

# Malleus- Handle Fracture: Literature Review and A New Surgical Approach

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## Citation

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## Abstract

A fracture of the malleus-handle is a rare traumatic middle ear lesion. We report a malleus-handle fracture with associated conductive hearing loss. The surgical approach was novel. The incus was removed and a TORP was placed from the remnant of the malleus to the foot plate of the stapes. The prosthesis was held in position with a silastic rubber band to the neck of the stapes.

A review of the literature regarding the causes of malleus-handle fracture, mechanism of injury, clinical picture and surgical management is also presented.

## INTRODUCTION

In traumatic middle ear lesions the tympanic membrane is commonly affected, but ossicular lesions do occur. Among the ossicles, the incus is often exposed to subluxation or fracture. Less frequently the stapes is involved. The malleus is only involved in 2% of the middle ear lesions and isolated malleus fractures have been mentioned only few times in the literature. <sup>1,2</sup>

The first case in the literature of isolated malleus handle fracture was reported by Meniere's 1855. He described how a gardener accidentally thrust a twig of a pear tree into his ear. Examination revealed an extensive laceration of the tympanic membrane and the mobile end part of the malleus-handle could be detected. <sup>1</sup>

Frequent causes of malleus handle fracture include head trauma, barotraumas penetration of a hairpin or a twig. Our patient experienced a malleus-handle fracture after quick removal of a finger from the ear canal. This mechanism of injury has been previously reported. <sup>2</sup>

## CASE REPORT

A male aged forty referred from the Accident and Emergency Department. The patient reported that three weeks earlier, while he was taking a bath and cleaning the right ear with his finger he felt a sharp pain. Shortly after that he observed a right sided hearing loss. There was no

history of ear discharge or tinnitus. The patient also denied any dizziness.

Otoscope examination of the right ear showed an intact tympanic membrane. However there were congested blood vessels along the handle of malleus and anteriorly displaced long process of the incus. Tuning fork test revealed conductive hearing loss to the right ear.

Pure tone audiometry revealed 60dB conductive hearing loss in the right ear with air bone gap about 50dB (figure 1). Tympanometry showed high compliance with a peak of 3.7cm<sup>3</sup>. (figure 2). A provisional diagnosis of ossicular disconnection was made. High resolution CT scan of the temporal bone showed no evidence of disruption in the ossicular chain.

Figure 1

Figure 1: Pure tone audiogram revealed 60dB conductive hearing loss to the right ear with air bone gap about 50dB.

