THE CORTICAL MASTOID OPERATION

AN ANALYSIS OF NINETY-ONE CASES

BY

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The following comprises an analysis of ninety-one cortical mastoid operations performed consecutively by me while acting as ear, nose, and throat surgeon at Selly Oak Hospital, Birmingham. The operations and after-treatment were carried out in the main according to the generally accepted methods. There are, however, many minor variations in the procedure adopted by aural surgeons, as regards both the actual operation and the after-treatment. A few of such different methods have been tried in these cases, and the conclusions reached are given.

Material

The cases were chiefly of the very acute type, with general tenderness, and frequently oedema, over the mastoid process. Ten of them had subperiosteal abscesses. Many were toxæmic on admission, the children being often ill nourished and suffering from lack of fresh air and sunlight. The period between the onset of aural symptoms and admission is given in the table below.

Duration of Symptoms before Admission					No. of Cases
2-8 days	...	...	...	...	73
2-8 weeks	...	...	...	...	16
12 weeks	...	...	...	...	1
20 weeks	...	...	...	...	1

There is a very noticeable gap between the "2-8 days" and "2-8 weeks" groups, which may have some bacteriological significance. Possibly the first group of seventy-three were cases of primary tympano-mastoiditis, while the remainder were cases of tympano-antritis in which the mastoid gradually became involved. In twenty-three the ear infection was a complication of some general condition, as indicated below.

Condition	No. of Cases
Cough or cold	7
"General upset"	3
Scarlet fever	2
Measles	2
Bronchopneumonia	2
Whooping-cough	1
Whooping-cough and pneumonia	1
Whooping-cough and measles	1
Influenza	1
Acute bronchitis	1
Acute tonsillitis	1
German measles	1

One case was the sequel of tonsillectomy and three were reopenings of old mastoid operations. In five the operation was bilateral, and undertaken on infants under 1 year of age with purulent otitis media, which had failed to clear up after myringotomy. Four of these were suffering from gastro-enteritis with vomiting and loss of weight, and one from malnutrition.

The ages of the patients ranged from 9 months to 56 years, as shown in the following table.

Age	No. of Cases
Under 2 years	20
2-5	28
5-10	20
10-20	7
20-30	6
30-40	3
40-50	4
50-60	3

Operation

Except where intracranial complications were suspected, most patients diagnosed on admission as having acute mastoiditis were given a minimum of one night in hospital before operation. Suspicious cases of otitis media were watched in hospital. If a positive diagnosis was made, one tried to operate at the right, not necessarily the earliest, moment, to find the happy medium between "rushing in" and "cooking."

The operations were performed under gas and oxygen with ether, or ethyl chloride followed by ether; and the anaesthetic was given either through a rubber catheter in the nasopharynx or by means of a Hirsch's airway with anaesthetic tube, so that the anaesthetist was well removed from the field of operation. In all a half-inch bipp strip was placed in the meatus.

The instruments used for the bone work were: a set of straight-backed gouges and a mallet, Volkmann's sharp scoops Nos. 1 and 2, Ballance's double-ended scoop-curette, and a Grant's probe. The bone was removed in three planes, working parallel to the dura mater of the middle fossa, the lateral sinus, and the posterior meatal wall. No overhanging edges were left. An attempt was made to open all the cells, so that a large cavity often resulted. The aditus was well opened up, and in some cases the white prominence of the external semicircular canal could be seen. All granulations were removed from the aditus with the curette, and in a number of instances its patency was tested by attempting to syringe saline through into the meatus.

In certain cases one group of cells was involved to a much greater extent than the others, as the following figures show.

Group of Cells	No. of Cases
Tip cells	18
Zygomatic cells	7
Petrosal angle cells	4
Posterior meatal wall cells	2

In the first group the whole tip was removed. In every case the area posterior to the sinus was explored, and in six infected cells were present. No special point was made of exposing the dura of the middle fossa or the sinus, unless signs or symptoms demanded it, but they were exposed without hesitation to open or remove diseased cells. The sinus was exposed in forty-five and the dura in forty cases. The wound was one-half or three-quarters stitched, according to the size of the cavity. The latter was lightly packed with half-inch bipp ribbon gauze. In complicated cases the wound was left open and packed with hypertonic saline ribbon gauze. In all a half-inch bipp strip was placed in the meatus.

