Mastoidectomy using an osteoplastic flap

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During the past 20 years there have been numerous changes in our approach to mastoid surgery. New procedures have been evolved, and old ones discarded or sometimes revived. In our present state of knowledge, three principles govern our approach to surgery of chronic ear and mastoid suppuration.

Firstly, all disease and especially all cholesteatoma, must be eradicated at operation. As a corollary, any mastoid operation must allow good exposure to every part of the middle ear and mastoid. Secondly, as much as possible of the normal anatomy must be preserved so as to give the best chance of restoring hearing by reconstruction. Thirdly, the exteriorized mastoid bowl with its unstable epithelium is no longer acceptable to the patient nor to the otologist.

Like many other otologists, the authors have become disillusioned with the techniques of obliterating the mastoid cavity with various autogenous grafting materials. Such grafts frequently become infected or shrink to such an extent as to leave behind a large mastoid bowl.

The combined-approach operations of Jansen and Smyth have gone a long way towards solving this difficulty in that they preserve the posterior bony meatal wall, thereby eliminating the problem of an exposed mastoid cavity. These combined-approach operations however, do not give adequate surgical access to the posterior part of the middle ear because visibility is hampered by the preserved posterior bony meatal wall in its normal position.

We have therefore reached a situation where preservation of the bony bridge is a highly desirable ultimate objective, yet its presence during the operation is an intolerable obstruction to proper exposure.

The operation described in this paper is designed to resolve this dilemma by allowing temporary displacement and subsequent replacement of the bony posterior canal wall. Its blood supply is kept intact by maintaining its attachment to meatal skin using the osteoplastic-flap principle.

Operations using a similar principle have been described by Schnee (1963) and by Portmann (1967, 1969). Schnee performs a per-meatal atticotomy and then mobilizes the posterior canal wall after exenterating the mastoid. Portmann (1967) removes the posterior bony canal wall altogether and then reconstitutes it with bone chips. In 1969, Portmann described a method in which the meatal skin is elevated from the bony

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external meatus and the posterosuperior bony wall resected and later replaced.

Technique

The mastoid may be approached by either the endaural or post-aural incision according to the surgeon's preference. Either is equally satisfactory except in the very cellular mastoid when the post-aural route is preferred.

The temporalis muscle is identified and retracted upwards. McEwen's triangle is exposed and care is taken not to detach the posterior meatal wall periosteum from its bony attachment.

The mastoid air cells are exenterated in the usual manner and the bony excavation extended well forwards between the tegmen and the roof of the bony meatus. The bony posterior and superior meatal walls are then thinned down so as to leave only a thin bony bridge separating the mastoid from the meatus. The medial end of this bony bridge is drilled down on its posterior aspect so as to expose the short process and the body of the incus. The excavation is extended downward, antero-lateral to the facial canal so as to form a posterior tympanotomy slot opening into the facial recess as described by Jansen and Smyth.

The bony posterior meatal wall (which now constitutes 'the bridge') is mobilized by means of a superior and an inferior osteotomy incision. The superior incision extends laterally from the anterior part of the attic and the other extends laterally from the lower end of the posterior tympanotomy slot. The osteotomy incisions are executed by making grooves in the bone using a cylindrical burr which are gradually deepened until the soft tissues of the meatus are encountered along the whole length of the grooves.

When this manoeuvre has been completed, the mobilized bony bridge, attached to the meatal skin is displaced forward. In order to improve the mobility of the flap, the meatal periosteum is elevated for a short distance on each side of the osteotomy incisions. This gives an excellent exposure of the whole middle ear cavity including the area of the eustachian tube orifice, the hypo-tympanum and the sinus tympani. Diseased ossicles, polypi and cholesteatoma are removed and reconstruction of the ossicular chain and tympanic membrane is carried out if the surgeon is satisfied that there is no cholesteatoma remaining.

The operation is completed by replacing the posterior meatal skin and bone (constituting the osteoplastic-flap) in its natural position. The flap is kept in place by packing the meatus with $\frac{1}{2}$ in. ribbon gauze impregnated with Neomycin-hydrocortisone ointment. The wound is closed without drainage and a pressure dressing applied. Antibiotic cover is maintained for 7 days and the ribbon gauze wick is removed after 10 days. The patient is then seen at weekly intervals until the ear is dry and healed.

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Results

In this paper the results of the 40 operations using the osteoplastic-flap are presented. Originally there were 41 consecutive cases, but one patient was completely lost to follow-up thus leaving 40 available for analysis. About half the operations were carried out by the endaural route and the other half by the post-aural approach.

Criteria

Table I shows the criteria for operation and for inclusion in this series. It should be emphasized that all patients included had an active discharge from the ears, and this had persisted despite medical treatment.

TABLE I.

OSTEOPLASTIC FLAP MASTOIDECTOMY—40 CASES CRITERIA FOR INCLUSION IN THE SERIES.

1. Pre-operative otorrhoea for at least 6 months which did not resolve on conservative treatment.
2. Free from upper respiratory disease.
3. Haemoglobin level not below 75%.
4. Post-operative follow-up of at least 6 months.

Findings at operation

Table II shows the findings at operation. All patients had some kind of active pathology in the middle ear or mastoid.

TABLE II.

OPERATIVE FINDINGS IN 40 CASES OF OSTEOPLASTIC FLAP MASTOIDECTOMY.

Operative findings	No. of cases	Percentage
Cholesteatoma	25	60
Extensive infection of mastoid air cells ..	24	58
Broken ossicular chain ..	33	82

Reconstruction method

Table III shows the number of cases in which tympanoplasty was carried out and the methods used for reconstructing the ossicular chain. There were eleven cases where no reconstruction was undertaken, because there was extensive cholesteatoma or because the middle ear mucosa was in such a poor state that one felt that it would result in extensive adhesion formation in the middle ear. Sialastic sheeting was not used in any of these cases.

