Section of Otology

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The Surgery of Otosclerosis

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IN December 1946 I gave a Review of the Surgery of Otosclerosis (*Proc. R. Soc. Med.*, **40**, 320) and I should now like to submit some personal impressions and experiences of this fascinating and expanding branch of Aural Surgery.

What I have to say will be based on personal experience in over 400 operations for otosclerosis and some 250 operations on the labyrinth for other non-suppurative conditions.

The operation in general use and which I employ is based on Lempert's nov-ovalis approach, and consists in making a window in the anterior part of the bony external semicircular canal and adjacent ampulla. This opening is covered by a flap derived from the skin covering the anterior wall, roof and posterior wall of the bony external meatus, continuity with the intact tympanic membrane being preserved.

Its proper performance makes considerable demands on the surgeon and calls for practice, patience and self-control. The surgeon must ensure that he is provided with good illumination and adequate magnification, particularly for the most important part of the operation, namely the making of the fenestra. This must be made on top of a mound, so that when the tympano-meatal flap is placed over the fenestra it will invest it closely and seal it off like a rubber patch sealing off a puncture in a pneumatic tyre. Great care must be taken to avoid injury to the membranous labyrinth, or anything that may encourage the formation of excessive fibrous tissue or bone formation over or within the fenestra. Hæmostasis, a fenestra with clean margins, a perilymph space free of blood and of bone debris, an intact membranous canal and ampulla, and a thin intact tympano-meatal flap from which all flakes of bone have been removed, are essential for success. Lempert and his former pupil, Shambaugh, have furthered the progress of the operation by drawing attention to these and other factors. From my own experience I would like to emphasize the value of adequate magnification whilst making the fenestra. A binocular dissecting microscope, which is freely manœuvrable and which has a brightly illuminated field is, I believe, the surest way of achieving a clean fenestra, a clean flap, an undamaged membranous labyrinth and a perilymph space free from bone debris and blood.

Only when this stage of the operation is properly performed can a good and lasting improvement in hearing be expected. The following photographs (Figs. 1, 2 and 3) show the fenestra as it appears at operation under a continuous flow of saline. They are enlargements from the 16 mm. colour cinefilm taken by Mr. E. Gwynne Evans and Mr. Edward Mackie which will be shown at the end of the paper.

Therefore, the closest attention and much practice have to be devoted to the making of the fenestra, and the wise surgeon will ensure that he is not tired out by the preceding steps of the operation, cramped for space by inadequate exposure, handicapped by poor illumination, nor, finally, embarrassed by lack of experience in working in a magnified field.

Other aspects of the operation have been fully dealt with elsewhere, and, provided that the exposure is adequate, both at the time of operation and for the post-operative inspection and treatment of the cavity, and that important neighbouring structures are not imperilled, the details of the soft tissue and bony approach can be left to the individual surgeon. My own preference is for the endaural approach, though, as I have seen when visiting Mr. Simson Hall in Edinburgh, the post-aural approach gives an excellent view. I have still, however, to be convinced of the value of the antauricular approach advocated by Popper.

The bony cortex of the mastoid can be reduced to bone dust by a dental drill or removed by sharp gouges. The drill has the advantage of being more bloodless and, in practised hands, can be very accurate and safe. On the other hand, the reduction of the mastoid cortex to fine bone dust by a drill is a messy, laborious and time-consuming procedure. Having tried

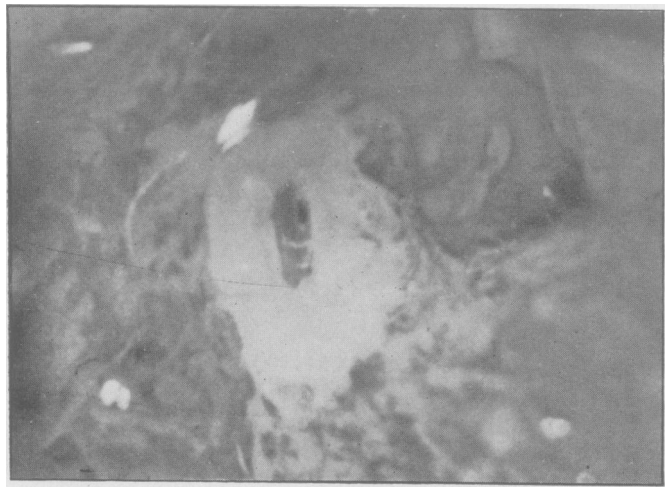


FIG. 1.—Magnified view (× 6) of a newly created fenestra. The top of the fenestra has been cut off and turned over, where it can be seen to the left of the fenestra. The membranous canal with some shreds of endosteal debris and bone will have to be cleared away.