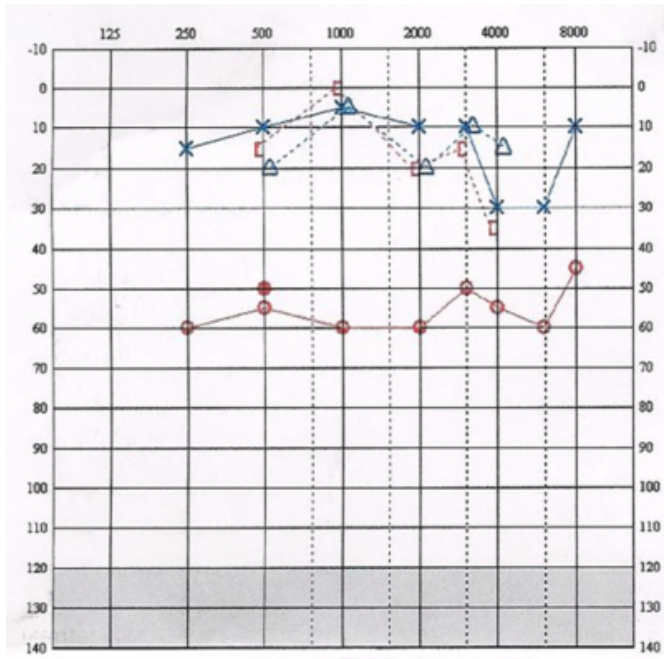
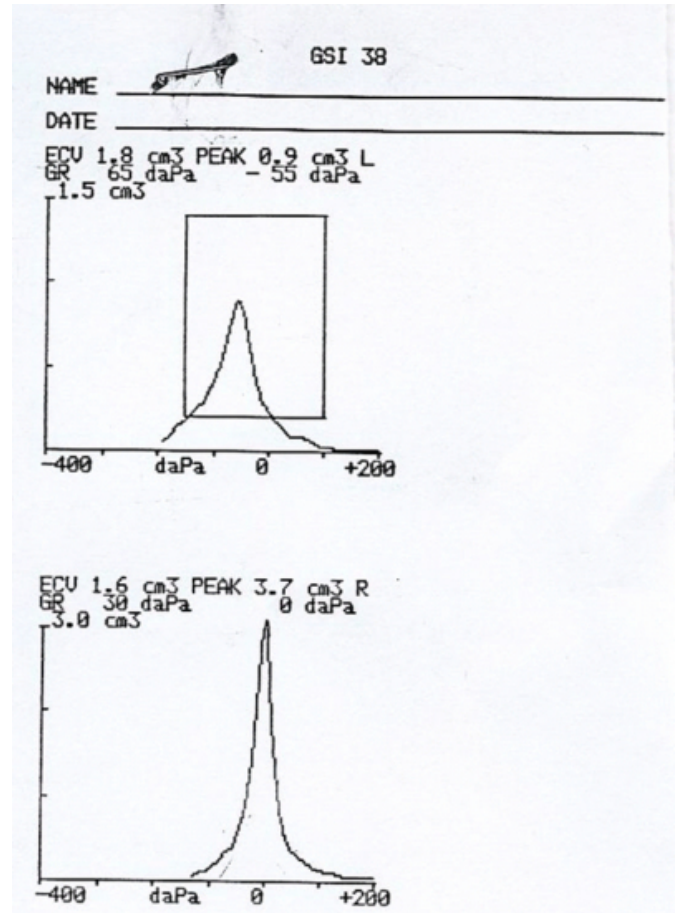


Figure 2

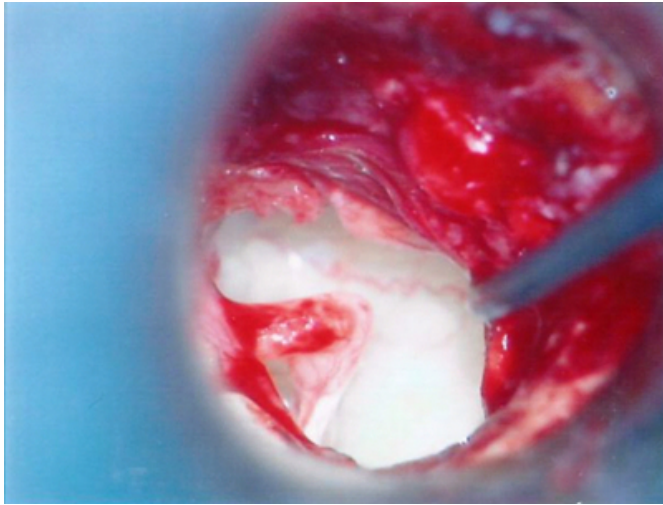
Figure 2: Tympanogram to the right ear shows high compliance with a peak of 3.7cm<sup>3</sup>.



The patient had exploratory tympanotomy, which revealed fracture of the lower half of the malleus-handle and the upper half of the malleus was fixed to the attic (figure 3). The incudo-stapedial joint was intact and the stapes was mobile. The upper half of the malleus was mobilized and the lower fractured segment was left in apposition with the upper half of the handle of malleus.

