IS MYRINGOPLASTY WORTHWHILE?*

By PHILIP H. BEALES (Doncaster)

I WOULD like first of all to thank our President for giving me the opportunity of presenting this short paper today.

For some time now as a result of various talks I have had with colleagues who have visited my Theatre it has been clear to me that there is a great variation in the results of plastic ear operations. The operation of myringoplasty is one that is praised by some and condemned by others. It occurred to me that you might be interested in my theories as to why there should be such a variation in results.

Although I regard myringoplasty as primarily an operation to repair a defect in the ear-drum in an ear that is free of infection, it is also, in every case, an operation in which the whole of the tympanic cavity and its contents are examined and tested under the direct vision of the microscope.

It is thus not a minor exercise for the trainee surgeon but a comprehensive and difficult procedure that may well tax the skill of the most experienced otologist.

The operation is never carried out unless the ear has remained free of infection at repeated examinations over a period of at least twelve months, and the indications I adopt when this fundamental condition is fulfilled are shown in the following table.

TABLE A.

INDICATIONS FOR MYRINGOPLASTY.†

1. DEFECTS OF TYMPANIC MEMBRANE WITH RECURRENT ATTACKS OF OTITIS MEDIA THAT ARE BELIEVED TO BE DUE TO INFECTION FROM WITHOUT e.g. EAR DISCHARGE AFTER SWIMMING.
2. DEFECTS OF TYMPANIC MEMBRANE WITH APPRECIABLE HEARING LOSS.
3. DEFECTS OF TYMPANIC MEMBRANE ASSOCIATED WITH VERTIGO.
4. WHEN PATIENT IS REJECTED FOR AN OCCUPATION ON ACCOUNT OF A TYMPANIC MEMBRANE PERFORATION.
5. ALL TRAUMATIC PERFORATIONS THAT DO NOT HEAL QUICKLY.
6. TYMPANIC MEMBRANE PERFORATIONS AND ASSOCIATED TYMPANOSCLEROSIS.

†In all cases Tympanic Mucosa must be normal at several examinations over a period of at least twelve months.

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I have tried with this operation and in fact all tympanoplastic procedures to apply all the basic principles of plastic surgery to a sound otological operation.

This may sound simple but I wonder if those who are unsuccessful in these operations do in fact combine the two specialties completely? I have used a free skin graft usually a full thickness one in my cases, and the results show that in about 60 per cent. of operations there has been reasonable hearing improvement which is maintained over the years, and in about 90 per cent. of cases the ears have remained dry. When using free skin grafts certain basic principles must be adopted if the graft is to take and survive indefinitely.

The basic principles are shown in the following table:

TABLE B

Basic Principles of Free Skin Grafting.

1. Scrupulous care to avoid infection at operation.
2. The preparation of a suitable graft.
3. The application of the free graft to a suitable bed.
4. Prevention of bleeding beneath the graft after application.
5. Prevention of trauma to the graft until it is well vascularized.
6. Prevention of infection of the graft after application.

I will now enlarge on these basic principles:

(1) I do not need to emphasize that asepsis at the time of operation is of vital importance and penicillin does not absolve us from the responsibility of taking great care not to introduce infection at the time of operation. The same care should be taken as, for example in a fenestration operation.

(2) The preparation of a suitable graft is an essential. A full thickness post-auricular skin graft is frequently used as it is convenient to take and the quality of skin it provides is good. This type of graft must be entirely free of fat if it is to take properly. The trimming of the fat from the graft requires time and patience and the raw surface of the graft should always be examined with the microscope before it is applied. It is very instructive to do this and makes one realize that it is in fact very easy to leave islands of fat on the graft and thus make the chances of 100 per cent. take less certain.

It is easy to damage the graft in its preparation and skin hooks and not forceps should be used when handling it.

(3) A free skin graft must be applied to a suitably vascular bed if it is to take completely and if it is to survive indefinitely and complete hæmostasis must be present when the graft is applied to its bed.

Hæmostatis is obtained by combining a suitable general anæsthetic with a local injection of a vasoconstrictor and the application of a topical vasoconstrictor immediately before the graft is applied to its bed.