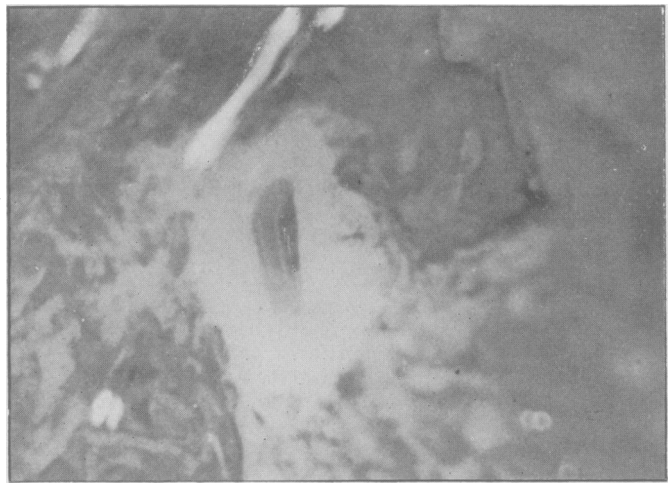


FIG. 2.—The same fenestra as in Fig. 1, after all the shreds of bone have been cleared away.

FIG. 3.—The completed fenestra. The membranous labyrinth can be clearly seen and in the upper part of the fenestra the membranous canal can be seen bending into the ampulla (× 10).

both, I prefer a little blood at this stage to a lot of bone dust, though of course both can be, and are, satisfactorily removed by flushing the cavity with warm saline. In this connexion I should like to emphasize the value of irrigation of the operative field with saline at 100° F. In the earlier stages intermittent irrigation is sufficient, but for making the fenestra continuous irrigation as suggested by Shambaugh is most helpful. It is, however, of some importance to ensure that the irrigating fluid is constantly at 100° F.; for the exposure of the unprotected vestibular labyrinth to gross thermal changes is obviously undesirable, and may augment the post-operative vestibular disturbance.

After removing the head of the malleus, I always cut the tendon of the tensor tympani where it is inserted into the neck of the malleus. By doing this I believe the chance of troublesome clicking or vertigo on contraction of the tensor tympani after the operation is reduced.

Sufficient bone must be removed to allow full freedom of movement under magnification in the region of the fenestra. Aubry, van Eyck, Dohlman, Popper and, lately, Shambaugh advocate a very limited removal of bone and they try to avoid opening the mastoid or even the antrum. I have not, as yet, any experience of this limited approach, though if it will hasten post-operative healing without increasing the risk of undesirable complications from infection it will be an advantage. Skin grafting the raw areas of the bony cavity at the time of operation helps to shorten the healing time.

For the first few post-operative days, the tympano-meatal flap and cavity need to be subjected to continuous, gentle and non-adherent pressure. This can be achieved by lining the cavity with strips of oiled silk—Lister's Green Protective—and then packing it with small pieces of marine sponge. Shambaugh, from whom I got the idea of using sponge, employs two relatively large pieces soaked in sulphadiazine cream, but I believe that smaller pieces give a more evenly distributed pressure, and I am not as yet convinced that any local antiseptic is of value.

With regard to the post-operative period, some vestibular disturbance is the rule, due not so much to infection, as has been suggested by some observers, but to the altered physical conditions within the labyrinth. This can best be overcome by the head and balancing exercises developed by Cooksey and myself for the management of the disturbance of balance following vestibular injuries. Campbell has recently reported on the value of dramamine in combating the post-operative vestibular disturbance. Most patients are out of bed on the fourth post-operative day, and leave hospital within the fortnight.

Some degree of post-operative infection of the cavity is common, and though continued discharge may be a nuisance it rarely affects the hearing result, and seems to be due to infection of soft tissue rather than bone.

The results are largely governed by the care with which cases are selected and the skill with which the operation is carried out.

Before, however, considering the selection of cases, I should like to deal with operative results.

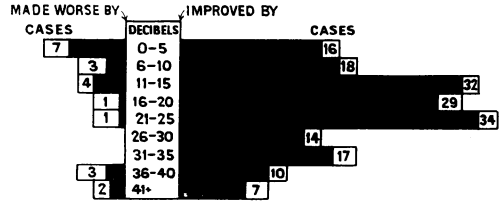
Results.—Now when we come to the recording of results, I must confess that I am somewhat at a loss to know how best this should be done. In fact, I would go farther than this and say that no one person, least of all the reporter himself, is in a position as yet in which he can say what is the fairest—or should I say wisest—way of doing this. It is mainly by watching his results that the surgeon can measure his progress and be stimulated to seek for further improvement. Furthermore, by reference to his own results he can offer the most likely and, therefore, the fairest estimate of the amount of improvement in hearing that fenestration in his hands will offer.

Many standards have been suggested for reporting results and the American Otological Society has a sub-committee to enquire into standards for reporting fenestration results, which has already made provisional suggestions. It would, I think, be a great help to all who are interested in this work, if a committee could be set up in this country as well to advise on the best way of recording the results of the fenestration operation, and I would venture to suggest that this Section would be a very appropriate body to undertake such a task.

With regard to my own results, I would prefer to give the figures in terms of decibel improvement or loss for pure tones within the critical range of speech frequencies (512, 1,024 and 2,048 c.p.s.). I have grouped the cases in 5-decibel steps and have included only those patients who have been followed up for eighteen months or more after operation, and I have chosen this time because so far I have not had any patient whose hearing deteriorated after eighteen months. I think that the ideal way of testing the hearing capacity after operation is by means of recorded speech, and Silverman and Walsh have already published some interesting observations along these lines.

