STAPES MOBILIZATION

By R. S. VENTERS (Carlisle)

THE invitation to present this paper in association with Dr. Rosen and Mr. Cawthorne was indeed a surprise, and I feel much honoured.

Though I admit, that at first I was a sceptic, the impact of Dr. Rosen's original article was profound, for if mobilization of the stapes was, in my opinion, a questionable procedure, the feasibility of opening into and viewing the tympanic cavity with impunity was not. I confess to having done no preparatory cadaver surgery and, though this may shock some, I would say in mitigation of my crime, and more especially to the younger members, that I have had more than twenty-five years of daily familiarity with the temporal bone. This is what happened in Case No. 1. My enthusiasm was unlimited and I set myself the task of perfecting the technique and laid plans for a carefully recorded series of cases.

Though Dr. Rosen's original description of the operation cannot be bettered, there are, having worked out the operation for myself, several points in technique that are worthy of some emphasis. I prefer a general anæsthetic in order to ensure not only freedom of movement, but freedom of speech. An immediate audiograph is of questionable value, for the sedated patient has a reduced cochlear response and the non-sedated a euphoric inaccuracy. The degree of mobilization bears no relationship to the ultimate hearing gain and in any case I do not like my theatre cluttered up with more gear than is necessary. The first 30 cases were operated on with spectacles alone. Since the acquisition of a Zeiss operating microscope, however, I have found technically that it is easier and quicker to proceed with spectacles to the point of full reflection of the meatal flap and tympanic membrane. The subsequent inspection and mobilization is done with the aid of the microscope.

The limited magnification, and in consequence the greater depth of focus of the spectacles, allows one to keep in view the whole of the tympanic membrane and the deep half of the canal without fiddling around with the speculum. The edge of the tympanic membrane is approached first just below the tympanic notch, and the bluey grey of the intratympanic mucosa must be well defined before entering the cavity and reflecting fully the tympanic membrane from the sulcus. In eight out of ten cases the chorda tympani nerve remains tucked close to the tympanic bony ring and must be recognized. It is readily detached from its mucosal

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bed with a fine pointed seeker and pushed medially. With increased experience I found that it was never necessary to sacrifice the nerve.

With the exception of two cases, apart from some sundry small adhesions, I found the cavity to appear perfectly normal. One showed quite clearly fusion of the crura and in another the cavity contained glutinous mucus which would not even enter the sucker and had to be removed like winding up a skein of wool. I presume a case of faulty diagnosis.

The high-powered view of the tympanic cavity fascinates me and I admire greatly the descriptive drawings of Rosen, Scheer, House and others, depicting with great vividness and skill the footplate and crura, but I cannot relate what I see to what they seem to see and draw. Even with removal of part of the bony tympanic ring the fenestra-ovalis with its stapedial footplate remains to me terra incognita in a high percentage of cases. The long process of the incus, the posterior crus and the apparent depth of the fenestra with a frequent overhanging upper rim presents quite a problem to my visual field and manipulative dexterity. There is also the overall mucosal blanket and above, the facial nerve. In some, anatomical variation does allow to a view of the lower and anterior portion of the fenestra and in an attempt to visualize the annulus, I have reflected the mucosal blanket, but its vascularity is such that hæmorrhage can be troublesome and difficult to control.

I have observed, however, and in spite of the visual limitation, that in several there seemed to be no line of demarcation between the footplate and the fenestra. In most the footplate itself seems to be so thin as to be almost transparent. I had the impression of almost looking into the vestibule and an apt description would be thin ice on a pond. On touching this lightly with a fine probe, the plate perforated with limited radiating multiple fractures. Direct, visually controlled mobilization or fenestration of the footplate seems to me to be applicable only in a small percentage of cases.

In recording operative details it was soon apparent that there was one finding almost common to all, fixation of the footplate. The stapes was mobile in only 18 of my series of 130 ears. As this must of necessity be a personal assessment, I took considerable care in determining accurately, whether or not fixation was complete. There seemed no doubt about the fixation in almost every case, but there was a very distinct varying difference in the tactile sense of solidity. Some seemed almost to be monolithic and others gave the sensation of being fixed to a less secure base. At ten magnification and over, this tactile sensation of insecurity of the latter could be related to visual movement and along both the long and short axis.