After-treatment

The bipp pack was left in for five days unless undue rise of temperature indicated its removal. After that a flavine and paraffin pack of half-inch ribbon gauze was substituted and changed daily. In the complicated cases the saline pack was changed daily from the first. The meatal bipp was changed daily, and on the sixth day flavine and paraffin substituted; this was continued until the meatus was dry. In packing the cavity on the sixth and subsequent days with the flavine and paraffin ribbon gauze, care was taken to pack the depth of the wound firmly, so as to ensure firm granulations growing in the antrum and aditus. The remainder of the cavity was lightly packed, and several parallel folds of the ribbon gauze were inserted between the skin edges to keep them well apart and to prevent falling in. The wound was not allowed to close until the middle ear had stopped discharging.

Complications

There were four cases of perisinous abscess, two of cerebellar abscess, and one of subdural abscess and thrombosed lateral sinus.

Immediate Results

There were five deaths, all due to meningitis. This was confirmed by post-mortem examination. Two of the patients had previously had meningitic signs, and at operation cerebellar abscesses were found and drained. Both died on the day following operation. The third had a small subdural abscess in the posterior fossa and a fibrous cord in place of the lateral sinus. The abscess was drained, lumbar puncture carried out daily, and the wound re-dressed with hypertonic saline at the same time. The patient lived for three weeks. The other two deaths were in children. One, the infant suffering from malnutrition and bilateral otitis media, died four days after operation. The other, a child of 3, developed head retraction and an acute mastoiditis on the other side five days after the first operation. The second mastoid was opened, and lumbar puncture at the time of operation gave a turbid fluid. The child died three weeks after the second operation. One patient developed suppurative panophthalmitis on the same side as the operation, necessitating evisceration of the eye ten days later. The eye was affected on the day following operation. The lateral sinus had been opened because it was covered with granulations and there was a history of rigors; it bled freely from both ends. Mr. L. P. Jameson-Evans, the ophthalmic surgeon who performed the evisceration, considered that the eye condition was due to embolic spread from the mastoid. There was one instance of facial paralysis; this was noticed on the day following operation, and was, I think, due to the removal of some deep tip cells. Recovery was complete in four months.

During the healing process in hospital four patients had to have granulations in the wound curetted. After discharge to the out-patient department six had to be readmitted, five with abscesses in the scars, which had to be opened and drained, and one which required removal of necrotic bone. The remaining eighty made an uninterrupted recovery. The average time in hospital was thirty-three days, but the majority were in for about twenty-one days, the longest period being fourteen weeks in a case which obstinately refused to granulate. No patient was transferred to the out-patient department until the meatus was dry and the cavity healing up satisfactorily without much discharge. The average time from operation to final discharge from the out-patient department was ten weeks; five being discharged within three weeks, eight within four weeks, twelve within six weeks. The longest time was twenty-four weeks.

Late Results

A review of the eighty-six surviving cases, approximately six months after operation, was of great interest.

Seventy-seven patients were satisfactory in all respects. The hearing, as tested with the whispered voice, was normal, the middle ear dry, and the wound soundly healed. In eight cases there was still discharge—in seven from the meatus and in one from a sinus in the wound. No local cause could be found for persistence of discharge in the latter case, nor in one of those with meatal discharge. Both were children in poor general condition, and treatment was directed towards improving this. Of the six other patients with meatal discharge, one, the only adult, had a small granulation on the drum, which was being cauterized; the discharge was rapidly diminishing. The other five had a sticky mucous discharge, and required removal of adenoids.

The four infants suffering from gastro-enteritis were of special interest. After doing myringotomy I was inclined towards conservative treatment, but Dr. D. G. Leys, the physician in charge of these patients, felt that the continued suppuration was the cause of the gastro-enteritis and that the mastoid antra should be drained. This was done, and within ten days improvement was noted in all cases. The vomiting stopped, and they began to put on weight. The operation is a short one, the scar negligible, and the hearing preserved.