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The drawings show the four sites for the injection of the local anæsthetic adrenalin solution.

In practice the most satisfactory solution has been found to be about 2·5 c.cs. of a mixture of 3 c.cs. 2 per cent. xylocaine and 1 c.c. of 1/1000

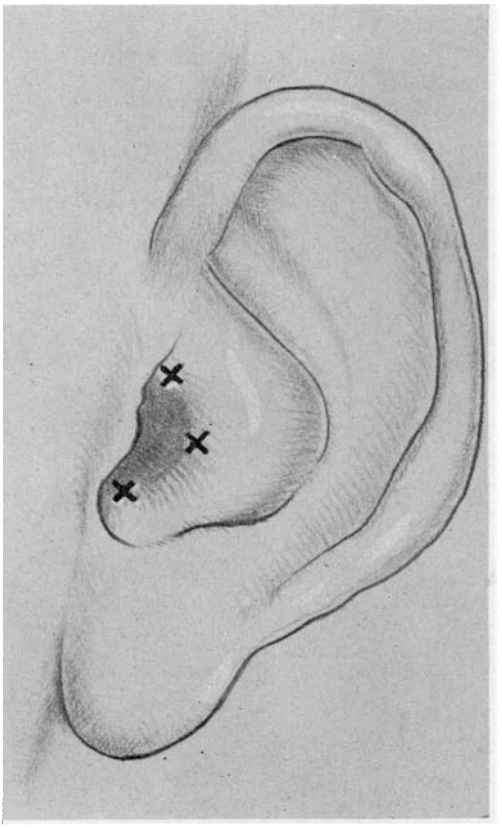


FIG. 1.

Three of the four sites for injection of local anæsthesia.
See caption Fig. 2.

adrenaline. The concentration of adrenaline in this mixture would be regarded as too high by the physiologists but weaker concentrations have been less effective.

An endaural incision is used and the incision on the posterior meatal wall is not carried too close to the annulus.

The skin of the deeper part of the posterior meatal wall is very thin and it is easily destroyed if a periosteal elevator is used to raise it at this level. The skin of the outer two thirds of the posterior meatal wall can be elevated readily as it is thicker, and it is this skin which is included in the meatal flap held by the retractor. The thin skin is handled under direct

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vision using the microscope and by doing this one is able to preserve portions at least of the periosteal layer of the deep bony meatus. The free graft will later be in contact with this part of the posterior meatal wall