It is my opinion that this movement is the result of distortion or bending of the footplate rather than even limited mobility of the annular ligament.

It would seem that the long-accepted clinical evaluation of total

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stapedial fixation has been well confirmed both visually and by direct tactile assessment. The audiograms do not seem to differ and in no way indicate the known varying pathological lesions either as to extent or position, healed or active. I believe that I can now assess this subtle degree of fixation with a fair measure of accuracy and can determine immediately those cases likely to be successful and those likely to fail. With increasing experience I have broken fewer crura and now desist should my tactile sense of solidity be such that crural fracture is likely and I fenestrate at a later date.

What is more important, is the fact that I now achieve a much higher percentage of successful results and I attribute this not only to a better selection of cases, but to a more accurate application of pressure on the right place and in the right direction. The mobilizer must be placed at the neck and the pressure applied posteriorly, slightly downwards, and in the long axis of the footplate.

The procedure I follow does not vary in any way from that described by Dr. Rosen, but I have three observations to make that to me are important.

It is not essential to observe a light reflex from the round window to assure oneself of a successful outcome. Various factors are involved such as the direction of the primary light, depth of the membrane and amount of reflecting fluid in the niche. There is one other factor, however, that could be overlooked; there may be insufficient movement at the footplate to produce a fluid wave in the perilymphs for visual appreciation of round window movement by light reflex.

Another observation concerns the stapedial tendon. Normally the stapedial tendon has the appearance of being taut and straight and, on application of a probe to its surface, one can appreciate a certain amount of bounce. On successful mobilization it will be seen that the tension has gone and it may even have a slightly bent appearance and bounce is replaced by sag. I deduce from this that the crural arch is displaced posteriorly and downwards and does not return to its previous normal position.

Thirdly, in no case have I observed either the presence of blood or leakage of perilymph around the footplate area and assume that the mucosa remains intact.

I shall have more to say about these observations later.

Table I. My series consists of 108 patients, 130 ears and all operated on under the National Health Service. Twenty-two patients had both sides operated on. All had the poorer ear operated on first.

To begin with, I accepted for operation with little discrimination, almost all cases of clinical otosclerosis that came my way, but soon adhered largely to the Shambaugh-Carhart formula and classification as for fenestration. It would seem to me, and put simply, that the flatter the audiograms and the greater the air/bone gap the more likely a successful result. However, there were so many exceptions to this that *one would be bold*

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indeed to build up a patient's hope on the presentation of an ideal audiogram or refuse operation on the evidence of a less promising one.

On the presentation to the patient of a truthful statement as to the considered chances of success I have experienced no difficulty in persuading patients to have the operation. It may be that in my more northern climate the patients are more phlegmatic, but more important is the fact that the bonfire telegraph of the Lakeland and Scottish Border hills, reminiscent of the depredations of the Scots and English, still exists and they clamour to have the operation done.

TABLE I

STAPEDIAL MOBILIZATIONS
(OCTOBER, 1955–OCTOBER, 1957)

	Males	Females	Total
No. of patients	50	58	108
No. of patients—single operation	36	50	86
No. of patients—double operation	14	8	22
Total no. of ears	64	66	130

Table II. This Table shows the immediate results and you note the very successful percentage relative to the moderately successful. No audiograph is required to persuade one that a case has been very successful. The patient knows, everyone directly and indirectly associated with the ward knows and emotional upsets and tears are not uncommon. At times it has been quite embarrassing. Mothers have had to be parted from their children in order to undergo a period of acoustic rehabilitation and others have kept indoors to avoid traffic noise.

TABLE II

IMMEDIATE POST-OPERATIVE RESULTS ON 130 EARS
(OCTOBER, 1955–OCTOBER, 1957)

	Number	Percentage
Very successful	71	55
Moderately successful	20	15
Failures	39	30

Table III. My first cases were done in October, 1955, and I have followed up all cases done prior to June 1st, 1957, either by personal examination or by means of a questionnaire. The percentage of immediate successful results is 70 per cent. and the percentage of successful results maintained out of the total to that date is 53 per cent.