The results now to be considered are those from cases on whom I operated by the technique described, between July 1946 and August 1948. Only those of whom I have no record for at least eighteen months after the operation have been omitted.

TABLE I.—HEARING FOR PURE TONES WITHIN THE CRITICAL RANGE OF SPEECH FREQUENCIES (512, 1,024 AND 2,048 C.P.S.) EIGHTEEN MONTHS OR MORE AFTER FENESTRATION FOR OTOSCLEROSIS IN 198 CASES (INCLUDING 5 REVISIONS).



The selection of suitable condidates for surgery from among those deafened patients who hopefully present themselves is no easy task, nor is it a matter about which hard-and-fast rules can be laid down.

The series under consideration does not include any patient who:

(1) Was not thought to be suffering from otosclerosis.

(2) Did not have an intact and healthy tympanic membrane.

(3) Could not tolerate and understand speech with the help of a high quality amplifier.

Each patient selected for operation has, at the time of the first interview, been put into one of three groups, Suitable, Borderline, and Unsuitable, and the distribution in this series has been as follows:

TABLE II

Suitable	107
Borderline	80
Unsuitable	11

In classifying a case of otosclerosis in terms of suitability for operation it is necessary to assess the patient as a whole; taking into consideration the history, the appearance of the tympanic membranes, the tone of the voice, tuning fork and pure tone audiometer tests, and the ability to understand amplified speech. In the present state of our knowledge, I hesitate to give precedence to any one of the significant features of the clinical picture of otosclerosis that I have just mentioned in selecting cases for operation. Instead I would prefer to give, in summarized form, a typical case from each of the three groups.

TABLE III.—SUITABLE

Mrs. O. D., aged 48. History of progressive deafness ten years. Not affected by birth of only child. Hears better in noisy surroundings. No history of deafness in family.

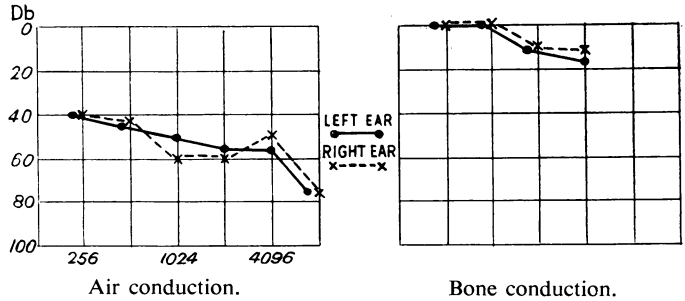
On examination.—Upper respiratory tract healthy. Soft voice of normal timbre.

Tympanic membranes: Intact, normal lustre, mobile on auto-inflation.

Speech (at conversational level): Unamplified, 3 inches; amplified, 12 feet.

Tuning forks (512, 1,024 and 2,048 d.v.): All negative Rinne and normal bone conduction.

Pure tone audiometer: Maico D.9.



Air conduction. Bone conduction.

Conclusions: Otosclerosis with unimpaired cochlear function. Suitable for fenestration. 50% chance hearing speech at 10 feet. (Operation resulted in hearing speech at 20 feet.)

TABLE IV.—BORDERLINE

Mrs. E. D., aged 45. History of slowly progressive deafness 31 years. Not affected by birth of only child. Hears better in noisy surroundings. History of deafness on mother's side of family.

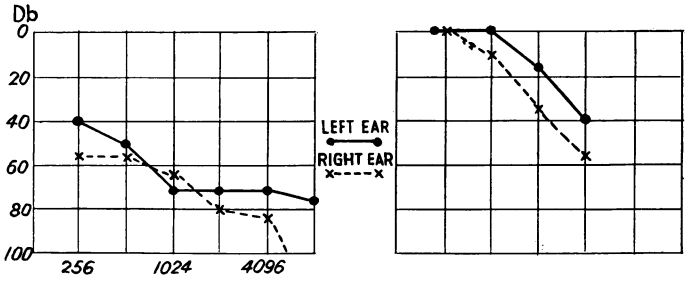
On examination.—Upper respiratory tract healthy. Soft voice of normal timbre.

Tympanic membranes: Intact, normal lustre, mobile on auto-inflation.

Speech (at conversational level): Unamplified, not heard; amplified, 6 feet.

Tuning forks (512, 1,024 and 2,048 d.v.): Negative Rinne 512 and 1,024. Not heard left, and heard by bone only right, 2,048. Reduced bone conduction 1,024 and 2,048.

Pure tone audiometer: Maico D.9.



Air conduction. Bone conduction.

Conclusions: Otosclerosis with slight impairment of cochlear function. Borderline for fenestration. 30% chance hearing speech at 3 feet. (Operation resulted in hearing speech at 8 feet.)

TABLE V.—UNSUITABLE

Mr. F. C. H., aged 43. Progressive deafness sixteen years. Hears better in noisy surroundings. Brother also deaf.

