

THE UNIVERSITY OF MINNESOTA

GRADUATE SCHOOL

Report
of
Committee on Examination

This is to certify that we the undersigned, as a committee of the Graduate School, have given Herrmann Eugene Bozer final oral examination for the degree of Master of Science in Otolaryngology and Rhinology. We recommend that the degree of Master of Science in Otolaryngology and Rhinology be conferred upon the candidate.

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REPORT
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COMMITTEE ON THESIS

The undersigned, acting as a Committee of the Graduate School, have read the accompanying thesis submitted by Herrnan Eugene Bozer, for the degree of Master of Science in Otolaryngology and Rhinology. They approve it as a thesis meeting the requirements of the Graduate School of the University of Minnesota, and recommend that it be accepted in partial fulfillment of the requirements for the degree of Master of Science in Otolaryngology and Rhinology.

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THESIS

CHRONIC SUPPURATIVE OTITIS MEDIA

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The latent dangers arising from acute and chronic suppurative middle ear disease have long been recognized. Hippocrates (460-350 B.C.) called attention to these, and clearly described the clinical course of several patients dying of intracranial complications arising from ear disease. Some four hundred years later Celsus called attention to the gravity of such disease and warned that prompt attention should be given at the onset "lest a greater danger arise".

In the ensuing years, knowledge of the ear increased when such anatomists as Vesaleus, Eustachius, Fallopius, Du Verney, Morgagni, Scarpi, and others gave their time and study to the temporal bone and adjacent structures. When the anatomists had paved the way, the clinicians followed. Riolanus (1649) first suggested opening the mastoid by operation. One hundred years later Petit carried out the operation to a successful issue for the first authentic instance. Later Von Troeltsch, Schwartz, Zaufal, and Stacke added their refinements and to the two latter must be given the credit of originating and developing the radical mastoid operation.

This operation was primarily designed to accomplish the complete removal of all necrosis, cholesteatome, and infected granulation which had involved the mastoid antrum and adjacent mastoid cells. It was not intended to displace local treatment where the pathology of the ear was accessible to measures applied by the way of the external auditory meatus. However, the operation rapidly came into popularity with the otologists and soon became regarded as a short cut to the cure of chronic suppurating ears, thereby saving much time ordinarily spent in the local treatment. This tendency toward the adoption of radical operations in cases where local treatment alone was indicated, was later recognized and, in 1904, about fifteen years after the birth of the radical mastoid operation, such men as Blake, Bacon, Theobald, Dench,

McKernon, and others in this country were warning against the indiscriminate use of the radical operation. Blake speaks of this treatment of chronic suppurative otitis media as, "now fallen somewhat in desuetude except as a preliminary measure." Some time later McKernon, speaking before the American Otological Society, says, "From observations and reports I am inclined to believe that it is frequently done when little or no necrosis exists, and before other means of a simpler and more conservative nature have been tried to cure the discharge." This reaction was felt abroad as well. At the Congress of the German Otological Society in 1908 such well known aural surgeons as Korner, Schuba, Hartman, Politzer and Siebenman were expressing the opinion that the radical mastoid operation was being done too frequently, and that many or most cases could be successfully cared for by local treatment through the external auditory canal.

If the results of the radical mastoid operation were completely satisfactory in all cases operated upon, less emphasis might be attached to the plea that persistent, conservative treatment should be used in uncomplicated cases, before resorting to operative measures. The results, however, are not so uniformly satisfactory as one might desire. Ruttin, of Vienna, claims only 70 per cent cures of suppuration. Fraser and Garretson, of Edinburgh, obtained 75 per cent cures in 110 cases. They included in their "cures" twenty-four cases in which the mastoid cavities remained moist, but in which no actual suppuration was present. In 23 per cent of their cases the hearing was markedly diminished. Stucky reports 89 per cent cures of suppuration. Twenty-one of his hundred cases had diminished hearing after the operation. Bowers reports 76 per cent cures and diminished hearing in 6 per cent. These statistics are taken from the cases of aural surgeons of recognized, wide experience and ability. Undoubtedly the results are not so good in cases operated by men of less experience.

Another factor which must be considered is that the postoperative care of the patients is generally long and tedious. The patient, as a rule,

must remain under close care of the surgeon, as any neglect of the after-care of the ear, until it is entirely healed, is very apt to defeat the purpose of the operation. Politzer reports the time of postoperative treatment in his cases to average three to four months. This is about the average time required by most men to obtain a thoroughly healed radical mastoid cavity.