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TABLE III

NUMBER OF EARS SUCCESSFULLY OPERATED ON PRIOR TO JUNE, 1957

	Number	Percentage
Number of initial successes: Very Successful and Moderate ..	73	70
Number of successes maintained: Very Successful and Moderate ..	55	53

With the exception of one case with a transient middle-ear infection, there have been virtually no complications. No patient has experienced vertigo and in about 50 per cent. of all cases with pre-operative tinnitus, the tinnitus disappeared.

Though the percentage of very successful maintained results, even with a more critical criteria of acceptance and increased skill, may not greatly exceed 60 per cent., *the social rehabilitation of those as the result of a safe and, to the patient, a minor operation, cannot be ignored by any practising otologist.*

When I met Dr. Rosen I bombarded him with questions and his invariable modest reply was "I do not know" and my reading of the literature would lead me to believe that there are still many questions unanswered. It is insufficient to state that the "proof of the pudding is in the eating of it". I frankly do not believe, except perhaps in a very small percentage of cases, that true stapedial mobilization, or if you like stapediolysis takes place.

I find it equally hard to accept that it is justifiable to destroy permanently the ossicular chain, in order to knock a hole in the footplate or to bite a piece out of its edge. Surely these holes must be covered eventually, if not by bone, by dense scar tissue. Direct attack on the edge of the footplate is more logical if you can see it and define it without being destructive, but early in this paper I confessed that I cannot define the footplate with any degree of accuracy, except in a small percentage of cases. Again, *if that something which happens, on pressure being applied to neck, does not happen,* there must be a fairly extensive fusion between the rim of the fenestra and the plate. I grant that this fusion may be broken by direct visual application of elevators, but the resultant contiguous, rough, saw-like, bony edges can hardly be conducive to free movement and the maintenance of mobility.

Though the numbers are small I certainly got the impression that if the operation was successful on one side there was a good chance of success on the other. Twenty-two patients had both ears operated on and a double successful result was achieved on fifteen. I infer from this, that if the pathological lesion, both as to site and extent, has been such as to ensure a successful result on one side, it is reasonable to suppose that a similar lesion exists on the other. Patients who have had a successful result require

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no persuasion, indeed are anxious, to have the other side done, and I am chary about advising further operation in the unsuccessful.

I do not ponder on why the successful maintained results do not much exceed 50 per cent., for the varying pathological lesions must prevent a successful outcome in any given number of cases. This operation can only be part of, but must be part of, one's armament in the treatment of otosclerotic deafness. I wonder what really happens at the footplate? With a normal cochlear response and clinical fixation of the footplate, restoration of a freely-moveable ossicular chain should produce normal hearing, but that does not happen, and why not? Why is the hearing maintained at all and why does tinnitus disappear in some and not in others?

Just as the very successful hearing result leaves no shadow of doubt that it is successful, I believe that a successful operation is something just as well defined, at least to the experienced operator. On the application of varying pressure the crura rotate backwards and downwards, with or without an audible click, in a most definite fashion. There is no sense of a sudden collapse as occurs with broken crura, but rather a controlled sensation of sinking backwards and downwards. When this occurs I feel reasonably certain that the result will be good.

My observations and results do not, I think, materially differ from those of others employing the same technique, and though there are imponderables there are certain well-established and definite findings. These can be summed up as follows:

(1) Clinical fixation confirmed at operation;
(2) A successful operation with consequent good results;
(3) Maintenance of improved hearing in at least 50 per cent. of cases.

Fig. 1 shows diagrammatically the stapes with direct lines of stress. The thickened edge of the footplate is substantially held to the rim of the fenestra by the annular ligament, and it is well known that on forcible removal of the stapes both crura and footplate will often fracture before the ligament gives. The upward arrows indicate the thrust of the perilymph in the vestibule, which for practical purposes can be looked upon as a closed cavity.

