reason for firmly packing the bony cavity. There is a tendency among some operators to pack the wound too lightly and for a longer period of time than necessary. The less packing the smaller the scar and more rapid the recovery. After the cells are re-

moved the abscess cavity has a tendency to take care of itself, and therefore any artificial drainage is to be avoided. The tendency of a mastoid wound after the cells are drained is to go to spontaneous recovery, if we will leave the wound alone. The cutaneous structures are closed with Michel's clips in patients past the first year of life; if in an infant, the lips of the wound are closed with a ten day chromic catgut. The Michel's clips may be removed in from twenty-four to thirty-six hours. The sooner the clips are removed the less likelihood there is of a scar. The external surface is now cleansed and a layer of gauze saturated with pure alcohol is applied, and over this the usual dressing. In the great majority of our cases we have no postauricular depression, and very little scar at the line of incision, in either the simple or radical operation. A blood clot operation has nothing better to offer except, in a few favorable cases, a more rapid healing.

If the operation is performed in the morning, and on those past infancy, the external dressing is removed in the evening and a new dressing applied. Daily, and sometimes twice daily, the dressing is removed, the auditory canal irrigated with warm 1 to 5000 bichlorid solution, and a warm moist dressing applied about the ear and covered with dry gauze. By taking this precaution we save the patient a great deal of pain and hurry the recovery many days.

The patients are always pleased with frequent change of external dressing, pain is greatly relieved and sleep more assured. The patient is usually up and about on the fourth day. As soon as the gauze strip comes away moistened with serum or slightly tinged with pus, we permit the wound to close. It is unnecessary for the wound in the bony canal to be filled with granulations before the external wound is allowed to close. The treatment of the postauricular wound following the radical operation varies but little from that described above. We do not trouble ourselves with skin grafts.

After one week I try to discard the bandage. The wound is covered with a strip of gauze and cotton, half moon shaped, which fits behind the pinna and is held in position by collodion. If the posterior wound is slow in closing, we pass a cotton tipped probe saturated with phenol as far into the fistulous tract as it will go. One application of phenol is usually all that is necessary. A postauricular fistula may persist for

a long time and try the patience of Job before it is cured. Fortunately such a case is rare.

Sometimes where necrosis has been of long standing, or the cat gut fails to be quickly absorbed, healing is retarded by the formation of excessive granulations about the mouth of the wound. Cutting them away does not always stop their recurrence, neither does the application of escharotics prevent their growth. These cases are exposed to air and sunlight as long as possible. The patient may go a whole day with wound exposed. In winter the dry air of the house suffices, and in summer the free warm sunshine is sufficient to dry the granulations. It is remarkable how quickly these cases recover after the bandage is removed and the granulations exposed to the air and sunlight. The value of heliotherapy is given but little consideration by otologists. A treatment so simple and so natural should be applied more often. Air and sunlight are very essential and efficient in healing the middle ear cavity after the radical as well as the simple operation. In the radical operation, as soon as the patient becomes ambulatory, all dressing should be removed from the canal and the ear exposed for as many hours as possible to the rays of the sun. All forms of dressing retard repair. There is practically no danger of any new infection when the reparative process has once begun. A patient should not ordinarily remain longer than a week in a hospital for a simple or radical operation. The expense of a hospital to the average individual is very great, and sometimes eats up most of the money that should come to the physician. As long as the patient is free from temperature and able to be out of bed, there is no good reason why they should not report daily at the physician's quarters for dressing. Cat gut sutures are often a potent factor in retarding recovery. The longest period I recall of plain cat gut remaining unabsorbed was eight weeks.

As to the use of urotropin, we have used this drug in most cases of severe infections of the mastoid in which we suspected a possibility of some brain complications. There is sufficient literature on the subject to prove that the spinal fluid contains urotropin when administered per os to encourage one to use the drug. In young children and even adults the irritation to the kidneys is very great when the drug is given in large

closes. In infants the urine will be tinged with blood, and in adults great pain will be experienced upon urination.