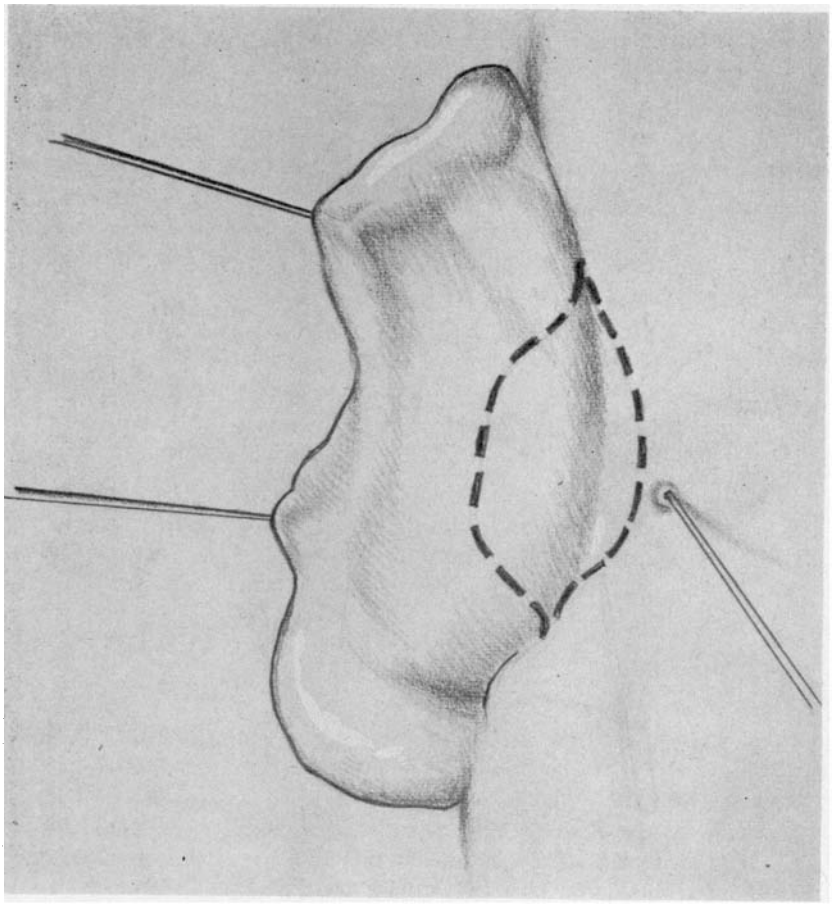


FIG. 2.

SITES FOR INJECTION OF LOCAL ANÆSTHETIC ADRENALIN MIXTURE.

The four sites for injection of two to three c.cs. of a mixture of three c.cs. 2 per cent. xylocaine and one c.c. of 1/1000 adrenalin. This mixture is used combined with general anæsthesia for all aural operations and gives better hæmostasis than the weaker adrenalin concentrations that are usually employed. When cutting a post-auricular graft it is important to avoid puncturing the skin that will be used for the tympanic membrane repair with the needle used for the local injection.

and more blood vessels will remain to nourish the graft if this technique is adopted. In a similar way the skin that is removed as a strip from around the rest of the deep meatal wall at its junction with the annulus is removed gently so that the periosteum is in part preserved. Complete preservation

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of periosteum is not possible as the skin is partly fused with it at this level of the meatus.

(4) A moderate pressure dressing at the end of the operation helps to

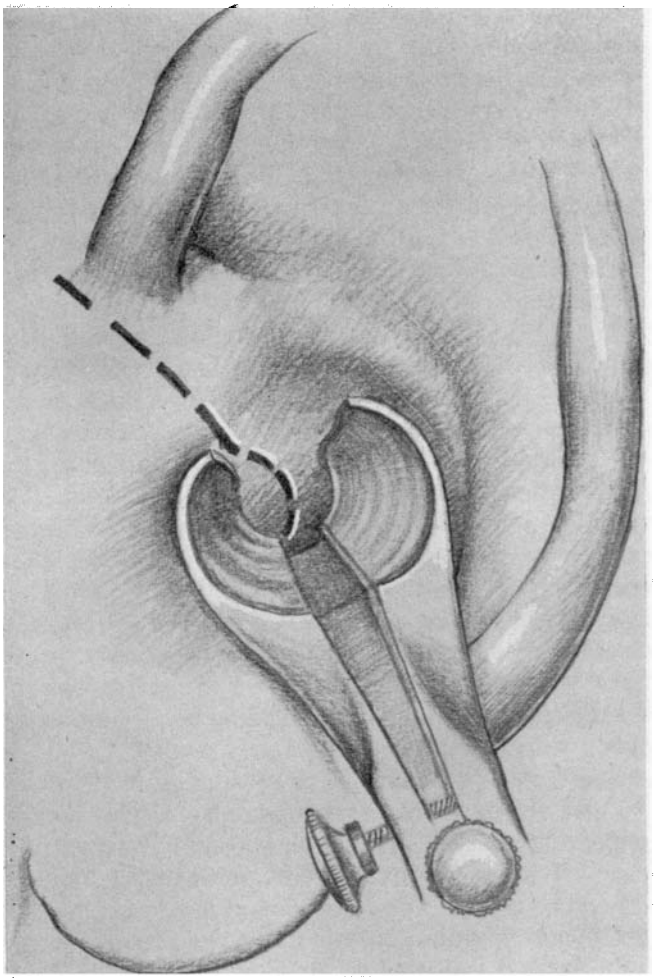


FIG. 3.

ENDAURAL INCISION USED FOR MYRINGOPLASTY.

