THE ROSEN OPERATION—EARLY EXPERIENCE

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THIS paper is simply a report on the first twelve months' work on Rosen's operation by two surgeons working independently. It does no more than comment on the excellent papers already written by Rosen and others, but there are suggestions of slight differences both in the choice of case and in technique.

Our first impression is that the Rosen technique opens up a field of surgery for the treatment of middle-ear deafness which is quite new to otologists. Secondly, we believe that as a treatment for otosclerosis it has certain advantages over the fenestration operation, although it may be displaced in its turn by other methods. Lastly, it must be remembered that Rosen originally developed his technique as a means of inspecting the middle ear—in fact it is the first really practical way of doing this—and that it is useful in other middle-ear conditions besides otosclerosis.

Indications for the Operation

We do not propose to present an exhaustive list of indications, but simply to give our views in the light of our relatively short experience of the type of case on whom we have performed the operation, or propose to perform it in future. Examples will be given of actual cases as we have met them.

1. OTOSCLEROSIS

This condition is, of course, the main indication and we fully agree with the views of Rosen, Scheer, Simson Hall and others that more patients may be regarded as suitable for stapes mobilization than are suitable for fenestration.

(*a*) *The case suitable for fenestration*

Every case that is suitable for fenestration is suitable for stapes mobilization. The indications for fenestration were discussed by one of us in an earlier paper. (McKenzie, 1952). In this connection it must be remembered that of those cases seen in out-patients with otosclerosis, only about one in ten is suitable for fenestration. We are of the opinion that a Rosen operation should be done first in every case, unless there are strong reasons for preferring a fenestration.

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(*b*) *The case with slight deafness*

Where the degree of deafness is less than 30 db and constitutes only a relatively small handicap, few surgeons would recommend a fenestration. To explore the middle ear by the Rosen technique, however, constitutes such a minor intervention from the patient's point of view that we do not hesitate to recommend it. In fact, we think that this is the best type of case and most likely to lead to a successful result.

(*c*) *Unilateral Otosclerosis*

These cases are not common, and careful investigation is required in order to establish that the deafness is confined to the middle ear. We both have examples of unilateral otosclerosis where stapes mobilization has been successful.

(*d*) *The case with deafness which is too severe for fenestration*

It is in this type of case that the Rosen operation holds out the greatest hope. Provided the bone conduction loss is not severe, an air conduction loss for the speech frequencies of 80 to 90 db is no bar to an attempt to improve the hearing by mobilization of the stapes. In this connection we have also found, like Rosen, that the degree of deafness seems to bear no relation to the degree of fixation found at operation. Only slight improvement in hearing may result, but if it is permanent it may be of great value to the patient because it makes him use his hearing aid better.

(*e*) *Failed fenestration*

Where fenestration of one ear has been unsuccessful, there are two possibilities: mobilization of the stapes can be undertaken in the fenestrated ear, or it can be done to the other untouched ear. The first will depend, of course, on an undamaged internal ear, and the possible improvement in hearing is limited by the interrupted ossicular chain. One might try to obtain a columellar effect by making the drum touch the head of the stapes. One of us has attempted this, but so far without success. The other found on opening the middle ear that the crura had been fractured during fenestration and did nothing further. However, it was easier to raise a skin flap and to enter the posterior area of the middle ear than to lift the meatal skin during the usual Rosen operation.

(*f*) *Successful fenestration on one ear*

There is always a slight reluctance to advise a second fenestration, where the first has been a success. There need, however, be no hesitation in suggesting a mobilization on the other side. Both ears may show the same gain after operation, though the method of improvement is different.

(*g*) *The borderline case*

By this is meant the type of case where the bone-air interval is so small that fenestration would not be worth trying. A stapes mobilization may

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be successful in bridging a gap of 15 to 20 db, and this small improvement may be a great help.

(*h*) *Age*

By this we mean patients under 16 and over 55.

Nowadays few surgeons would advise fenestration over the age of 55. In the young the otosclerosis may be so active that the fenestra closes by bony growth. The middle aged and elderly are regarded as unsuitable for a variety of reasons, the most important of which is that a large proportion of them never fully regain their balance after fenestration. The same objections do not apply in stapes mobilization. In young people, even if the otosclerotic process is still active enough to lead to refixation of the footplate it is possible to repeat the operation or to fenestrate when the time is suitable.

Troublesome vertigo has been very rare in any of our cases and only once has it lasted more than a day.