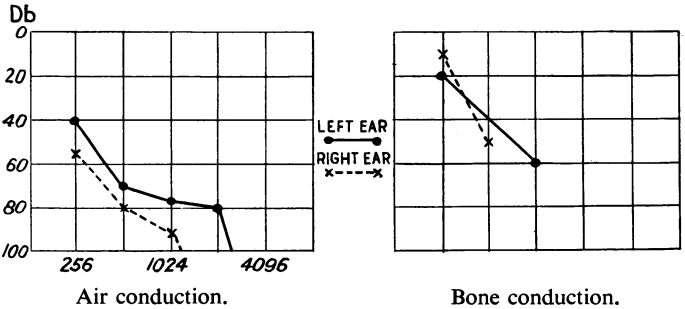
On examination.—Upper respiratory tract healthy. Slight alteration in timbre of voice.

Tympanic membranes: Intact, normal lustre, mobile on auto-inflation.

Speech (at conversational level): Unamplified, not heard; amplified, 4 feet.

Tuning forks (512, 1,024 and 2,048 d.v.): Negative Rinne 512 and 1,024 right. Air equals bone 512 and 1,024 left. Positive Rinne 2,048 left, not heard right. Reduced bone conduction 512, 1,024 left and right, and 2,048 left.

Pure tone audiometer: Maico D.9.



Air conduction. Bone conduction.

Conclusions: Otosclerosis with considerable impairment of cochlear function. Unsuitable for fenestration. 20% chance hearing conversation at 1 foot. (Operation resulted in hearing remaining unchanged.)

The following tables show the results in each of the three groups:

TABLE VI.—HEARING FOR PURE TONES WITHIN THE CRITICAL RANGE OF SPEECH FREQUENCIES (512, 1,024 AND 2,048 C.P.S.) EIGHTEEN MONTHS OR MORE AFTER FENESTRATION FOR OTOSCLEROSIS IN 107 CASES CLASSIFIED AS SUITABLE.

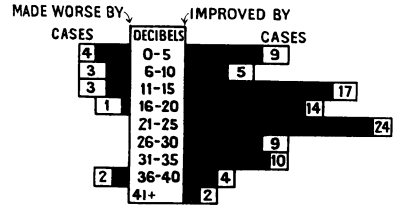


TABLE VII.—HEARING FOR PURE TONES WITHIN THE CRITICAL RANGE OF SPEECH FREQUENCIES (512, 1,024 AND 2,048 C.P.S.) EIGHTEEN MONTHS OR MORE AFTER FENESTRATION FOR OTOSCLEROSIS IN 80 CASES CLASSIFIED AS BORDERLINE.

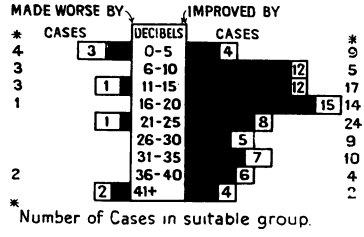
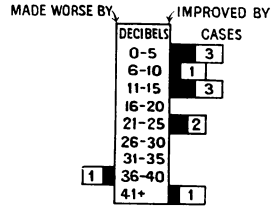


TABLE VIII.—HEARING FOR PURE TONES WITHIN THE CRITICAL RANGE OF SPEECH FREQUENCIES (512, 1,024 AND 2,048 C.P.S.) EIGHTEEN MONTHS OR MORE AFTER FENESTRATION FOR OTOSCLEROSIS IN 11 CASES CLASSIFIED AS UNSUITABLE.



It will be seen from the foregoing tables that the classification of cases is an uncertain business. Some classified as unsuitable do well, whilst others thought to be suitable do badly. In estimating to the patient at the time of the first consultation the chances of success, I have in the past offered suitable cases a 50% chance, borderline a 30% chance, and some unsuitable cases a 20% chance of long-term improvement in hearing. The extent to which the hearing is likely to be improved by operation is of course governed by the original hearing loss. I estimate this on the basis of a possible improvement of 25 decibels for the critical speech frequencies and translate this into terms of everyday hearing.

Indications.—Now I believe that in its present form the fenestration operation is most likely to be successful when the otosclerotic bone is limited to the region of the oval window, and *per contra*, that extensive spread of otosclerotic bone, either over the surface or into the cavities of the bony labyrinth, renders a case unsuitable. Therefore any clinical indication of such extensive growth should be carefully sought for, and, if present, taken into consideration in assessing suitability for operation.

In my previous review of the surgery of otosclerosis I mentioned four signs of poor prognostic significance, and I should now like to add a fifth.

TABLE IX.—SIGNS OF POOR PROGNOSTIC SIGNIFICANCE

(1) Alteration in the *timbre* of the voice.
(2) Intolerance of *amplification.*
(3) Disappearance of *paracusis.*
(4) Reduction of *bone conduction.*
(5) Pink-tinged *tympanic membrane.*

I would suggest that in the first three groups the organ of hearing is definitely at fault. In Group 4, the organ of hearing may be responsible, but I believe that loss of bone conduction can also be caused by widespread otosclerotic bone, particularly if it seals up both labyrinthine windows. In the last group, the tympanic membrane is seen to have a pink tinge due, it is believed, to transmitted colour from the mucosa covering the promontory —the so-called Schwartze sign. This is often associated with other unfavourable signs, particularly loss of bone conduction, and is generally regarded as an unfavourable sign.