The incision of the posterior meatal wall skin should not be carried too close to the tympanic annulus. The skin of the deeper part of the posterior meatal wall is very thin and should only be handled under magnification. It is liable to be torn and destroyed if handled with an elevator.

immobilize the part and reduces oozing of blood if the defect is vascular. Too much pressure can theoretically be applied over a hard defect and

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prevent the graft from taking because of ischæmia. In fact this is very difficult to produce as the pressure under a dressing rapidly reduces. An inner dressing of moist gel foam on the outer surface of the graft and an outer dressing of BIPP gauze has proved satisfactory.

(5) It is vital to prevent trauma to the graft until it is well vascularized. In practice this means that all methods that stretch the graft must be avoided.

Most damage will be done by too early inflation of the ear after operation. This stretches the graft and tears some of the blood vessels carrying nourishment to it. The central part of the graft in the tympanum is receiving its blood supply from the periphery only and it is very vulnerable for at least two weeks after operation. Myringoplasty should not be done at all if the Eustachian tube is obstructed, and if the tympanic mucosa has not been damaged at operation and if the graft is supported by a little gelatin foam in its central portion, nothing will be gained by early inflation. It is not usually required at all.

(6) Infection of the graft after operation occurs in two ways. The graft may be applied to a bed which is infected, where it will not take unless the infection is controlled by antibiotics or it may be infected, from without by the collection of discharge on its skin surface. The first is easy to deal with and the second is caused by an error on the part of the surgeon.

If any raw surfaces, however small, are left at the end of operation to heal by granulation, discharge will occur and this often becomes infected. The discharge lies on the surface of the graft and causes inflammation which may destroy the graft.

Complete cover of all raw areas at the end of operation is relatively easy to achieve after myringoplasty as no cavity has been created in the mastoid.

Here lies the essential difference in healing between myringoplasty and tympanoplasty with a mastoid cavity.

In myringoplastic procedures a free skin graft if applied correctly should take and survive, but in tympanoplasty with a mastoid cavity one cannot prevent the free graft from becoming infected if it is applied to the mastoid cavity as well as the tympanum, as free skin grafts will not take properly on bare bone. Spontaneous healing or healing by granulation of the mastoid cavity again does not solve the problem as this is a slow and uncertain method and it allows infected discharge to damage the free tympanic graft.

Therefore for tympanoplasty with a mastoid cavity a flap with its own blood supply is necessary for lining the mastoid cavity, or a method such as Ian Thorburn has shown today is essential for success.

I hope that more otologists will come to realize that the so called problem of the unhealed mastoid cavity is largely one of their own creation and will use methods that ensure sound healing. I will now discuss my results of myringoplasty operations.

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Examination of Results:

TABLE I.

HEARING RESULTS AFTER MYRINGOPLASTY.

87 OPERATIONS BETWEEN MAY, 1955 AND JULY, 1960.	
Hearing improved in ..	46 cases.
Hearing unchanged in ..	30 cases.
Hearing worse in ..	2 cases.
No record of hearing in ..	9 cases.
HEARING RESULTS EXPRESSED AS A PERCENTAGE.	
Hearing improved in ..	59 per cent.
Hearing unchanged in ..	38 per cent.
Hearing worse in ..	2 per cent.

Table I shows that a useful hearing gain has been obtained in about 60 per cent. of cases. The improved hearing level seems to be maintained over the years.

TABLE II.

ANALYSIS OF HEARING GAIN EXPRESSED AS AVERAGE FOR SPEECH FREQUENCIES 500, 1000, 2000 C.P.S.

Over 10 decibels gain	11 cases or 24 per cent.
Over 15 decibels gain	13 cases or 28 per cent.
Over 20 decibels gain	10 cases or 22 per cent.
Over 25 decibels gain	4 cases or 9 per cent.
Over 30 decibels gain	8 cases or 17 per cent.

Table II shows the amount of hearing gain for the speech frequencies and one should note that there is a significant group with a hearing gain of over 30 dbs. These cases showed additional lesions such as a broken ossicular chain, or a fixed stapes. These lesions would have been missed if a blind operation without a complete examination of the ossicular chain had been carried out.

TABLE III.

PREVIOUSLY REPORTED RESULTS OF MYRINGOPLASTY.