We therefore consider that operation can be undertaken in patients who are unsuitable for fenestration because of their age.

(*i*) *The presence of other diseases*

These will have to be considered in each case. It is evident that many neurological, cardiovascular, pulmonary and other progressive conditions would generally constitute a contra-indication to fenestration. The same objections do not necessarily hold for stapes mobilization (especially if performed under local anæsthesia). One of our cases is a lady of over 50 who has disseminated sclerosis, and we think that the improvement in hearing has greatly helped her morale. Also included in our series are three patients with advanced otosclerosis, referred by psychiatrists, who considered that restoration of hearing would assist recovery from their mental illness.

(*j*) *The patient who is reluctant to submit to fenestration*

As we have already stated that we prefer to do a Rosen operation in every case otherwise suitable for fenestration, this is no problem. We all know patients who would on no account submit to the fenestration operation. To them we can explain that the Rosen operation is a minor procedure, and little more than a simple examination of the middle ear. When considered in this way many patients can be included who would be unsuitable for anything more elaborate.

(*k*) *Little or no hearing gain after stapes mobilization*

Professor Torsten Skoog suggested to one of us that the ear might be explored again after an interval and the stapes mobilized once more. Other workers, including Rosen himself, have expressed the same view and have acted upon it. One of us has re-mobilized two cases, one with

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success. The only objection to this is that adhesions sometimes form in the middle ear after the Rosen operation.

2. Middle-ear deafness of doubtful nature

We have both encountered cases where there was a middle-ear deafness of slight or moderate degree and the drumhead appeared to be normal or nearly so, but there was a history of past infection or of intermittent deafness. It is in this type of case that examination of the middle ear can be of value. Sometimes one finds otosclerosis, at other times serous otitis with thick tenacious mucus. There may also be adhesions or a broken ossicular chain.

3. Deafness, presumed due to former otitis, where the drumhead looks normal

Some of these patients will have completely normal looking drumheads, others will show scars, retraction or even small dry perforations, which do not explain the loss of hearing. Exploration of the middle ear in such cases has shown strands of mucus, fibrous adhesions, damaged ossicles, and an empty oval window without any signs of a stapes or incus, even though the drumhead seemed normal. Some of these cases improved after the appropriate intervention, such as the division of adhesions or sucking out mucus.

4. Other Indications

(*a*) Tympanoplasty and myringoplasty. There is a suggestion that Rosen's approach could be useful as a preliminary, when an inspection of the ossicular chain is necessary before trying to close a perforation of the drum by tympanoplasty or myringoplasty.

(*b*) Goodhill has used this approach to explore the middle ear in deafness from Paget's disease and fragilitas ossium. The improvement in hearing will clearly depend on the state of the ossicles, but apart from this, Rosen's approach should be valuable in distinguishing the middle-ear element in difficult cases of mixed deafness.

(*c*) There has been a suggestion that removal of the incus by Rosen's approach might produce a middle-ear deafness in a case which has a pure perceptive loss. If this is so, a hearing aid could be fitted more easily, for it is often these cases of high tone deafness in adults which resist all treatment.

(*d*) Middle-ear deafness due to trauma can sometimes be successfully approached through the meatus. One of us has recently encountered a case of middle-ear deafness due to a foreign body, which was relieved by an exploration through Rosen's incision. Thorburn has reported a case of traumatic middle-ear deafness due to fixation of the head of the malleus to the attic, which he was able to relieve by an approach through the

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aditus, and Rosen's incision seems a practical alternative to an endaural incision.

(*e*) Tinnitus has on occasion been relieved following the Rosen operation, even when the hearing has not improved.

The Operation (E.H.R.)

The technique has been fully described by Rosen and others (Derlacki *et al.*, 1957, Goodhill, 1956, Rosen, 1956, 1955, 1956) and a detailed description is unnecessary. I propose therefore to give my own experience where this has been different from that of others.

My operation technique has followed more or less closely that of Rosen with minor modifications.

Premedication has varied. Most patients have received 1/3 gr.Omnopon one hour before operation. Some have had 3 grs. of Nembutal, and lately I have tried 100 mgm. Pethidine. Nembutal appears to be most satisfactory for patients who are not unduly apprehensive. For those who are, Omnopon seems preferable but has the disadvantage of making some patients too drowsy for testing their hearing on the table. In fact a few patients went to sleep during the operation. Pethidine seems to be adequate in allaying fear without producing drowsiness, and seems worth further trial.

