THE DISLOCATED INCUS

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It is well recognized that head injuries frequently cause perceptive deafness. That the deafness may sometimes be of conductive type due to a disrupted ossicular chain is less well known but has been reported in the literature. A type of conductive deafness may also occur after simple mastoidectomy and though only a few cases have so far been described, the condition is perhaps more frequent than the number of references may suggest. It, therefore, seems worthwhile to describe a case and review the literature.

Surgical Anatomy of Dislocation

The short process of the incus is anchored by short strong fibres of the posterior ligament to the fossa incudis in the floor of the aditus. Kobrak (1959) also describes a superior ligament which descends from above to the body of the incus. Helmholtz (1868) points out that the main support to the incus is the incudo-malleolar joint. This synovial joint being of a double-saddle variety, whilst allowing a fair degree of movement, has a kind of cog-mechanism which prevents it from sub-luxating. Uhrlich (1926) and Kelemen (1944) examining serial sections of temporal bones of patients who died after head injuries found disruption of the malleolo-incudial and incudo-stapedial joints, injury to the tensor tympani muscle and almost invariably an intact stapedius tendon. Bauer (1959) suggests that accidental trauma to the short process during any operative manipulation in the region of the aditus may rotate the body of the incus and thereby carry the short process downwards and forwards with disruption of the incudo-stapedial joint. These anatomical and clinical observations suggest that the incus is perhaps the most vulnerable of the three ossicles to trauma.

Case Report

W.D., a boy of 9, was first seen on *1st July, 1937*, with a history of left earache followed by a purulent discharge of 5 weeks duration. He complained of a great difficulty in hearing on that side and otoscopy showed a pulsating discharge through an inferior perforation in the tympanic membrane. He had mastoid tenderness and could hear a whispered voice at 8 inches. A diagnosis of acute otitis media with mastoiditis was made and a simple (Schwartze) mastoidectomy was performed. He made an uneventful recovery and was discharged 10 days later. It appears from the case notes that the hearing was poor at the time of discharge from the hospital. He was asked to report in 6 weeks but did not till 26 years later when he returned with an acute otitis media on the other side which soon resolved totally with antibiotic treatment. On the left side there was a post-auricular scar, the drum-head was normal

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and tuning fork tests indicated a middle-ear deafness. Audiometry showed normal bone conduction threshold and an average air conduction level of 70 db. above threshold which in view of the history and clinical findings was attributed

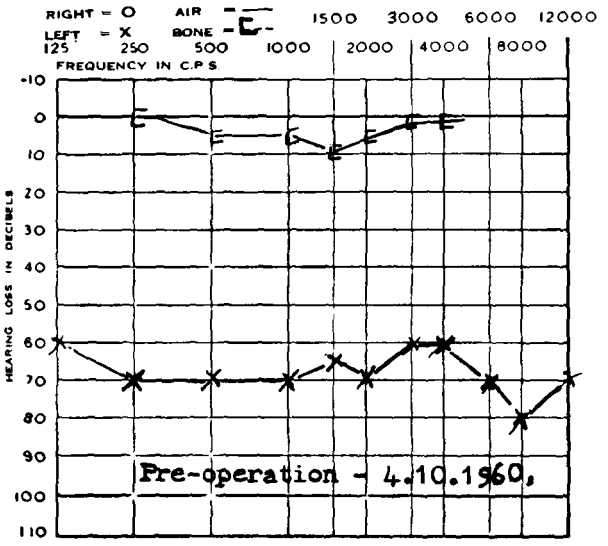


Fig. 1.

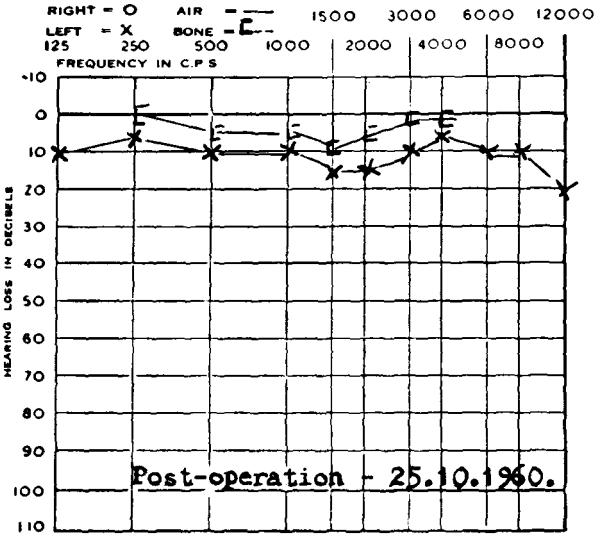


Fig. 2.

to a break in the sound conducting mechanism (Fig. 1). An exploratory tympanotomy was carried out under a local anæsthetic by Dr. I. Simson Hall on *5th October, 1960*. The incus was found to be dislocated downwards with its long process lying in the hypotympanum. The stapes was intact and mobile, the

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incus though intact could not be re-positioned and was therefore extracted. A polyethylene strut was inserted between the neck of the malleus and the stapedial head. The hearing improved as soon as the drum was replaced and had been maintained at a high level with almost complete closure of the air-bone gap when last seen a year later (Fig. 2).