**Figure 3**

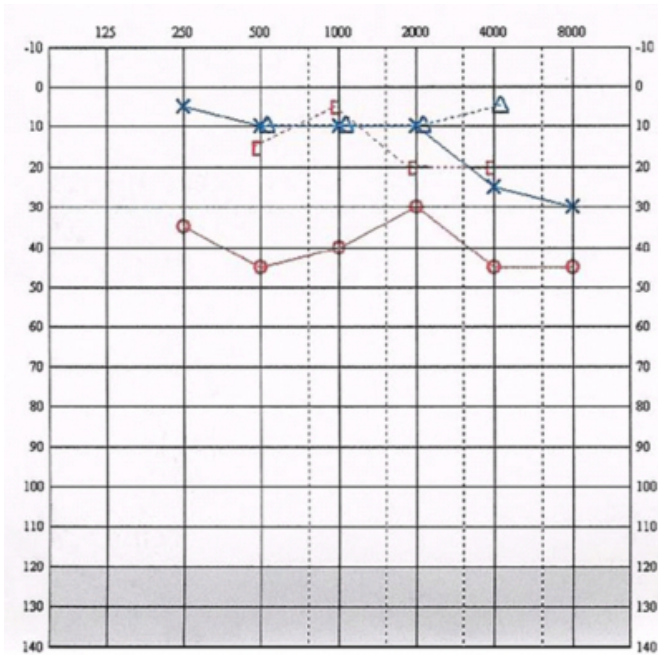
Figure 3: Fracture of the lower half of the malleus-handle. The upper half of the malleus fixed to the attic.



Two weeks post-operatively. The patient reported a slight improvement of the hearing. However, two months later the patient reported that his hearing had deteriorated and he was complaining also from constant hollow sensation in the right ear. The audiogram showed 40dB conductive hearing loss with air bone gap about 30dB. (figure 4)

**Figure 4**

Figure 4: Two months after the exploratory tympanotomy, the audiogram showed 40dB conductive hearing loss with air bone gap about 30dB.

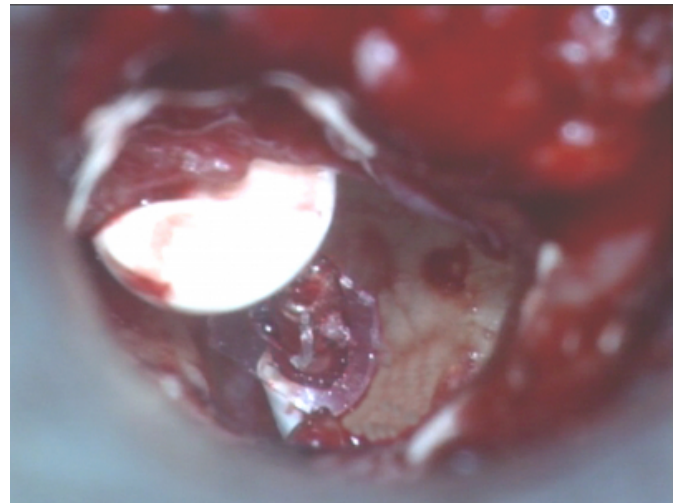


The patient was keen to undergo further surgery to improve his hearing.

Ten months later, a revision ossiculoplasty (with malleus relocation<sub>6</sub> and silastic banding technique<sub>7</sub>). This was performed by Dr/Vincent of Beziers, France as part of an international otology course. The tympanomeatal flap was raised through a permeatal approach and the incus was removed. The malleus remnant was relocated posteriorly after cutting of the tensor tympani tendon. A Total Ossicular Reconstruction Prosthesis (TORP, Universal Titanium Prosthesis- H/A Head with Shoe) was placed from the malleus remnant to the stapes foot plate. This was 6mm in length and was held in position with a silastic rubber band attached to the neck of stapes. (figure 5)

**Figure 5**

Figure 5: TORP (Universal Titanium Prosthesis- H/A Head with Shoe) was placed from the malleus remnant to the stapes foot plate. This was held in position with silastic rubber band attached to the neck of stapes.

