OBSERVATIONS ON STAPES MOBILIZATION

By H. D. BROWN KELLY (Glasgow)

THE following remarks, based on the author's experiences in the performance of his first hundred cases of mobilization, are submitted in the hope that they may help those who are undertaking this work for the first time.

Cadaver Training

Training on the cadaver is of great value, as it affords excellent opportunity for practising the incision, elevation of skin flap and drumhead, and removal of the posterior bony wall. It must be admitted that it gives little help in practising the actual mobilization, as the ossicles here are usually loose and easily displaced. If it is possible to obtain from the post-mortem room several intact stapes, these should be glued by the footplate to a sheet of cardboard. Then, by applying the mobilizer to their necks, some idea is obtained of the degree and direction of pressure which the ossicle will stand before fracturing. It will be found that great variation exists in the strength of individual bones.

Diagnosis

A careful history, clinical examination, and modern audiometry allow an accurate diagnosis to be made with surprising frequency. In over 90 per cent. of cases the pre-operative diagnosis of stapes fixation was correct. Three patients showed absence of incus—their examination and audiograms were suggestive of otosclerosis. In six instances the stapes was found to be mobile. The audiograms in these were suggestive of otosclerosis with commencing cochlear degeneration. There was some high tone loss, but bone conduction was good, and there was a fair "step" between bone and air conduction.

The present series of cases consists of 28 males and 72 females. The youngest patient was aged 12 years, and the oldest 59 years. The average age was rather surprisingly high, being 35 years. Otosclerosis so often becomes manifest in early adult life, and it is hoped that patients will seek relief at an earlier stage of the disease when there is a better chance of successful result.

https://doi.org/10.1017/S002221510005619X Published online by Cambridge University Press

Anæsthesia

All cases were operated on under general anæsthesia. This is contrary to the usual preference for local infiltration plus sedation, but I prefer it. Although there may be a disadvantage in a slightly less bloodless field, such bleeding as does occur is in the early stages (incision and elevation) only. By the time the middle ear has been opened, the bleeding has ceased. With a local anæsthetic, one has to keep the patient's comfort constantly in mind, and may consciously or subconsciously tend to hurry the operation on this account. The result may be unnecessarily fractured crura or other mishap.

Now that the footplate can be visualized under the microscope, and the round window reflex observed, it is not so necessary to test the hearing on the operating table in order to know that satisfactory mobilization has taken place.

The services of an expert anæsthetist are, of course essential. I am indebted to Dr. W. Sniper for his help and for these notes: Before operation, Adrenoxyl, 2 c.c. intramuscularly, is given. This decreases the permeability and increases the contractility and resistance of the capillary walls. When a conventional anæsthetic (pentothal, muscle relaxant, gas, oxygen and trilene) is given, nembutal or morphine and atropine are given as premedication. A free airway, adequate gas flow to eliminate CO_2, and a steep head-up tilt to the table all help to minimize bleeding.

The hypotensive drugs, such as Hexamethonium and Arfonad may be used, but only a slight head-up tilt is then permissible because of the risk of cerebral anoxia. The new inhalant Fluothane has also been used. This agent has the effect of lowering the blood pressure. It is important to give atropine before its use, and to take frequent blood pressure readings.

Unfortunately the lowering of the blood pressure does not, *per se*, ensure a bloodless field, especially in young, fit patients. The risks of hypotension must be borne in mind, but by a judicious use of the methods outlined, a reasonably dry field is obtained.

The Operation

Most operators have now abandoned Rosen's original pointed knife, and use some form of instrument with a rounded cutting edge. A circular bladed knife such as that advised by Portman is very satisfactory. By its use, the tendency to tear the thin skin of the meatal floor is reduced to a minimum. The Rosen elevators are found to work better if the original square ends are rounded and sharpened.

Before removing bone from the posterior meatal wall, it is well worth while dissecting free the chorda tympani nerve, and pushing it forwards so that it does not obscure the view of the incudo-stapedial joint. Many surgeons make no attempt to preserve the nerve, and indeed this structure

https://doi.org/10.1017/S002221510005619X Published online by Cambridge University Press

is rarely referred to in descriptions of the mobilization operation. It must be emphasized, however, that some patients complain bitterly of an unpleasant metallic taste after the nerve has been severed. Two in this series said that this metallic sensation made all food taste the same, and resulted in loss of appetite. This detracted considerably from their pleasure at their improved hearing. In accordance with the observations of E. G. Collins, atrophy of lingual papillae on the same side as the severed nerve can be seen.

The amount of bone to be removed in order to obtain a good view of the stapes varies enormously. If only a little need be taken away, the Rosen curettes suffice, but if it is necessary to remove a good deal of bone, a small chisel is used. The electric drill has also been tried, but its exact control within the limits of an aural speculum is difficult.