The operative mortality in uncomplicated cases is low; about 1 to 2 per cent for experienced surgeons. Permanent paralysis of the seventh nerve occurs in about the same percentage of operated cases.

When we take into consideration that a radical operation results in from 11 to 30 per cent failures to obtain complete cure of suppuration, that 20 per cent of the cases will have diminished hearing, and that the post-operative care is very difficult in many cases, requiring, on the average a period of close attention for three months, we will readily see that the operation should be used only as a last resort for the cure of the infected ear. And if a little more care and persistency of treatment, than is ordinarily used, will result in the curing of certain cases which at first may seem to be refractory, the effort will be well worth while; and some of the unpleasant results and features that accompany the radical mastoid operation will be avoided.

Practically all aural surgeons consider the persistence of chronic aural discharge after a thorough course of treatment an indication for operation. But what is a thorough course of treatment? That is something that cannot be standardized and must vary with the extent of disease of the individual case under observation; and so Siebermann has stated, "We must not only know how to employ conservative treatment, but we must have a clear guiding principle as to how long we may do so."

The treatment of chronic middle ear suppuration has depended principally upon the character of the disease in the ear. All treatment requires a preliminary cleansing of the ear before any special method is applied.

This cleansing is generally accomplished by a syringing of the middle ear and its appendages with a weak saline solution of about 90° to 95° temperature. Fluids of greater or less temperature are quite apt to cause vertigo. When the perforation of the tympanic membrane is small, the tip of a small syringe may be inserted through the opening, care being taken that undue pressure is not exerted in the middle ear by introducing the fluid too forcibly. Quite often a negative pressure, applied by means of a small suction tube to the diseased ear, will produce better results than syringing, this being especially so in cases with small perforations. Politzerization or catheterization of the tube of the affected ear is also quite beneficial in some cases where the greater portion of the discharge is of tubal origin.

After the cleansing portion of the treatment has been carried out, various methods may be used in the further attempt to control the disease process. The methods now in general use may be briefly summarized as follows:

I. Antiseptic Method:

The antiseptic method depends upon the application of various medicaments to the diseased ear in order to inhibit the growth of the organisms there. Hydrogen peroxid is probably the most popular antiseptic used, as it has a remarkable cleansing action as well as an antiseptic one. Boracic acid, iodoform, benzoic acid, aristol, bichlorid of mercury, and zeroform are other antiseptics commonly used in the ear.

II. Alcohol Method:

Treatment by instillation of alcohol in various dilutions of 50 per cent to 95 per cent is often of great value. Alcohol not only gives the value of an antiseptic action, but also produces a dehydrating effect upon the swollen and thickened membranes of the diseased ear, which is quite beneficial. This method is particularly applicable in the granular forms of otitis media.

III. Caustic Method:

The caustic method consists of the use of various caustic agents, among which may be mentioned silver nitrate, chromic acid, ferric chloride and trichloroacetic acid. These drugs are especially useful in keeping down exuberant granulations that form over the walls of the tympanum and at the edges of the perforation.

IV. Dry Method:

After a preliminary catheterization and removal of the secretion from the middle ear and external auditory canal, a long tampon of sterilized tape is introduced into the external canal as far as the tympanic membrane, or even through the perforation, if possible. The gauze may be either plain or impregnated with various antiseptics, such as iodoform, boracic acid, aristol, etc. This should be changed daily, or even twice a day if saturation takes place. This method is applicable to cases where the discharge is not profuse and is non-fetid. It often serves well when syringing of the ear produces vertigo, thus making a wet treatment quite disagreeable to the patient.

V. Ionization Method:

The ionization method consists in the electrolysis of a solution of zinc salt which has been instilled into the diseased ear. The value of this treatment seems to lie in the action of the ionized zinc upon the infection existing in the ear.

VI. Vaccine Method:

Vaccine therapy of chronic otitis media has been put on a firm basis by the work of Nagle, Haskins and Dwyer. While stock vaccines in many cases seem to give excellent results, Nagle, working with very carefully prepared autogenous vaccines, has reported the best results so far of anyone using this method.

VII. Roentgen Ray Therapy:

Recently the effect of roentgen rays upon chronic otitis media has been tried and a few favorable cases have been reported. However, the reports are too few for any true judgment to be placed upon this type of treatment.