Numerical records of hearing are difficult to obtain in a busy out-patient department, but each case was tested with the whispered voice, the other ear being occluded.

In seventy-eight out of eighty-six cases the hearing was normal. Of the remaining eight, seven had meatal discharge. Four of these had poor hearing, and three slight impairment. The eighth was dry, but had a large central perforation following measles. There was practically no hearing by air conduction.

The appearance of the tympanic membrane in the seventy-nine dry cases was, apart from the scars, remarkably normal; in one, a measles case, as mentioned above, only the margin of the membrane remained. In another there was a small transparent sphere attached to the membrane just above the umbo. I have not seen this appearance before. In four instances the membrane was definitely indrawn.

In four there was some deformity of the external auditory meatus, making it difficult to see the whole membrane clearly. Every effort had been made to avoid trauma to the meatus at the time of operation, so I was disappointed to find that this had occurred. There was no external otitis in these cases.

In seventeen cases there was moderate depression over the scar behind the ear; in the remainder none or very slight.

General Remarks

These observations are based on a study of the temperature charts and notes of the cases.

1. *Temperature*.—It was noted that in those patients in whom the temperature was high at the time of operation it often remained raised for some five or ten days afterwards. After a short rest in hospital for twenty-four to forty-eight hours or more, the temperature often came down to about 99° F., and if then operated on, most reached normal within a few days.

2. *Operative Technique*.—The importance of opening up the aditus so that the external semicircular canal is exposed, of curetting the aditus, and of syringing saline through the middle ear was well demonstrated. Of the eight patients in whom all these things were done seven had no meatal discharge after five days. In the remaining cases the meatal discharge ceased after an average of eleven days.

3. *Drainage*.—It is important to ensure that there are firm granulations in the antrum and aditus in order to shut off the operation area from the middle ear; thus abscess formation in that area is avoided should the patient have another middle-ear infection. For the first five days after operation the middle ear drains through the well-opened aditus into the loose bipp pack. Very firm packing of the deepest part of the wound with flavine and paraffin ribbon gauze for at least a week after this ensures that the middle ear is completely shut off from the healing mastoid cavity. Later the packing need be only sufficiently tight to ensure that the cavity fills up with firm granulation tissue, and that there are no small residual collections of pus. Tube drainage, I think, is not a good method, because it may produce a cavity, filled with loose granulations, which may easily become reinfected from the middle ear, or in which pus may

remain pocketed after the wound has healed superficially. These remarks apply particularly to cases treated in large institutions where the operator cannot do his own dressings. It is not denied that most patients do well on almost any type of post-operative treatment provided the operation has been efficiently performed; now and again, however, one does see abscesses in the wounds of well-performed mastoidectomies, and I believe it is due to a failure in post-operative treatment.

4. Incision.—Two types of incision were used. The one which gives the best exposure of the mastoid process is one which I learned from Mr. Gill-Carey, surgeon to the Central London Throat, Nose and Ear Hospital and used on about one-half of these cases. It is a semi-circular incision from just above the upper attachment of the pinna to the tip of the mastoid, extending backwards to the hair line. This incision goes through skin and subcutaneous tissues only. After these have been reflected forward, the periosteum is incised by a vertical cut at the anterior end of the wound; after a backward incision at the upper and lower ends of this cut the periosteal flap is reflected posteriorly. Besides giving a good exposure this incision does away with the necessity for a horizontal posterior incision when dealing with post-sinus cells. Its disadvantages are that the retractor does not always hold very firmly in the wound, and that, should it prove necessary to leave the wound open, the flap falls in and secondary suture becomes essential. On the other half of these cases the more usual incision down to the bone was used. It had the same limits above and below as the first, but extended posteriorly only about half an inch behind the attachment of the pinna. A horizontal back cut was often necessary to explore the post-sinus cells. The first incision is to be preferred for the exposure it gives and for cosmetic reasons, except where the wound has to be left open.