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Hearing results

Table IV shows the hearing results in these 29 cases where reconstruction was attempted; it can be seen that approximately half of these obtained a substantial improvement in hearing and this represents about one-third of the total number of cases.

TABLE III.

OSTEOPLASTIC MASTOIDECTOMY—40 CASES TYMPANOPLASTY PROCEDURE.

Procedure	No. of cases	Percentage
Middle ear reconstruction attempted	29	73
Tympanoplasty I (using temporalis fascia) ..	6	15
Transposed incus, or bone chip, on head of stapes	15	38
Conical bone chip, or transposed incus, from stapes footplate to T.M. graft	8	20

TABLE IV.

OSTEOPLASTIC MASTOIDECTOMY—40 CASES.

Hearing results in the 29 cases where middle ear reconstruction was undertaken:

Result	No. of cases	Percentage
Closure of air-bone gap within 10 dB.	11	38
Improved, but without closure of air-bone gap	2	7
Hearing unchanged ..	15	52
Hearing worse	1	3
Severe sensori-neural hearing loss	0	0

Dryness

Figure 1 shows the length of time taken for the operated ears to become dry. It will be seen that the discharge came to an end in all cases except one, within 16 weeks. The average length of time taken for the ears to become dry after operation was 4 weeks.

Complications

Table V shows the complications of the operation. The only serious sequelae were a facial palsy which recovered after 10 days, and a meatal stenosis associated with otitis externa which has persisted.

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Discussion

The technique employed in this operation is designed to improve access to the middle ear by temporarily dispersing the bony bridge. In this respect it is similar to the procedures described by Schnee (1963) and Portmann (1967), but differs from them in that the normal anatomy of the meatus and of the bony annulus is preserved.

Having practised this operation over the past two years we are satisfied that the procedure described is a sound practical undertaking in patients with active chronic middle ear disease.

Technically it is no more difficult than the combined approach operations, and in many respects, is easier in that it gives a better exposure of the middle ear. An experienced otologist can complete this operation in

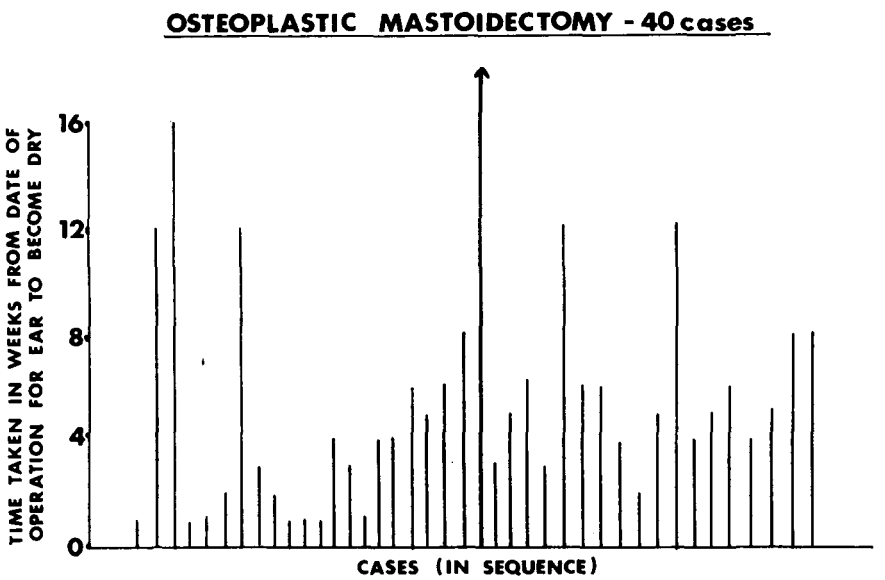


FIG. 1.

TABLE V.

OSTEOPLASTIC MASTOIDECTOMY—40 CASES COMPLICATIONS.

Complications	No. of cases	Comments
Temporary facial palsy	1	Complete recovery after 10 days
Facial nerve exposed and sheath slightly traumatized at operation	3	None of these cases had any resulting facial weakness
Wound sepsis and failure of primary healing	2	One of these cases has haemophilia
Meatal stenosis	1	At least partly due to otitis externa

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1½–2 hours. Complications are not more common than in other mastoidectomy procedures. Healing is rapid and a dry ear is the almost invariable end result.

Approximately 30 per cent of cases get a good hearing result at the first operation. This is disappointingly low but it must be emphasized again that the cases in this series all had active middle ear suppuration (wet ears) and were potentially unsuitable or unfavourable for first stage reconstruction. Many of the 70 per cent who did not hear after the first operation did so after a second stage tympanoplasty but not enough of these have been done as yet to give meaningful figures.

The osteoplastic operation, in common with all 'closed' mastoid operations can be criticized because one cannot be sure that one is not concealing cholesteatoma, the surgeon must be prepared to abandon this technique and to carry out an old fashioned type of radical mastoidectomy whenever there is extensive cholesteatoma formation and complete removal cannot be carried out with certainty. First stage reconstruction, for the same reason, should not be done in all cases. Second stage tympanoplasty after this operation however, is made much easier by removal of infection and by preservation of the normal meatal anatomy at the first operation.

Summary

A description is given of a mastoidectomy technique in which the posterior bony meatal wall is fashioned into an osteoplastic flap so as to constitute a 'mobile bridge'. This is displaced forward to give access to the middle ear during the operation and subsequently replaced so as to restore the normal anatomy of the meatus. The findings and results in 40 such operations are described. All but one had rapid healing resulting in a dry ear in a few weeks. Tympanoplasty was attempted at the first operation in 29 cases and of these 13 obtained a good hearing improvement.

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