Needless to say, modifications of the various methods described above have been used, in order to effect the various types of disease process to be treated. Quite often a combination of one or more methods will give good results, where the use of either method alone apparently has no result.

The treatment of chronic suppurative otitis media quite often requires a considerable time until good results are obtained. In fact, the persistent application of well directed treatment will often be productive of good results in what appears for a considerable time a hopeless case. This time element often presents an economic question from the patient's standpoint.

A patient having spent considerable time and money in obtaining an apparent cure of a chronic discharging ear, will often ask, "Will this good result be permanent?" Quite often, because of economic reasons, he will not be able to have repeated long courses of treatment. The surgeon should be able, in these cases, to give the patient a prognosis. In order to do this he must have a good knowledge of the importance of the different factors which would tend to cause that particular ear which he is treating to either remain cured or to revert to its former condition. This knowledge is obtained by a good follow-up system of cases which have been treated and in which a record of the factors influencing the course of the disease have been kept. After sufficient data have been obtained, certain deductions may be drawn. This information applied to other cases will offer a possibility of an appropriate prognosis being given.

A group of 190 selected cases which had received treatment in

the Clinic was chosen. Chronic suppuration in none of these cases was influenced by malignancy, mycosis, or any constitutional disease, such as diabetes, active tuberculosis, or syphilis. All of these cases had been treated within a period of one and one-half years, the shortest time lapsed since treatment being one year. All of these cases had continued treatment until it was felt that no further benefit could be obtained from its continuance. In the majority of these cases, the disease process had apparently been controlled so that the affected ear was dry and had remained so for at least one week before dismissal from the Clinic. A much smaller group had refused to become entirely dry, there being still a little moisture in the middle ear at the time of dismissal. No cases had been included in the group on whom the physician had not been permitted to use every means available, or who had not cooperated with the physician to the fullest extent, in the local treatment of the ear.

The treatment was essentially a combination of the first three methods described above, varying in each individual case with the type of disease process encountered. All obstructions to drainage, such as crusted adherent bands, necrosed ossicles, etc., were removed as far as possible and daily cleansing of the middle ear and attic regions instituted after the method of Politzer. No other type of treatment, such as vaccine therapy, ionization methods, roentgen ray or radium were used. Needless to say, all nose and throat disease was carefully eliminated as far as possible, and the patient's general condition thoroughly investigated and cared for. The extent of the suppuration in the affected ears of all these cases was carefully classified at the time of treatment, after a method employed in this Clinic. The method is purely empirical and is based upon the extent and location of the diseased process in the ear. In the main, four types or classes of ear suppuration were recognized.

Type I included all cases where the discharge was of a thin viscid mucoid type and arose solely from the Eustachian tube. The perforation

generally is quite large and is usually situated in the anterior inferior quadrant, although at times the whole of the tympanic membrane may be gone, due to a former active suppurative process of the middle ear, which has since healed.

Type II included all those cases in which the suppurative process was confined to the hypo and meso-tympanum. In these cases the perforation of the tympanic membrane may be large or small and situated any place in the pars tensa. The mucous membranes lining the tympanic cavity are quite often markedly thickened, granular in appearance, and secreting a thick mucoid fluid containing many leukocytes. Areas of necrosis of the bony walls may be present and occasionally necrosis of the lower portion of the ossicle may be demonstrated.

Type III included cases where the suppurative process and necrosis involves the attic as well as the lower portions of the tympanum. Quite often the perforation of the tympanic membrane is in Shrapnell's membrane and most of the suppurative process is concealed from inspection. Generally, however, the attic seems to be involved secondarily to the infection below, so that Shrapnell's membrane is intact. A probe introduced from below the level of the anterior and posterior folds will find free access up into the attic and will quite often dislodge masses of thickened discharge, fragments of necrosed ossicles, and portions of cholesteatoma, which have collected in that region.

Type IV included the ears containing, in addition to the disease process of Type III cases, definite suppuration of the antrum and the adjacent mastoid cells. This is quite often demonstrated by fistulous tracts from the posterior canal wall leading into the mastoid cells, the walls of which are often necrotic or have been eroded by cholesteatoma. Occasionally the aditus ad antrum is so enlarged by cholesteatoma that the anatomical effect of a radical mastoid operation is produced. A radical mastoid operation is indicated in all Type IV cases. Short, preparatory treatment is given before operation,

with the intention of cleansing the middle ear and its appendages as much as possible in order that the postoperative care may be lessened.

An open tube, contributory to the discharge, may be present in any of the above classes.