Fig. 2 represents what I think happens. The stress constructional engineers refer to this as "punch and sheer". The posterior crus, the stronger of the two, is pushed backwards and downwards, and, especially in cases where the plate is thin, a variable portion of the actual plate is carried into the vestibule. There must of necessity be a break anteriorly, and as no break of the anterior crus can be felt I assume that the fracture, in most cases, takes place near the plate. The closely adherent unbroken mucosal blanket remains attached to the fragment and it is likely that this forms a false ligament.

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Fig. 3. This is similar except that it attempts to show the situation where the otosclerotic lesion invades the anterior part of the plate and crus.

I realize that much of this is based on conjecture, but it would seem to

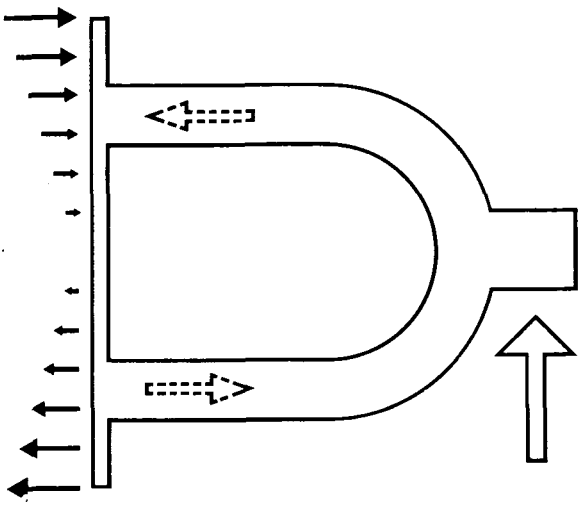


Fig. 1.

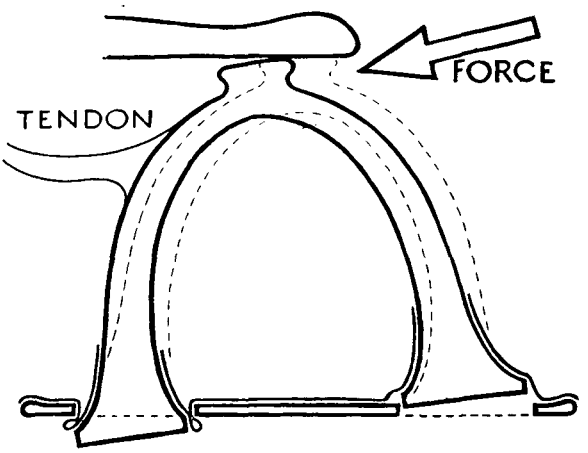


Fig. 2.

explain *that something* which happens. It would account for the permanence of the successful result, and it might even explain why hearing is not restored to nearer normal due to the reduction in force and amplitude of the fragment relative to complete stapes.

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In conclusion

The operation as described by Dr. Rosen, is an established effective procedure in the relief of deafness due to otosclerosis.

The operation is not easy and demands a high degree of manipulative dexterity and tactile sensibility.

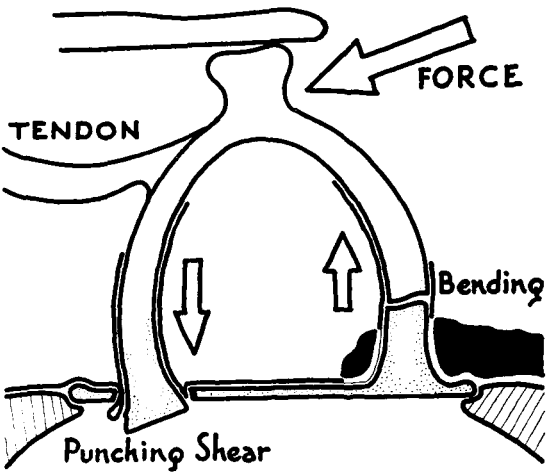


FIG. 3.

As a maintained improvement in hearing, with social rehabilitation, can be expected in over 50 per cent. of cases, only the failures should be submitted to fenestration.

The descriptive name "stapes mobilization" has been too long accepted to be lightly discarded, but I venture to suggest that it is not entirely accurate.

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