All but two patients were done under local anæsthesia, using 3-4 ml. Xylotox injected into the outer third of the meatus at 6, 12 and 3 o'clock (for the left ear, 9 o'clock for the right ear). Two patients had a general anæsthetic, one on account of age (15 years), the other because she was very apprehensive and the colleague who had referred her had promised her a general anæsthetic.

The operating microscope was used in about 30 per cent. magnifying glasses (×3) in the remainder. I have a slight preference for the latter, as they seem to give enough magnification, provide just the right focal length for comfortable working and allow more freedom of movement, especially when making the meatal incision. The new Beck binocular microscope is invaluable when demonstrating the steps of the operation to onlookers.

Instruments: At the suggestion of Simson Hall and others, I have lately been using the larger of the two curettes for my incision, elevation and reflection of drum, and I agree with them that this makes the operation—if anything—easier. I always sharpen my instruments before using them. The accurate placing of the stapes mobilizers on the neck of the stapes may be difficult in a small ear, and I feel their design could be improved. Perhaps again the larger curette, this time blunted and with a slightly curved neck, would make a satisfactory mobilizer.

Footplate technique: A good many variants of a direct attack on the

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footplate have now been described (Rosen, 1955, House, 1957, 1956, Fowler, 1956 and others). I have tried freeing the anterior border of the footplate on a few occasions, where either the anterior crus has been broken, or the usual neck mobilization failed to work. I must say I approach the footplate with much trepidation each time.

On a few occasions I have deliberately dislocated the incus and afterwards replaced it. This does not appear to have adversely influenced the outcome. It makes mobilization easier, as it allows one a very much better view of the stapes (head, crura and footplate).

The Operation (W.McK.)

The case for a local anæsthetic is that it is simpler and that the improvement in hearing can be established during the operation by the use of an air conduction earpiece surrounded by a sleeve of sterilized cloth. I have been so accustomed to general anæsthesia, however, that the majority of my earlier cases were explored under nitrous oxide, using a vaso-depressant. The results have been satisfactory, but if it is intended to work directly on the footplate of the stapes (which was not done in my cases) a local anæsthetic might be preferable. I have hesitated to touch the footplate of the stapes, as I followed the advice of Professor Skoog, who had avoided the footplate in order to lessen the risk of damage to the internal ear.

The approach is made slightly easier by a small incision in the roof of the meatal opening. A small retractor can then be fitted into the meatus. The operation field is then large enough for the microscope and will not depend on the size of the meatus.

The first incision into the meatal wall is made with one of the bone spoons in the set of Rosen's instruments, which is sharpened to produce a knife edge. This is better than the triangular knife, for the triangular knife is apt to tear the meatal wall unless it has been sharpened for each case, whereas the rolling action of the spoon will not tear the soft tissues. The incision is placed about 5 mm. away from the tympanic ring. If the flap is made too long, it is a nuisance to manage, and if it is too near the drum there is a risk that a tear may extend into the drum membrane. The extreme upper and lower ends of the incision may have to be made by touch if the Zeiss microscope is used, for the field under the microscope is confined to the central part, but this really matters very little because the view of the middle ear under the microscope is always large enough. The flap is easy to raise, and the work can all be done with the bone spoon except sometimes in the roof of the meatus where a small pair of scissors is a help. The junction between the drum and meatal wall can be lifted as easily as the remainder of the meatal wall. At this stage the blue mucous membrane of the middle ear can be seen intact throughout the length of the exposed section of the tympanic ring. Great care must now be taken about the incision. The triangular knife in the set of Rosen's instruments is

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too large to be used freely, because the anatomy of the middle ear varies so much that at times a prominent stapes can be damaged by the knife before a chance is given to inspect the ossicles with the microscope. In one case the anterior crus of the stapes was fractured in this way.

The only other difficulty during incision is the chorda tympani. It can usually be displaced downwards so that it will not interfere with the later part of the operation. There is no doubt that it is better to spare the chorda tympani, for the disturbance of taste resulting from its division may be permanent.