TABLE X.—HEARING FOR PURE TONES WITHIN THE CRITICAL RANGE OF SPEECH FREQUENCIES (512, 1,024 AND 2,048 C.P.S.) EIGHTEEN MONTHS OR MORE AFTER FENESTRATION FOR OTOSCLEROSIS IN 20 CASES WITH PINK-TINGED TYMPANIC MEMBRANES.

MADE WORSE BY CASES	DECIBELS	IMPROVED BY CASES
	0-5	4
1	6-10	2
2	11-15	2
1	16-20	2
	21-25	1
	26-30	
	31-35	1
1	36-40	1
2	41+	

In the present series, 20 cases were noted as having pink-tinged tympanic membranes, and only 7 of these sustained an improvement of more than 10 decibels for the critical speech frequencies, despite the fact that 12 had been assessed before operation as suitable cases. On the other hand, 7 were made worse. Until I was reviewing the present series of cases I did not fully appreciate the grave prognostic significance of pink-tinged tympanic membranes. I have found that such cases have been the cause of much disappointment, and in future I shall put all such cases in the "borderline" or "unsuitable" category; though by doing so I do want to emphasize that they should not be denied operation provided that they appreciate that the chance of success is slender.

The cause of failure in some instances is only too obviously—and I refer to my own cases—faulty technique, in others faulty selection, and there are some in which the cause of failure is not obvious; but it is only by doing a certain proportion of apparently unsuitable cases that we can advance this work. In 3 out of the 11 apparently unsuitable cases that I operated upon, there was an improvement in hearing of more than 20 decibels for the critical speech frequencies. Therefore although the prospect of improvement is not necessarily bright in cases classified as unsuitable, I do not think that they should be denied operation if there is evidence of effective cochlear function.

Before concluding, I should like to offer a few observations on two other forms of surgical treatment that I have tried.

Removal of stapes.—I have removed the stapes in 23 cases of otosclerosis, all but 4 of which would be classified as "unsuitable". One of the "suitable" cases has retained his improvement for nearly four years. If we can solve the problem of sealing off the oval window and of retaining the tympanic membrane intact and of normal tension, I believe that this might prove to be a most effective and lasting form of treatment, because, after all, it is the natural window; and once the stapes has gone, is unlikely to become sealed over by bone again, as anyone will realize who has seen the oval window under the dissecting microscope.

In another small group, all considered unsuitable, I have performed a fenestration operation and in addition removed the stapes. In all the 4 cases so treated, I believed that the round as well as the oval window was impeded by otosclerotic bone. In none, however, was there any improvement in hearing; but I still hope that in such cases, provided that there is sufficient cochlear function to appreciate and tolerate amplification, some form of operative treatment may be found to be of help, and I intend to continue to search for it.

Sequelæ.—There are two final aspects of this problem that are of considerable physiological interest and which may help us further to appreciate the mechanics of hearing.

I have not, as yet, seen a case of otosclerosis submitted to the fenestration operation in which exposure to loud sounds resulted in a vestibular stimulus. Readers will recall the Tullio phenomenon in which a window made in the lateral canal renders the animal—pigeons, in the cases Tullio described—liable to a vestibular stimulus on exposure to a loud sound.

I had a patient, suffering from Ménière's disease, on whom in 1938 I made an opening into the bony lateral semicircular canal, without disturbing the membranous labyrinth. This patient, after leaving hospital, complained that exposure to any loud sound caused giddiness, and investigation revealed that exposure to a pure tone of 80 d.b. within the range 250–4,000 c.p.s. caused a movement of the eyes and deviation of the head and body. This was relieved by a second operation, in which the membranous external semicircular canal was removed and, as a result, cochlear function destroyed.

Now why is it that Tullio's phenomenon is not seen after the fenestration operation for otosclerosis? For I have not as yet seen it, nor have I knowledge of any record of it. I think that the reason may well be that the Tullio phenomenon is dependent upon unimpeded round and oval windows. I have seen 3 patients suffering from severe and intractable vertigo following a fenestration operation. In each case there was reason to suspect that the foot-plate of the stapes was not impeded by otosclerotic bone. In each case also the hearing had been made worse by the operation and it seemed advisable to consider destroying the remaining but clearly disordered vestibular function. Up to the present I have not seen such a sequel in otosclerosis, though as Shambaugh points out it can occur. I do feel that an artificial opening in the bony vestibular labyrinth is particularly liable to cause troublesome vertigo if the natural openings are unimpeded. For this reason I would hesitate to advise the fenestration operation where there was any reason to suppose that the stapes was mobile.

The other feature that is of particular interest to me is that limited damage to the membranous canal does not, in cases of otosclerosis, necessarily result in a complete loss of hearing. In every case of Ménière's disease in which I have removed all or even part of the membranous semicircular canal, total and irreversible deafness has resulted. I have, however, accidentally torn the membranous external semicircular canal across in 4 of the cases in the present series. In none was the hearing improved; whilst in 3 it was not altered by more than 10 d.b. either way, in the fourth it was made much worse, but was not abolished. In each case the membranous canal was torn across at the posterior end, well away from the ampulla. I hope in due course to report the result of deliberately carrying out a similar procedure in cases of Ménière's disease.