From 190 questionnaires mailed, ninety-six replies were received. Of the ninety-six cases, in seventy-eight (81 per cent) the discharge had entirely ceased and no apparent suppuration was present when the patient left the Clinic. In eighteen (19 per cent) the discharge had not entirely disappeared. Of the seventy-eight who left with dry ears, forty-two (54 per cent) remained dry and thirty-six (46 per cent) had not. Of the eighteen who had left without having the discharge entirely cleared up, two became dry without further treatment after leaving the Clinic and in sixteen cases the ears continued to discharge.

Of those who remained in good condition there were twenty-four males and twenty females. The average age was thirty-four years. The average duration of the disease before treatment at the Clinic was fourteen plus years, the time varying in individual cases from two months to fifty years. Of these cases, twenty had had a constant discharge, while twenty-four had had intermittent discharge, i.e., there were intervals of varying length during which the ears had apparently been dry. As a rule these periods of quiescence were of short duration; generally only a few months.

Of those patients in whom the ears did not remain in good condition there were twenty-eight males and twenty-three females. The average age was twenty-four. The average duration of disease was twelve plus years, the shortest being three months and the longest thirty-six years. Twenty-one had had a constant discharge and twenty-nine an intermittent discharge.

It would seem from the above statistics that the sex of the patient was not a factor in the ultimate results, and that at least in cases

of long standing, as nearly all of these cases were, the age had very little influence. Constancy of discharge does not seem to be an unfavorable factor. It would also seem that in a group where the duration of the disease was of such length, the average being thirteen years, a few years more or less of the disease duration would make but little difference.

The average duration of treatment of the cases that remained in good condition was 3.6 weeks. In the cases that failed to remain in good condition the average duration of treatment was 4.7 weeks. Failure of good results cannot be laid, at least, to less effort spent in treatment.

An attempt was made to determine what effect, if any, the etiology of the suppurative process had upon the results of treatment. As many cases were of so long standing, however, the patients in many instances were unable to recall the exciting cause, so that what statistics were obtained were too few to justify an attempt to draw any conclusions. It does seem, however, that those cases originating from scarlet fever are very resistant to treatment, and the percentage of failures is as high in scarlet fever ears as any other type.

As has already been mentioned, we have made an attempt to classify the extent of the disease process of the affected ears at the time of the first examination. In order to determine the value of the classification as an aid to prognosis in the results we may expect from local treatment of the ears, we have shown the ultimate results of treatment in each of the different types of ears in the following table.

TABLE I.

Type	Good Results.	Unsatisfactory Results
1 - - - - -	6 - - - - -	6
2 - - - - -	24 - - - - -	27
3 - - - - -	13 - - - - -	15
4 - - - - -	2 - - - - -	3

In the above table we are impressed by the fact that the percentage of good results is no higher in the Type I and II ears than in the more dangerous types, III and IV. In looking for an explanation we came to realize that the one factor, tending to cause recurrence of discharge present in all types to about the same degree, was an open tube. This we feel is the explanation to what, to the patient, is quite paradoxical; that a somewhat innocent aural discharge should recur after apparent cure as easily as one that is considered quite dangerous. As we have not had the privilege of examining all these cases to verify our results, but must take the patient's statement as to the condition of the ear, no doubt there are quite a number of the Type III ears which at the time of the patient's report, were discharging only because of an open tube and the attic was still in a good condition. For these reasons we feel that any classification which fails to consider the patency of the tube offers no aid in the prognosis of the permanency of the cessation of discharge; but we are quite sure that such a classification as we have mentioned does offer a satisfactory method of measuring the danger to life of any particular suppurating ear.

Occasionally, because of extensive involvement of the attic, one infers that the antrum and probably the adjacent mastoid cells must be also affected. These ears may clear up under treatment and we feel that the two Type IV ears in our series that did respond to treatment were probably of this kind, and that the actual disease process was not as extensive as it appeared at first examination.

Lillie has recently emphasized the importance of care in blowing the nose in those patients who have chronic discharging ears in which a patent tube is a factor. In our group we attempted to determine to how great an extent this was noticeable to the patients themselves. Tables II and III give a tabulation of the statistics obtained.