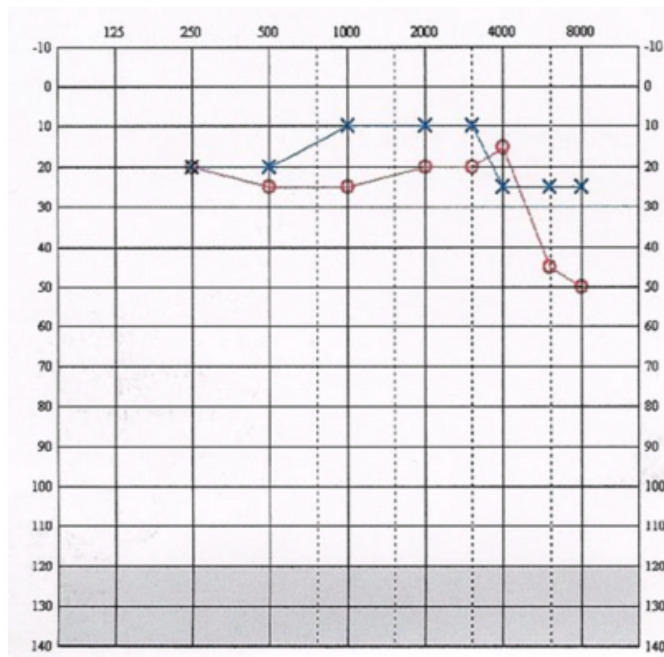


One month later. The pure tone audiometry showed almost normal hearing to the right ear with closure of the air bone gap. (figure 6)



**Figure 6**

Figure 6: One month after the operation, the pure tone audiogram showed almost normal hearing to the right ear with closure of the air bone gap.



**DISCUSSION**

Common causes of fracture of the malleus-handle in the literature are head trauma with skull base fracture (17 patients), blows on the tympanic membrane or barotrauma (7 patients), penetration of a pen holder or hair pins (6 patients), penetration of twigs entering the external auditory canal ( 4 patients), in about two patients the fracture was multiple. <sup>1</sup>

Harris & Butler <sup>3</sup> reported three patients with barotraumata and one with head trauma. All had an isolated fracture of malleus-handle. Pederson <sup>2</sup> reported two patients who had experienced malleus-handle fracture after quick removal of finger from the ear canal. Our patient had the same mechanism of injury. We believe that, when he removed his finger from the ear canal a large negative pressure was created in the canal. By this manoeuvre a relative over pressure in the middle ear resulted which was able to cause the malleus handle fracture. <sup>2</sup>

The diagnosis of malleus-handle fracture should be considered when a patient complains of hearing loss after trauma to the ear. The finding of high compliance tympanometry is characteristic of malleus handle fracture. The best diagnostic tool probably is the otomicroscope used together with siegle's speculum allowing for observation of the tympanic membrane movement including the malleus-

handle. <sup>2,3</sup>

Malleus-handle fracture may be detected on high resolution CT scans when a gap between the two malleolar fragments is present. However, if there is no gap or displacement of the fractured malleus segment the CT scan may reveal a normal appearance of the ossicular chain. <sup>4,5</sup>

Harris & Butler <sup>3</sup> reported four patients with isolated malleus-handle fracture. Surgical exploration was carried out in one patient with a malleus-handle fracture just below the lateral process. A chip of posterior canal wall bone was wedged into the fracture site to stabilize it. The surgery was partially successful. Harris &Butler <sup>3</sup> then recommended ossicular reconstruction technique next time using incus interposition between the stapes and the fractured malleus handle. They also suggested that a ventilation tube could be placed to reduce tympanic membrane and malleus movement during the healing process.

Pederson <sup>2</sup> reported two cases of isolated malleus- handle fractures below the lateral process that underwent surgical exploration. The edges of the fractures were freshened and some bone chips removed by curettage were placed on each side of the fracture. Gelfoam placed on the inner and outer surface of the tympanic membrane held this in position. Hearing was reported to be improved.

Applebaum & Goldin <sup>4</sup> reported one case of malleus-handle fracture. They used malleus to incus interposition graft of autologous cortical bone placed between the fracture line of the malleus-handle and the long process of the incus. Hearing was reported to be improved and there was closure of the air bone gap.

Our surgical approach was substantially different from those previous reported cases. We used the malleus relocation <sup>6</sup> and silastic banding technique <sup>7</sup>.A Total Ossicular Reconstruction Prosthesis (Universal Titanium Prosthesis-H/A Head with Shoe) was from the malleus remnant to the stapes foot plate (after removing the incus). The prosthesis was held in position with silastic rubber band attached to the stapes neck.

The patient reported improvement of his hearing immediately after the operation. A pure tone audiogram that was done one month later showed normal hearing except of mild high frequency sensori-neural hearing loss. (figure 6)

**CONCLUSION**

Malleus-handle fracture is a rare traumatic middle ear lesion.

We report a novel surgical technique for reconstruction of hearing using a TORP.

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