I have some patients whose ear continues to discharge, though this does not necessarily modify a good result; whilst others have a varying degree of narrowing of the meatus.

As yet I have not found it necessary to re-operate on a patient for either of these complications.

In 2 cases there was a facial paresis that cleared up within two weeks. In 31 cases the initial improvement was not maintained, due, I believe, in most instances to a partial or complete closure of the fenestra. On the other hand, 20 cases continued to improve three or more months after the operation, and one only started to improve seventeen months after operation. Finally in one case the hearing in the operated ear was lost entirely. Because of the possibility of making the hearing in the operated ear worse, I make it a rule to operate always on the worse hearing ear first. If this is successful, the other ear can, if desired, be operated on at a later date—not less than a year after the first operation.

With regard to revision operations, I must confess to being disappointed in the results. In the five that I have done in the series under review, I found bone extending into and, as a rule, surrounding the membranous canal. In three of these, the membranous canal was torn in endeavouring to free it from the surrounding bone. In none was there any permanent improvement in hearing as a result of the revision operation. I think that the next time I undertake a revision I shall be prepared if I find the membranous labyrinth entangled in new bone to make a fresh opening in the bony labyrinth, possibly in the posterior canal.

I should like to take this opportunity of saying how much I appreciate the generous help of my friends here and elsewhere for their kindness in entrusting their patients to my care. There is still much more work to be done and many problems to be solved. Above all we should not regard otosclerosis as a purely surgical problem and we should not lose sight of the fact, nor should we let our patients lose sight of the fact, that a good wearable valve-amplified hearing aid rarely fails to improve the hearing in cases of otosclerosis, and that surgery is only part of the management of the patient suffering from this form of deafness.

Finally, I should like to recall the names of those who have made this work possible, and in particular I would mention Jenkins, Holmgren, Sourdille, Lempert and Shambaugh, and to say of them as did Shakespeare in "The Tempest": "Your tale, Sir, would cure deafness."

Mr. E. R. Garnett Passe: *Technique.*—Three major controversies have arisen in the technique of the fenestration operation, namely:

(1) Should we exenterate the mastoid process, or should we be content with as small an approach in the form of an atticotomy as possible, either by the end- or the pre-aural approach? Having used both extensively I am whole-heartedly in favour of the mastoid being exenterated for the following reasons. It is possible to make my long fenestra with a protecting "hood", and to construct and position the flap more carefully, and to facilitate the subsequent dressings with less risk of post-operative infection or excessive granulation tissue formation.

(2) The second question is in the use of the lead burr. Personally I am awaiting the published reports on cases of two years' duration from those using this technique. In the few cases I have used it, sufficient time has not yet elapsed to judge of its value. I feel that the presence of any *noxious foreign body* must *increase* the tendency to excessive fibrous tissue formation from the under-surface of the flap, which, when it occurs, undoubtedly decreases the hearing.

(3) Thirdly, it has been suggested recently by Holmgren that it is not necessary to open the endosteum. Even under a magnification of 10, I find it almost impossible to clean the endosteum of all bone dust and chips without opening into the perilymphatic space. If I can preserve the endosteum I like to turn it down over the lower edge of the fenestration as suggested by Sullivan.

As one of the causes of failure in the restoration of hearing is obstruction of the round window with blood clot, I make a routine practice of thoroughly examining the foramen before proceeding to construct the fenestra. In order to keep the foramen clean during the construction of the fenestra I place in it a small piece of lintene attached to a thread. At the completion of the fenestra the pack is removed.

Healing of the cavity.—It soon became evident to me that the rate of healing was in direct ratio to the dryness of the cavity. Of great help in this respect are frequent dressings and the use of calgitex [1] which I introduced with Blaine in 1948. Skin grafting of the cavity enjoys a certain popularity, but I think that the risk of introducing infection in this way is unjustified. I find my large meatal graft and careful post-operative dressings quite adequate.

The employment of the recruitment test in borderline cases is a great help. I cannot agree with Mr. Cawthorne's observation *re* the inadvisability of operating on cases which show a pinkish tinge of the drum head—surely this may only mean that the membrana tympani is, perhaps, unusually thin.

Results.—Sufficient time has now passed since the fenestration operation was first performed in this country for us to begin to form our own opinion of its value without having to rely entirely upon the results obtained by otologists of other countries. However, there is still a dearth of published records by those of us who are making a specialty of the operation. On reviewing my results which I published last year [2], I find that there has been only slight material change in the percentage of overall improvement. Of my second series performed between three and four years ago the percentage of cases remaining at the practical level is still about 40%. These were all cases of cartilage stopple insertions. During the next three years 611 cases were operated on and from those cases whose audiometric records are available, comprising all groups, the following results were obtained:

Three-year-old cases—Just over 70% showed a maintained hearing improvement of over 11 decibels.