The view of the middle ear will now depend on the site of entry and the variations in anatomy. If entrance into the middle ear is made too low, there will be no ossicles visible, and only the promontory and round window will be seen. If the entrance is over the stapes, the oval window and both crura may sometimes be completely concealed by the bony tympanic ring which will have to be partly removed to show them. The bone spoon in the set will take away the bone quite well. The incus should now be seen, with the incudo-stapedial joint and the stapes, which should show the attachment of the stapedius muscle. The point is now reached when the stapes can be felt and some pressure made on the neck. Rosen recommends that the stapes should be made to move by pressure along the length of the footplate, but I have exerted pressure at right angles, across the long axis of the footplate in both directions with excellent results. The pressure is slight at first and then increases in strength, until the stapes moves, which usually happens quite suddenly. The stapes can be felt to move quite easily afterwards, and the feeling is unlike that which we felt when the crus was seen to be fractured. It is, of course, not possible to see exactly what has happened when this movement is produced, but at all events the impression that the stapes will transmit sound afterwards has been justified by the results. No more has been done in my cases and the footplate has not been touched. The meatal flap is replaced and the meatal incision closed with a silk stitch. The patient stays in hospital for the night, and can leave on the following day.

Goodhill and others recommend that the stapes should be mobilized by loosening the footplate, and that pressure on the crura should only be made if the footplate cannot be mobilized directly. The reports from America are concerned with large numbers of cases and we have had less experience in this country. Our results, however, are encouraging and we hope that they will be better when the technique has been fully developed.

Complications

(E.H.R.) Few complications have, so far, been encountered. Marginal tears have occurred which have all healed spontaneously; one patient has a permanent perforation. Facial palsy has occurred in three patients, passing off in two or three hours. It was undoubtedly due to Xylocain

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reaching the facial nerve. Perhaps the use of less local anæsthetic solution will avoid this in future.

The hearing was made worse (by over 20 db) in one patient, who also had the most violent vertigo and nystagmus towards the end of the operation. She had almost complete closure of the round window by otosclerotic bone, and I believe that my attempt to remove this damaged her round window membrane, but as she still has normal bone conduction in that ear she remains a puzzle. She had had her other ear fenestrated three years earlier with initial success, but the hearing improvement was lost two years later.

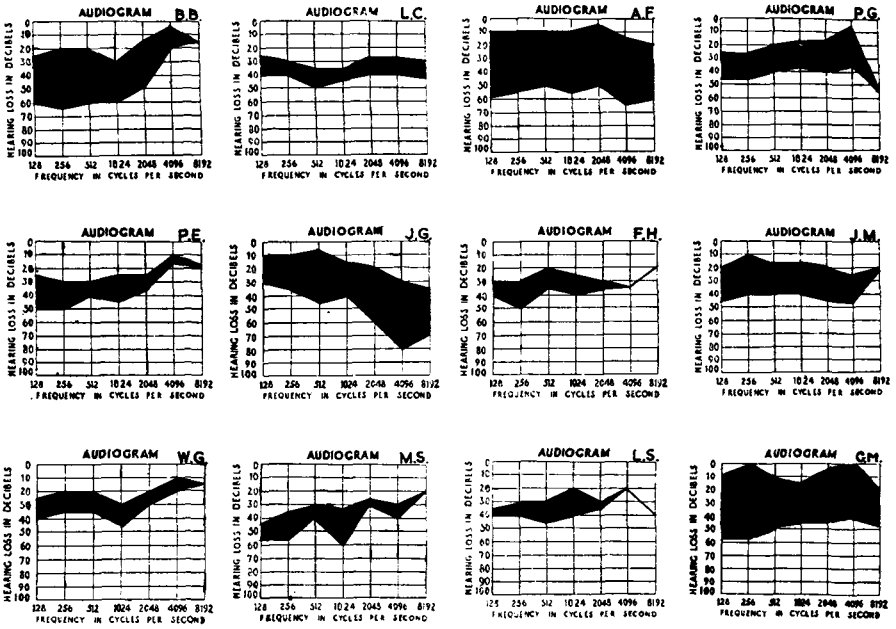


FIG. 1.

12 Audiograms illustrating good results.

Note especially A.F., J.G., J.M. and G.M. in whom almost normal hearing has been restored. Others (not illustrated here) achieved similar gains.

In one case both crura broke together, and had to be removed as loose bodies. The hearing was neither better nor worse afterwards.

Other findings of interest

Several patients with essentially conductive deafness were explored in the hope of finding adhesions in the middle ear which could be divided. In many ways this work appears to us the most exciting application of Rosen's operation, and it must be remembered that Rosen first devised his approach so as to be able to inspect the middle ear.

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We should like to describe some of these cases briefly.