As to vaccines, I have come to believe in them after operation, and not before. I have had what appeared positive results from vaccines in acute mastoiditis, only to have a second attack, fulminating in character, come on a few weeks after the ear was apparently cured. Where the antrum was exposed four to six hours after the second attack, it was found to be filled with *débris*. I am rather skeptical about the efficiency of vaccines in suppuration in closed cavities, such as the nasal sinuses and mastoid antrum and process. If the case is fulminating, and one organism is present in the pus from the canal, I give that vaccine at the operating table, and if more than one organism, I give the mixed vaccines, and they are known as stock. It is a reasonable presumption that autogenous vaccines are more potent than stock vaccines, but unfortunately in the great majority of cases we do not have time for the preparation of autogenous vaccines, and even had we time, our faith in stock vaccines prepared by the Lederle Laboratory in the East or the Cutter Laboratory in the West is greater than in an autogenous vaccine prepared by some one who is not a specialist in such therapy. It would be better in the preparation of vaccines to secure the pus from the mastoid wound rather than the auditory canal, and in virulent cases from the bone chips as well as from the free pus in the mastoid.

The accidental exposure of the dura or lateral sinus in the simple or radical operation, as far as I am able to judge, is free from danger. It is reasonable to presume that in the exposure of the dura or sinus we avoid cutting or tearing the tissue. A meningitis or phlebitis, if it occurs, has had its inception before operation. The dura has a very strong natural resistance to infection, and the resistance is much greater after the free drainage is established. Meningitis or thrombosis are diseases with a predilection to precede rather than to follow a mastoidectomy. Whenever the sinus wall is found diseased, it is my practice to widely expose the sinus so that imperfect drainage cannot produce phlebitis.

The so-called Heath operation has many points to recommend it to the otologist. The removal of the posterior bony wall of the canal down to the annulus tympanicus, with the formation

of a flap, for the cure of acute mastoiditis, is not an unsurgical procedure. By so doing we avoid filling a deep cavity with fibrous tissues, prevent the recurrence of mastoiditis, and secure more rapid healing. In the few cases that I have used this method the results have been perfectly satisfactory. The one disadvantage of all flap operations is the tendency to accumulation within the canal of cerumen mixed with debris. Very often cases require attention, at intervals, for many years.

In the consideration of the radical mastoid operation, the preservation of the ossicles, tympanic ring and some of the tympanic membrane, as advocated by Heath, Bondy, Ballenger, Botey, and many others, has given me, as it has most operators, a good deal of concern. We are idealists and are looking for ideal results. It remains a question of dispute as to the advisability of trying to retain the ossicles and tympanic ring, and probably will be discussed for years to come. It is impossible to tell anything of the necrosis of the ossicles until they are removed. Since the incus and some part of the malleus is destroyed in nearly all chronic suppurations of the middle ear, and the chain of articulation broken, the removal of the necrosed ossicles does not jeopardize the hearing. The size and shape of the drum may govern the indication for or against any effort to retain the tympanic ring and ossicles. Where the tympanic membrane is destroyed and the antrum filled with cholesteatomata, it is best to do the classical tympanomastoid operation. If, as far as the eye can detect, the ossicles are intact, the drum membrane not in apposition with the inner tympanic wall, and no symptoms that would indicate the possibility of a labyrinth irritation or meningitis, an effort may be consistently made to save the drum membrane and ossicles.

I presume I am subjecting myself to a good deal of criticism when I say that I seldom ever pay any attention to the orifice of the eustachian tube in the radical mastoid operation. The tube as a factor in prolonging any suppuration after the radical mastoid is, we think, overestimated. The cause of any failure to secure a dry ear is, as a rule, outside of the eustachian tube. Advisedly speaking, the cause is a disease of the bony structure which surrounds the antrum, and particularly along the aditus ad antrum, that retards recovery.