Two-year-old cases—73% showed a maintained hearing improvement of over 11 decibels.

A maintained hearing improvement of 11 decibels or more does not necessarily mean that the patient's hearing was maintained at the 30 decibel level. To my mind there can be no more difficult assessment of an operation result, for what improvement satisfies one patient does not necessarily satisfy another.

The fact that over 40 successful cases have had the operation performed on the other ear at their own request speaks volumes for its value.

REFERENCES

1 PASSE, E. R. G., and BLAINE, G. (1948) *Lancet* (ii), 651.
2 —— (1949) *J. Laryng. Otol.*, **63**, 495.

Mr. J. P. Monkhouse spoke of the difficulty of predicting results and said that he had obtained very marked improvement in some of the most advanced cases. These were often older people and the improvement seemed to last better than in some which might have been thought to be more favourable.

The assessment of results or of the value of a change of technique was necessarily a lengthy process and otologists should pool their knowledge and experience, but before they could do this, they must speak a common language. He felt that this meant the use of speech audiometry, since pure tone audiometry could err, sometimes suggesting a better and sometimes a worse hearing for words than was actually the case. However, as they had just heard, there were pitfalls in speech audiometry and a standard and reliable technique would have to be evolved.

The results at the Middlesex Hospital had been assessed on pure tone audiometry and the patient's own opinion had been entirely ignored.

Cases had been graded into "Very good"—over 35 decibels improvement; "Good"—25–35 decibels; "Moderate"—15–25 decibels; "Slight improvement"—5–15 decibels. Anything up to 5 decibels was considered as showing no change. The marking had been strict.

In the earliest series of 19 cases, in which a stopple was used, there had been an immediate improvement of some degree in 74% but now, after three years, only 16% retained any gain.

A series of 28 cases, without stopple but with a long fenestra and all two or more years since operation, showed an immediate improvement of 87%, falling after two years to 52%. The detailed figures were of interest: "Very good" 43% falling to 6%; "Good" 32% falling to 18%; "Moderate" 11% falling to 3%; "Slight improvement" 3% rising to 25%; "No change" 0% rising to 18%; and "Worse" 11% rising to 30%.

The following 14 cases operated upon more than eighteen months but less than two years ago showed approximately the same percentage (85%) of immediate improvement and to date 72% were still improved. Failure after a primary success seemed to occur around six months or at about eighteen months after operation, and since these cases had all passed the eighteen-month mark, he had hopes that they might show a better result than had the earlier series.

Mr. C. A. Hutchinson asked Mr. Cawthorne whether he had noticed any improvement in the hearing of the other ear after fenestration. The speaker noticed that using exactly the same audiometer at intervals of six months, a year and two years post-operatively, in a good case there appeared to be some improvement in the other ear.

He agreed as to a pink tympanic membrane being an index to a poor chance. Cases showing the "flamingo-pink" tinge did not do well with fenestration. He was interested to note that both Mr. Cawthorne and Mr. Garnett Passe referred to the need for an unobstructed foramen rotundum for a good result. When there was a poor result after what appeared to be a perfect technical procedure there might be some further improvement if a second fenestration was done through the promontory and covered with a flap of mucous membrane. He was experimenting along that line at present.

He did not use the same approach as Mr. Cawthorne. He agreed with Mr. Simson Hall and used the postero-superior approach, but whichever approach was used the technique inside was almost identical. Whether it was done pre-meatally or post-meatally one was faced with the bugbear of bleeding. One could cope with it up to a point by preliminary injection of the field with adrenaline saline. It was a great help, he found, to make use of continuous-flow saline adrenaline and small "postage stamps" of gelatin sponge; there were three sizes 1, 2 and 3; 3 was the most useful. One or more could be applied dry over an oozing area, left in place for twenty seconds when all the bleeding stops.

He would like to congratulate Mr. Cawthorne on his paper and admirable film.

Mr. A. Brownlie Smith said that he would have liked Mr. Cawthorne to have given some figures of the result of the operation according to the different age-groups. Otosclerosis was usually a more acute disease in the young and from his own cases he had found that the best and most permanent results were those obtained in older people where the disease had slowed down or stopped and where the bone regeneration was not so efficient as in younger people. He had found it difficult to decide whether to operate on young otosclerotics or not. He had a young girl of 16 under his care at present and he felt she might obtain a marked improvement in the hearing from the operation but, afterwards, be just as bad, if not worse, than before.

Dr. G. I. Henderson (*Dundee*) said that he had found that bleeding during operation had been considerably reduced by the type of anæsthesia used. The desired conditions had been obtained mainly by the intravenous injection of omnopon at the time the intratracheal tube was passed while light trilene was administered.

Mr. W. G. Scott-Brown advocated the use of a plastic or tantalum stopple and it was for that reason that he had sent all his cases to Air Commodore E. D. D. Dickson for the last six months for testing before and after operation. He had a small series of cases to record: in 1946 he operated on 20 cases and of these 4 had over 25 decibel improvement; 8 had over 15 decibels, and 5 had under 15 decibels; 3 remained the same or were worse. In 1947 there was a series of 21 cases; 7 obtained over 25 decibel improvement, 6 over 15 decibel improvement, and 5 under 15 decibel improvement—which did not give any very useful improvement. 3 were the same or made worse. The advantage of the stopple was that the operation was simplified and a fewer number of cases required reopening. He had only had to reopen 3 of the cases reported.