On opening the middle ear, the state of the mucosa covering the inner tympanic wall and the ossicles is noted. Normally it appears thin and pale, but in four cases in this series was red and vascular, surrounding the long process of the incus and the crura of the stapes with a thick, velvety covering. It was thought at first that this vascular appearance might indicate a certain stage in the development of the otosclerotic process, but there seemed to be no relationship between the appearance of the mucosa and the degree of stapes fixation. In two instances, the stapes mobilized easily at the neck with very slight pressure, but in the other two the footplate was so firmly fixed, that movement could only be obtained with difficulty. The former two patients had a good result as regards hearing, the latter were poor.

In six cases, numerous fine adhesions between ossicles and tympanic wall were divided.

The footplate of the stapes may be easily visualized, or it may lie at the bottom of a deep recess and be almost impossible to see, no matter at what angle the microscope be adjusted. It is usually possible to see the posterior crus, and its attachment to the footplate, but that part of the footplate on the promontory side is often hidden.

The crura also show a great variety of appearances, from the thin, atrophic ones which fracture at a touch, to the thick, sturdy crura, which can withstand a surprising amount of pressure.

Accidents and Mishaps

One patient developed a small granulomatous polyp at the site of incision. It was removed with a ring curette, and did not recur. Perforation of the tympanic membrane occurred in six instances, always at the postero-inferior margin. Only one failed to close within a few days. It healed eventually leaving an atrophic scar.

There was one case of post-operative otitis media which cleared up

https://doi.org/10.1017/S002221510005619X Published online by Cambridge University Press

with appropriate antibiotic therapy, but the final result as regards hearing was poor.

Division of the chorda tympani nerve has already been mentioned. There were no cases of facial palsy.

Dislocation of the incudo-stapedial joint occurred in some of the early cases, usually due to the sharp probe skidding off the long process, or from the application of misdirected pressure. Some surgeons have advocated the deliberate dislocation of the joint in order that pressure may be exerted directly on the stapedial head. If the incus is carefully replaced, no immediate ill effects are noted, but in view of the probability that the long process obtains its blood supply from vessels running in the mucosa covering the joint, this manœuvre is not advisable. Such cases may later develop a dry necrosis of the long process (Brownlie Smith, 1958).

Post-operative vertigo was noted in a few instances, but was only severe in three cases. In one patient, the vertigo was accompanied by vomiting and nystagmus, and followed by severe deterioration in hearing. This was one of the early cases, operated on under low magnification only, and the destruction of the labyrinth was probably due to dislocation of the stapes into the vestibule by too energetic manipulations.

Probably the most frequent mishap was fracture of the crura. When operating under low magnification, this accident could be mistaken for mobilization of the whole stapes. With practice, however, it became apparent that the "feel" of the intact, mobile stapes was quite different. Also the stapedius tendon remained tense, and not flabby and flaccid as when fracture occurred. With the improved magnification of the operating microscope, the actual fractures can, of course, be seen.

When fracture of both crura occurs, it is probably wise to attempt nothing further at the time, but arrange to do a fenestration later. Indiscriminate prodding at the footplate may result in a labyrinthitis and jeopardize the chances of hearing improvement by fenestration. Even if a degree of movement at the footplate is achieved, the fractured crura heal badly, and are not strong enough to transmit movements to a footplate whose mobility is in the slightest degree impaired.

One has to agree with Scheer (1959), that in cases of footplate fenestration as described by Rosen, the successful results are those in which the manipulations have resulted in either an intact, mobilized stapes, or in an inadvertent Fowler's anterior crurotomy, where the footplate cracks across, leaving a mobile portion attached to an intact, posterior crus.

Anomalies

In three patients, the incus was absent. When Dr. Rosen came to demonstrate his operation at the Victoria Infirmary, Glasgow, among his cases was a woman, aged 32, with clinical otosclerosis. When the middle ear

https://doi.org/10.1017/S002221510005619X Published online by Cambridge University Press

was opened, it was found that there was a gap between the shortened long process of the incus, and the stapedial head. Dr. Rosen inserted a piece of tissue from the meatal wall in an attempt to bridge the gap. One year later, I operated on her other ear, and found no trace of an incus. This case was fully reported previously (Brown Kelly, 1958).

The second case was that of a woman, aged 40, in whom a mobile stapes was found, but no incus. The drumhead was plastered on to the small, atrophic stapedial head in an attempt to get a columella effect. The result as regards hearing was poor.

When the third case of absent incus, in a boy aged 14, was encountered, the drumhead was very freely mobilized, by extending the incision round the full circumference of the meatus. The drumhead with its attached sleeve of skin was then firmly packed down on to the stapes. A gain of 15 decibels was thereby achieved. The stapes head, as in Case 2, was atrophic and rounded, with no evidence of an articular surface.

Results

A good result, with a gain of 20 decibels was obtained in 36 cases. A gain of 10 decibels occurred in 22 instances. Forty patients received no benefit. One was made worse (post-operative labyrinthitis).

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11 Sandyford Place,
Glasgow, C3

https://doi.org/10.1017/S002221510005619X Published online by Cambridge University Press