Author	Operations	Takes	Hearing		
			Improved	Unchanged	Worse
WRIGHT 1956 (10 cases hearing not tested)	56	40	25	5	0
BEALES 1957	17	16	12	5	1
MAWSON 1957	21	21	15	6	0
THORBURN 1960	17	17	14	1	2

Table III shows the results of other surgeons. One should note the high incidence of primary failure of the skin graft in Wright's series. This should be uncommon with a suitable technique.

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TABLE IV.

TYMPANIC PATHOLOGY FOUND AT 87 MYRINGOPLASTY OPERATIONS.

Tympanosclerosis	3 cases.	
Otosclerosis	2 cases.	
Fixed Stapes	5 cases.	2 otosclerosis 1 tympanosclerosis 2 fibrous adhesions
Interruption of Ossicular Chain at Inco-Stapedial Joint	8 cases.	
**Thickened Mucosa in Tympanum*	6 cases.	

*5 of 6 cases with thickened tympanic mucous membrane broke down later and two of these required Tympanoplasty.

N.B.—In 27 per cent. of cases abnormalities were found. This should condemn the blind operation carried out through an aural speculum in which the tympanum is not examined.

Table IV is of special interest as it shows that in no less than 27 per cent. of cases, a lesion other than a defect of the drum was found. This finding is a condemnation of the blind operation in which the whole chain is not examined at operation.

When the chain is found to be interrupted at the inco-stapedial joint, I apply the graft so that it lies in contact with both the remains of the long process of the incus and the head of the stapes as seen in the two drawings.

This procedure gives a better functional result than if the graft is applied to the head of the stapes only, as in the type 3 tympanoplasty, as one retains the lever action of the ossicles.

TABLE V.

HEALING RESULTS 87 MYRINGOPLASTY OPERATIONS.

81 cases remained dry or 90 per cent.
6 cases discharged or 10 per cent.

Primary failure of skin graft	1 case
Persistent small perforations of skin graft	18 cases
Late total disintegration of skin graft ..	3 cases (1 case was traumatic).
Tympanoplasty revision required in ..	2 cases
Development of cholesteatoma	0 cases

Note: 1. Preservation of meatal wall periosteum has not been achieved in MOST CASES IN THIS SERIES. PERSISTENT SMALL PERFORATIONS OF GRAFT SHOULD BE REDUCED IF THIS TECHNIQUE IS ADOPTED.
2. 5 of 6 cases that discharged after operation had thickened tympanic mucosa at operation. This finding is an absolute contraindication for myringoplasty.
3. CHOLESTEATOMA HAS NOT DEVELOPED IN ANY CASE IN THIS SERIES.

Table V shows that 90 per cent. of cases have remained dry. Examination of the grafts in the tympanum years after operation shows the presence of small hairs growing on them and proves that they will survive indefinitely provided that the grafts have been applied correctly to a

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suitably vascular bed. It is not correct to think that a free skin graft acts only as a scaffold for other cells to grow into.

The free graft can of course die and be cast off. Healing if it occurs will then be by granulation with a lining of scar tissue.