1. The first (W.McK.) was a man of 24 years. He had been watched for four years with a mild deafness, but he got steadily deafer until he had a hearing loss of 40 db on both sides by air conduction, suggesting a mild middle-ear deafness.

Exploration of the right middle ear showed a large strand of mucus. The post-nasal space was explored and a pad of adenoids removed. The hearing subsequently returned to normal in both ears.

2. The second case was a patient 30 years old with a six months' history of deafness. The hearing loss was slight and the audiograph

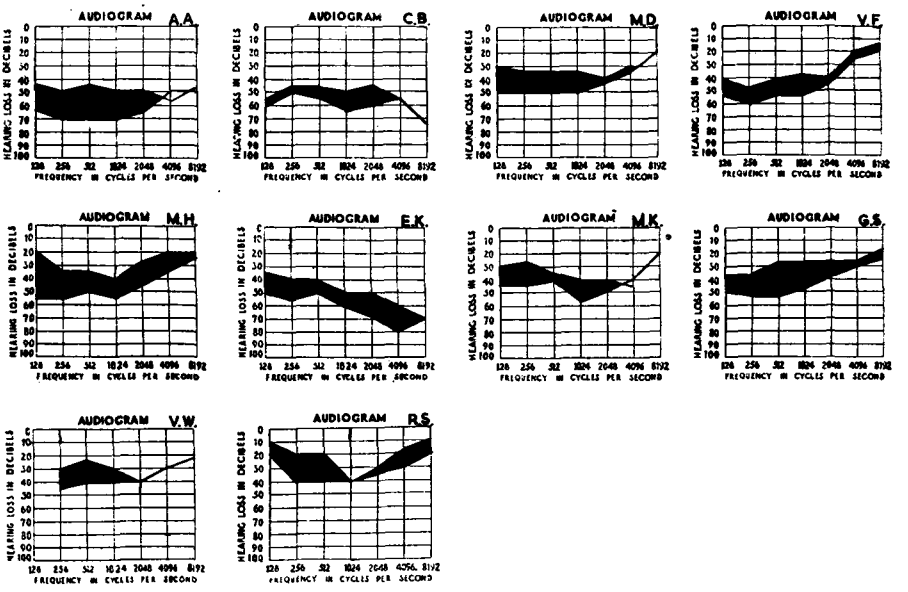


FIG. 2.
10 Audiograms showing improvement.

showed an air conduction curve only 25 db below normal for the speech frequencies. Exposure of the middle ear showed fluid and thickened mucous membrane, and the hearing later returned to normal on both sides after incision and aspiration of the fluid.

It might be argued that both cases should have been investigated by incision of the drum membrane in the first place. Neither case showed evidence of fluid, however, when the drums were inspected in out-patients, and in the first case aspiration *via* the drum would probably have failed to remove such thick exudate.

3. (E.H.R.) A lady aged 47 had a right mastoidectomy done in childhood. Hearing was much impaired (50-60 db), but bone conduction was

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fairly good (20-30 db). The left ear had been discharging intermittently for years. There was a large perforation for which a myringoplasty was done. The right ear also discharged a little mucus at times but no perforation was visible at the time and the drum was intact though scarred.

Exploration of the middle ear, apart from greatly thickened meatal skin and drum, showed a tiny perforation at the anterior drum margin, only revealed by suction, and through this very thick tenacious mucus could be aspirated. Drum reflection showed complete absence of ossicles, and an empty oval window. Hearing did not improve.