Review of the literature

(*a*) *Dislocation following head injuries:* This subject has been well discussed by Escher (1948), Rowbotham (1949), Cawthorne (1956), Thorburn (1957), Bauer (1958), Gisselsson (1958), Filsberg and Floberg (1960) and others.

(*b*) *Dislocation following simple mastoidectomy:* Schuknecht (1957), Hamberger and Lidén (1958), Plester (1959), Freeman (1959), Hough (1959), Hall and Rytzner (1957 and 1959), Filsberg and Floberg (1960) and Andersen and Engberg (1960) have described cases which they treated, as summarized in

TABLE I

Author	Age at time of mastoidectomy	Exploratory tympanotomy after	State of Incus	Operation to improve the hearing	Result—Gain in hearing
Schuknecht	2 years	14 years	Dislocated but intact.	Re-positioning.	Temporary improvement
Hamberger and Lidén	**	**	Absent.	Myringo stapediopexy	Average 50db
Plester	Early childhood	Several years	Dislocated but intact	Re-positioning	40 db
Freeman	3 years.	15 years	Dislocated but intact	Re-positioning	30 db
Hough	Early childhood	Several years	Dislocated but intact	Re-positioning	Improvement
Hall and Rytzner	**	**	Dislocated but intact	Ossiculoplasty	Improvement
Filsberg and Floberg	3 years	8 years	Dislocated but intact	Myringo-stapediopexy	40 db
Andersen and Engberg	**	**	Dislocated but intact	Ossiculoplasty	Improvement.
Present case	7 years	26 years	Dislocated but intact	Extraction and insertion of polyethylene strut	50 db. with total air-bone closure

** Details not available.

Table I. Of these, Schuknecht's patient was unique in being deaf for years after a mastoidectomy in childhood. During adolescence, after an attack of otitis media and recovery, a positional variation in the hearing was complained of —an improvement whilst the head was in the vertical position and a fall in hearing with the head flexed. This was confirmed by air-conduction audiometry and was of the order of about 40 db. At tympanotomy an intact but dislocated incus was seen and re-placed. The hearing improved but was maintained for 2 months only and was attributed by the same author as a failure of the ossicle to stay in position.

Comments

1. While no definite figures are available for the incidence or degree of conductive deafness following a simple mastoidectomy McKenzie (1958) noted that nine out of 50 patients had an average post-operative hearing loss of 44 db. in the speech range. Plester (1959) reviewing 1,000 operations for attempted improvement of the hearing found that the incus was dislocated in four and

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each of these patients had had a simple mastoidectomy performed in childhood. Hough (1959) reports having found a dislocated incus in four out of a series of 500 cases which he explored for conductive deafness.

2. Simple mastoidectomy is no longer a common otological operation, but in view of the large number of such operations in the past, disruption of the ossicular chain should be kept in mind when one is confronted with a persistent conductive deafness following such a procedure.

3. If the incus is found to be dislocated at exploratory tympanotomy, the following operative techniques to improve the hearing are available:

(*a*) *Repositioning*.—This, if technically possible, should be attempted. Schuknecht (1957), however, feels that the "incus may be considered to be an autogenous dead bone transplant and its failure to stay in position is not surprising". He feels that the problem of interposing a functioning structure between the malleus and the stapes is an intriguing one beset with many difficulties like a lack of vascular bed, maintaining position of either a living or artificial transplant and avoiding ankylosis or stiffening in the re-constituted ossicular chain.

(*b*) *Myringo-stapediopexy* after extraction of the dislocated incus. This seems to be quite a suitable method, the sound transmission now being through a columella effect. Very good gain in hearing has been recorded.

(*c*) *Ossiculoplasty*.—This rather ingenious technique involves extracting the incus, trimming the long process and re-placing it so that the short process abuts against the stapedial head and the body supports the drum-head. Hall and Rytzner (1957 and 1959) who devised this technique find that the "transplanted" incus derives its blood supply from the recipient site through the mucosal plexus on its surface and such an incus, removed several months afterwards has been found to be living bony tissue.

(*d*) *Interposition of a polyethylene strut* between the neck of the malleus and the stapes. This technique in the single case so far treated seems to have been quite satisfactory.

Summary

The surgical anatomy of the incus is discussed. The literature relating to traumatic dislocation of the incus following simple mastoidectomy in childhood is reviewed briefly. The different surgical techniques available to improve hearing are described. A case which occurred recently at the Royal Infirmary, Edinburgh is described.

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