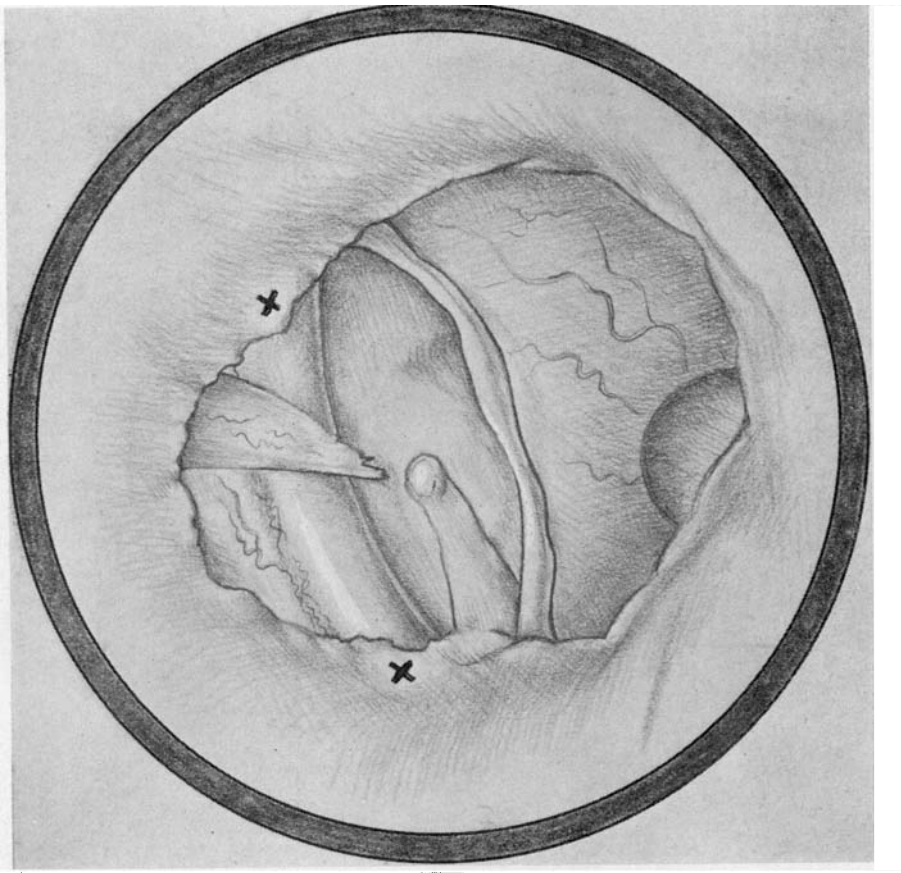


FIG. 4.

Drawing made during a myringoplasty operation showing a view of postero-superior aspect of right tympanum. Bone of posterior meatal wall has been removed as marked by two X. The long process of incus is eroded and the inco-stapedial joint is absent. The ossicular chain is therefore not functioning. The free graft will be applied and put into position in such a way that it not only closes the defect in the tympanic membrane but lies also in contact with the remains of the long process of the incus and head of the stapes. The remains of the tympanic membrane with its perforation are not seen in this drawing as it shows a small area under high magnification.

Table VI shows the incidence of otitis media after myringoplasty. Four cases of otitis media occurred months or years after operation. They were all treated by penicillin and in only one case was the graft destroyed.

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TABLE VI.

OTITIS MEDIA AFTER 87 MYRINGOPLASTY OPERATIONS.

Immediate post operative period	1 case
Late otitis media (in 1 case graft was destroyed)	4 cases