5. Sutures.—Various sutures and suture materials for the skin were tried. The double stitch, going deep and returning superficially, although everting the edges well, tends to cause scarring later. The simple stitch with horse-hair gave the best cosmetic results.

6. Post-auricular Depression.—The presence or absence of a depression behind the ear after operation is not dependent on the size of the cavity, the site of the incision, or upon whether the periosteal edges are approximated or not; probably it depends on some inherent property of the tissues concerned.

7. General versus Special Wards.—Owing to the great number of mastoid cases admitted to the hospital in the spring of 1934, a number of the above patients were nursed in the general wards. These had a more uninterrupted recovery and healed more quickly than those in the ear, nose, and throat wards. This was, I think, due to the absence of cross-infection. I did not hear that the general cases gained any corresponding benefit from the intrusion.

Summary

In the above series of ninety-one consecutive cortical mastoidectomies, comprising patients of all ages, eighty made an uninterrupted recovery. Six patients were readmitted for further operation, and five died in hospital.

The majority were in hospital for three weeks; the average time from operation to final dismissal was ten weeks.

A review of the eighty-six surviving cases after six months showed that seventy-seven patients had dry ears, soundly healed wounds, and normal hearing. In eight the hearing was impaired, and in a similar number there was persistent discharge.

In the operative technique, adequate opening up, careful curettage, and lavage of the aditus is important.

In the post-operative treatment, after the first five days, firm packing of the depth of the wound for about a week shuts off the middle ear from the operation area, and prevents reinfection of the latter.

My thanks are due to Mr. E. C. N. Strong, my successor, for the skill and attention he devoted to many of these cases during the healing stages; to the medical superintendent, Mr. R. P. S. Kelman, and to members of the lay and nursing staff of Selly Oak Hospital for their kind co-operation in the collecting of the above statistics; and to Mr. J. D. McLaggan, surgeon and dean of the Medical School, Central London Throat, Nose and Ear Hospital, for his valuable help and criticism in connexion with this paper.

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BACILLARY DYSENTERY: A SUMMARY OF TREATMENT

WITH BRIEF STATISTICS OF AN EPIDEMIC

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In the treatment of an acute epidemic disease, more particularly when specific measures are available, there should be no delay at the start. Hesitation means handicap, whether from uncertainty in diagnosis or from misjudgement of the severity of infection. Throughout the course of treatment practice should conform to theory, not to hypothesis, speculation, or experiment.

Theoretical Considerations

The toxæmia, and the orderly sequence in clinical events following infection, serve to distinguish bacillary dysentery from the many miscellaneous causes of this unpleasant symptom. When an exotoxin is present, as with the Shiga bacillus, the effect appears early and is severe. The amoebic disease has none of these general features. Amoebic dysentery is a non-vector protozoal disease. It may acquire high endemicity, but cannot become epidemic. The morbid process differs, and the course of disease is necessarily distinct.

The degree of severity in bacillary dysentery is the basis of clinical classification, the disease being either (1) mild, (2) severe, or (3) fulminating (choleraic): serum treatment is indicated in all except the mild cases. Clinical judgement depends on a recognition of underlying mechanisms. For example, in the Shiga infection there is early histotoxic anoxæmia, often manifest in the patient as a peculiar bluish flush, and giving way sooner or later to pallor. There is loss of tone in capillary and vasomotor areas, and a resulting fall in blood pressure. The signs denoting severity are those of imminent collapse, and are in terms of the circulatory system; they are not of the arresting nature of tenesmus or of strangury, and need not occur in proportion to the degree of fever or the frequency of stool. Bacillary dysentery is more than "an abdominal disease." It is for this reason that many cases which begin mildly become later severe or fatal.

Early exhaustion, which is due to toxæmia, is amenable to treatment, and certain drugs are of some value. Late exhaustion results from tissue depletion. It is less amenable to treatment, and all drugs are useless. It should not, however, be considered an inevitable and vague state of dissolution. To toxæmia is added deprivation and loss of most of the papulum out of which biochemical balance is effected. The mechanism of the syncope is that of peripheral circulatory failure. The principles of treatment are therefore as follows: improvement of tissue nutrition; increase of blood volume in