TABLE II

Results	Number	Percentage
Questionable - - - - -	33 - - - - -	41
Good - - - - -	35 - - - - -	31
None - - - - -	23 - - - - -	28

TABLE III

	Type II.	Type III.	Type IV.
Good results:	14 (56%) - - - - -	10 (40%) - - - - -	1 (4%)
No results:	10 (44%) - - - - -	9 (40%) - - - - -	4 (16%)

In Table II we see that out of ninety-six patients answering the above question, eighty-one were careful in blowing their noses easily, not to produce undue back pressure in the nasopharynx and Eustachian tubes. Thirty-one per cent reported that care along these lines had a decided beneficial effect in keeping their ears from discharging. Twenty-eight per cent were sure it had no effect, and 31 per cent were undecided.

Table III shows how the different types of ears were affected by this precaution. Here again we see that there is very little difference in the response to this factor between the Type II ears, which in this case included the Type I, and the Type III ears. Here again we must take into consideration that many of the Type III ears also had open tubes and consequently responded to this precaution. This is a strong reason for suspecting that many of the Type III ears, reported to have begun discharging again after apparent cure, were only doing so because of open tubes, and not because the old suppuration in the attics had started again. These figures again point to the view that the prognosis of cure, from the patient's standpoint, which is permanent cessation of discharge, cannot be based alone upon actual extent of the suppurative process in the middle ear and its appendages, but, to a large extent, must take into

consideration the condition of the tube. This is strictly in conformance with the view of Yankauer, set forth some years ago.

The frequency with which ears, which have once discharged and which have responded to local treatment, again become affected during head colds is shown by the following statistics.

Of the fifty-one cases that were discharging at the end of one year after treatment, twenty-nine began with colds. As the fifty-one cases included fourteen ears which had not been completely cured at the time of dismissal from treatment, we must deduct this number, which leaves thirty-seven. Thus twenty-nine of thirty-seven recurrences (78 per cent) were due to colds and probably the consequent nose-blowing.

SUMMARY

About 50 per cent of the cases of chronic suppurative otitis media, which have responded satisfactorily to local treatment through the external auditory meatus, remained in good condition for a period of from one to two and one-half years. We feel that an ear that remains in good condition for such length of time after apparent cure, holds but little danger to the patient's life, if proper precautions are observed. Many of our cases responded to treatment, although the disease had been of many years' duration. Failure to secure closure of the Eustachian tube is a big factor in the failure to keep an ear in good condition after having once obtained an apparent cure. Care in the manner of blowing the nose is very beneficial in keeping an ear in good condition in about 30 per cent of the cases.

The reports of results of the radical mastoid operation, performed by the best aural surgeons, show that the operation is attended by several unpleasant features, viz: the time required for postoperative care averages about three months; approximately 20 per cent of the cases result in

impaired hearing; and the operation is not successful in cleaning up all the disease process in from 11 to 30 per cent of the cases. The operative mortality and danger of securing facial paralysis, although small, must be taken into consideration. The operation, therefore, cannot be considered as a safe, sure and easy "short-cut" to curing chronic discharging ears.

CONCLUSIONS

1. One may expect about 50 per cent of the cases of long standing, chronic, suppurative otitis media that have responded satisfactorily to treatment to remain in good condition for a period of at least one to two and one-half years.
2. Sex, age, (not the extremes) and constancy of discharge have no apparent effect upon the results of the permanency of the cure.
3. Long duration of discharge is not necessarily an unfavorable factor.
4. The patency of the Eustachian tube must be taken into consideration with the type of pathology in the ear when offering a prognosis as to the permanency of apparent cure.
5. Local treatment must be well directed and persistent.
6. Care in the nose-blowing habit is an important factor in keeping an ear dry in at least 30 per cent of the cases, and this depends upon the condition of the tube and not upon the pathology in the ear.
7. We feel that many cases that were cured and remained dry would have had a mastoid operation if a conservative view had not been taken and persistent local treatment kept up.
8. It is reasonably safe to assume that the suppurative ear conditions which have responded well to treatment will do so again.
9. Discharge from the tube, after the suppurative process has

been controlled, may be considered of minor importance as far as real danger is concerned.

10. In so far as at least 50 per cent of the cases of apparent cures by conservative local treatment remain in good condition for sufficient length of time to regard them as unlikely to cause serious trouble if proper care is taken, we feel that local treatment should be carried out persistently in an effort to obtain satisfactory results. The radical mastoid operation, with its accompanying unpleasant features, should be resorted to in only those cases in which there is undoubtedly great danger of intracranial or labyrinthine involvement, and in those cases which will not respond satisfactorily to well directed and persistent local treatment.

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