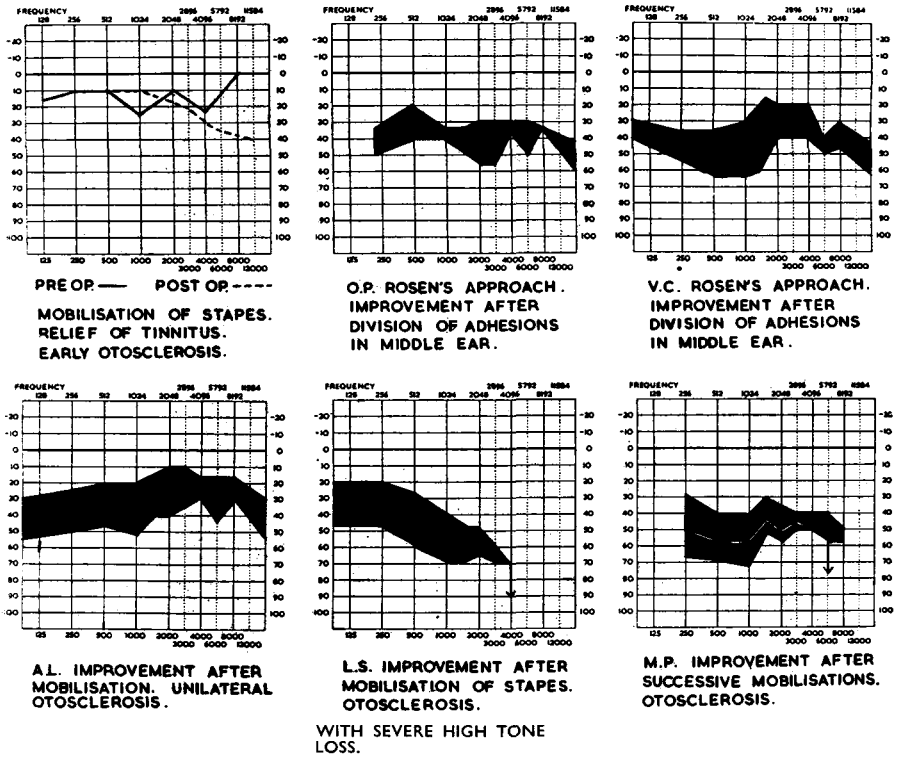


FIG. 3.

Comment. A broken ossicular chain had been expected, but did not account for her severe deafness. The empty oval window and the mucus came as a surprise.

4. (E.H.R.) A lady of 47 with deafness since early childhood following measles. Both drums were intact but scarred. There was a 40 db loss in both ears, moderate high tone deafness with corresponding bone conduction loss. Exploration of the right tympanum showed absent ossicles, an empty oval window and irregular sclerotic bone over the promontory.

5. (E.H.R.) A housewife of 24 had a right cortical mastoid operation

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done when she was 13. After leaving school she worked as a telephonist, and only became conscious of increasing deafness a year or two ago. Her right drum showed a small attic defect, but otherwise looked normal. The left drum was normal. Audiogram showed a very severe mixed deafness in the right ear but bone conduction was still 30-40 db. The left ear showed a similar curve, but only 20-30 db loss by air conduction up to 2,000; above 2,000 cycles the loss was severe.

The right middle ear was explored and found to contain a fine sheet of tissue which was possibly an old organized exudate, and several bands of adhesions. The stapes was present but only slightly mobile. The middle ear was tidied up, and an attempt made to close the attic perforation. The hearing remained unchanged.

6. (E.H.R.) A housewife aged 56 who had been deaf since the influenza epidemic in 1918. The deafness had increased since hysterectomy $2\frac{1}{2}$ years ago. There was severe bilateral conduction deafness (60 db) and nearly normal bone conduction. The drums looked normal. Exploration of her right middle ear showed an empty oval window, covered by a thick fibrous sheet, which was carefully picked off. The hearing did not improve.

7, 8 and 9. (E.H.R.) Three men aged 48, 58 and 61 respectively, had clinical otosclerosis. The middle ears were found to be quite normal in each case with a normally mobile stapes.

10 and 11 (E.H.R.) Two patients (cases 8 and 13) improved after finding and dividing adhesions, one of them by over 20 db in the speech frequencies.

12. (W.McK.) A woman of 35 was seen who complained of tinnitus in one ear after childbirth. There was a hearing loss of 20 db for 1,024 and 4,096 cycles but the audiograph was normal otherwise and there was no deafness in the other ear. The middle ear was explored and the stapes was found to be fixed. After mobilization the hearing improved and she lost her tinnitus.

Mobilization of the stapes

RESULTS

Improvement to 35 decibels or better for the speech frequencies 250, 500, 1,000 and 2,000 cycles	30
Improvement	21
Failures:	
Unchanged	30
Worse	3
Unchanged after improvement at first	1

Two patients who heard worse after mobilization, improved after fenestration, and their hearing might have returned to the original level if there had been a longer interval between the two operations.

(The above results refer only to patients in whom a diagnosis of otosclerosis was made.)

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Summary

1. An account is given of Rosen's operation by two surgeons working independently.

2. The results are so encouraging that it should be used in preference to the fenestration operation, and it is suitable for many patients who would otherwise not be considered for surgery.

3. The value of the operation in diagnosis of middle-ear deafness is discussed.

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