There was one interesting feature since he had used stopples with a larger hole through them. In cases with good hearing result there was practically no giddiness on touching the stopple. He asked Mr. Cawthorne for an explanation and he suggested that the displaced perilymph could "escape" up the canal through the stopple and so minimize the flow of perilymph along the canal.

Mr. R. Scott Stevenson said that no one had a greater admiration than himself for Mr. Cawthorne and his work, but he felt he had to ask one or two questions with regard to his paper. The first was about the criterion for operation. Looking at the audiograms that had been shown, he would say that the last 2 patients were cases of nerve deafness and to such patients he would say, "Go and get a hearing-aid and learn lip-reading". Hearing-aids and lip-reading were very helpful to such people, and it was wrong to persuade them to have a fenestration operation when the case was admitted to be so unfavourable. Otologists looked to Mr. Cawthorne for guidance on when to operate and in this paper they did not get it. He recognized Mr. Cawthorne's honesty of purpose, but if he operated on such patients, what were other people going to do? Mr. Cawthorne had started off by saying that the disease of otosclerosis was no longer obscure, but that was not really true. It was probably even more obscure to-day than it seemed to be before, and one did not know any more about the cause of otosclerosis to-day than was known one hundred years ago. Otologists must not be lured away by beautiful technique; it was always something to be suspicious of rather than to admire.

Mr. R. G. Macbeth said that Mr. Cawthorne had referred to his lack of experience of the Popper approach to this operation. In a series of about 100 cases the speaker had done 15 by the Popper approach. It looked very good in the pictures, it was very good in the post-mortem room, but when it was tried on the living it was a needlessly difficult operation to perform. Not only did the surgeon find himself mixed up with a plexus of veins in relation with the parotid fascia, but the access to the dome of the vestibule was restricted and he might have to become ambidextrous with the dental drill. The chance of post-operative scarring and stenosis was very much more marked than by the more traditional routes, and the chance of sepsis from the meatus seemed greater. It might be thought a little unfair to condemn the approach on a basis of 15 cases, but when the speaker reverted to the Lempert type of approach, he had been struck immediately by the fact that this was a much easier operation. The chorda tympani nerve was seen more readily by the Popper approach, but this seemed its only advantage.

Mr. F. McGuckin thought there might be some scientific interest in the audiometric recording of minor post-operative changes; but it would be well to realize frankly that improvements of the order of 5 or 10 decibels, perhaps even of 15 decibels, represented clinical failure from the viewpoint of the patient.

Mr. T. Cawthorne, in reply to the discussion, said he was interested in Mr. Garnett Passe's remarks and particularly in what he said about the round window. He had used the lead burr in a number of cases, but seeing, under the microscope, fragments of lead dropping into the perilymphatic space made him uneasy, so he had given it up.

Mr. Monkhouse and Mr. Brownlie Smith both brought out the point with which he entirely agreed, namely, that older cases did better. He was sure cases did better from the late thirties and forties onwards. He had had 4 cases which had been submitted to operation over the age of 60 and they had all done well. Unfortunately one must operate on some of the young people who have a rapidly progressing form of deafness but the results were sometimes disappointing. He had not analysed the results for different age-groups in this series.

Mr. Hutchinson asked about the question of improvement of hearing in the unoperated ear. He was particularly interested to hear that this was noticed in those patients whose hearing was much improved by operation. He thought it probable that when the ear not being tested was adequately masked, any apparent improvement would disappear.

With regard to what Mr. Scott Stevenson had said he hoped that he had not given the impression that he operated on every case he saw. He had agreed to operation in about 600 cases out of 1,100 cases of otosclerosis which he had seen during the past four years. Most of those classed as unsuitable decided against operation after they had realized the prospects of improvement. He assured the Section that the deafness in every case in the present series was, in his opinion, due primarily to otosclerosis.

It was quite true to say that otosclerosis was no longer an obscure disease. As was the case in many other diseases the cause was still not known, but the pathology was fully described. Moreover, the diagnosis of otosclerosis, except where it might be complicated by other otological disease, was not obscure, thanks to the constant clinical picture.

Owing to exigencies of space in the *Proceedings* the Honorary Editors are compelled to forgo publication of the following:

[*February* 3, 1950]

Speech Audiometry in the Assessment of Deafness. By Air Commodore E. D. D. DICKSON and F/Lt. D. L. CHADWICK.

[*March* 3, 1950]

DISCUSSION on **"Otitis Externa".**

Clinical and Pathological Observations on a Case of Leukæmia with Deafness and Vertigo. By Dr. C. S. HALLPIKE and Mr. M. SPENCER HARRISON.

[*May* 5, 1950]

DISCUSSION on **"Attic Suppuration".**

The Editor of the *Journal of Laryngology and Otology* has kindly agreed to publish all these contributions, with illustrations.