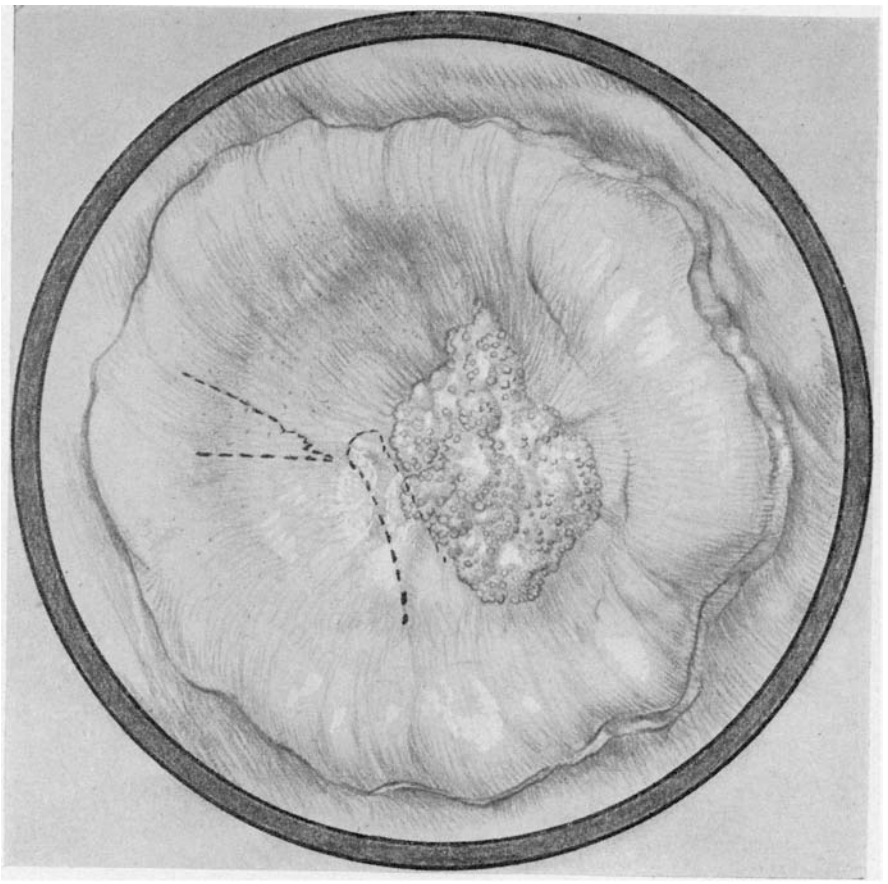


FIG. 5.

The skin graft is now being applied to close the defect of the tympanic membrane and also to lie in contact with the remains of the long process of the incus and the head of the stapes. This technique preserves the lever action of the ossicular chain and gives better hearing than would be obtained by attaching the graft to the head of the stapes only, as has been advocated when this lesion is found at a myringoplasty operation.

Table VII shows the type of perforations dealt with in this series and as would be expected the majority were the result of otitis media. There were three traumatic perforations of the ear-drum one from an explosion of a domestic boiler during a freeze up, one from a blast of compressed air in a factory and one from a perforating foreign body.

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TABLE VII.

Types of Perforation and Ætiology.

Subtotal and total drum perforations	22
Large central perforations	56
Small central perforations. ..	9

3 Traumatic perforations. Remainder from otitis media.

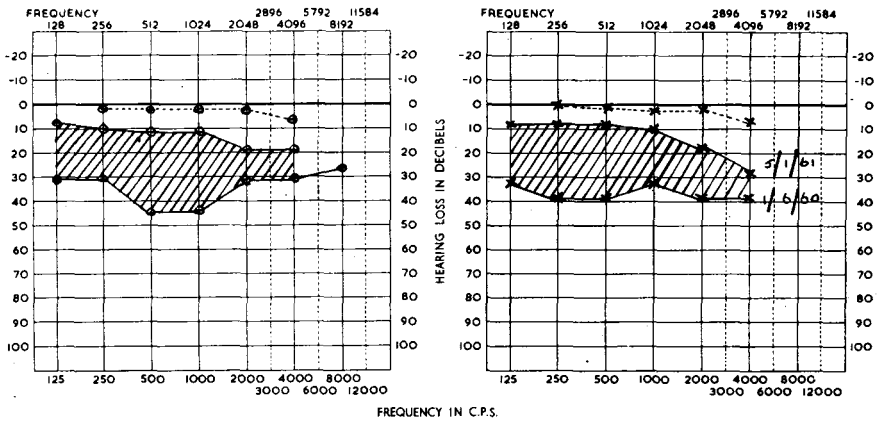


Fig. 6.

Hearing Gain After Bilateral Myringoplasty.

In this patient the ossicular chain was interrupted as part of the long process of the incus was missing. An extended myringoplasty was performed and the graft was placed in contact with the remainder of the long process of the incus and the head of the stapes. A better functional result is achieved with this method as the lever action of the chain is still retained.

TABLE VIII.

Sex and Age Distribution of 87 Myringoplasty Operations.

Male	40	
Female	47	
Age	5 — 10 years	23 cases
	10 — 20 years	33 cases
	20 — 30 years	10 cases
	30 — 40 years	10 cases
	40 — 50 years	6 cases
	over 50 years	5 cases

Note: Perforations of Graft Appeared in 4 out of 5 patients over the age of 50 yrs.

Table VIII shows that with the present technique the graft does not survive well in patients over the age of 50 years. There might thus be grounds for trying other types of graft in older patients.

In conclusion, my results lead me to believe that myringoplasty is a worthwhile procedure provided that patients are selected most carefully and provided that an operation is performed which combines sound principles both of the plastic surgeon and the otologist.

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An examination of my results will show that failures would have been less frequent if more careful selection of cases had been achieved.

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