

CLINICAL RESEARCH

Ossicular Chain Damage in Temporal Bone Trauma: Epidemiological, Clinical and Pathological Characteristics

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ABSTRACT

OBJECTIVE

The purpose of this study is to investigate etiological, clinical and radiological characteristics of traumatic injuries of the middle ear ossicular chain and to evaluate hearing loss.

MATERIAL AND METHODS

Thirty patients with traumatic ossicular injuries were retrospectively analyzed. Traumatic events, clinical features, ossicular lesions, treatment procedures, and audiometric aspects were evaluated.

RESULTS

The mean age at the moment of trauma was 25 years (range, 6 years - 62 years). In 18 cases (60%), the injury occurred by a traffic accident and in 7 (23.3%) by a fall on head. There was evidence of ossicular dislocation or ossicular fracture radiologically in 20 cases with 11 cases of incudomalleolar dislocation; 3 cases of incudo-stapedial dislocation and 5 cases of both. There was one case of platina fracture in a case of perilymphatic fistula. All patients underwent tone audiometry. The hearing impairment could be conductive (9 cases) Or mixed (3 cases).

CONCLUSION

Ossicular chain injury by direct or indirect trauma can provoke hearing loss, tinnitus, and vertigo.

KEYWORDS

Middle ear ossicles; Conductive deafness; Trauma; Dislocation

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INTRODUCTION

The middle ear is often exposed to blunt and penetrating trauma, blast or injuries. Ossicular chain injuries include dislocation at any of the ossicular joint as well as fracture [1].

Ossicular dislocations are far more common than fractures [1,2]. They can be subdivided into incudomalleolar or incudostapedial joint, and dislocations of the incus, stapes or incudomalleolar complex.

Dislocations may range from a subluxation to a complete disruption of the joint. Fractures may include all three ossicles.

Hearing loss after temporal trauma is common. For traumas limited to the middle ear, hearing loss is purely conductive. It can be mixed in case of a stapediovestibular luxation or footplate fracture [3]. The purpose of this study is to review etiological, clinical and pathological features of traumatic lesions of the ossicular chain and to evaluate hearing loss.

MATERIALS AND METHOD

We conducted a retrospective study that had included all patients with traumatic ossicular injuries admitted in the ENT department of La Rabta Tunis; Tunisia, over a 14-years period (January 2010 to December 2023). The data about traumatic events, clinical features, ossicular injuries and hearing outcomes were collected from patients' records.

RESULTS

A total of 30 patients were included in this study. The mean age at the moment of trauma was 25 years (range, 6 years - 62 years). Patients were predominantly male (sex ratio: 14). Eighteen (60%) ossicular lesions were caused by a traffic accident and 7 (23.3%) by a fall on the head. An overview of the traumatic events is provided in Table 1.

Traumatic events	Numbers of Cases
Traffic Accident	18
Fall on the Head	7
Physical Agression	4
Unknown	1

Table 1: Distribution of traumatic events (n = 30).

Hearing loss was reported by all patients. Vertigo occurred in 10 cases. It varied from positional vertigo to global instability. Fifteen patients presented non-pulsatile tinnitus.

Otосcopy showed: 10 cases of hemotympanum, 5 cases of otorrhagia, 6 cases of ear drum perforation, 5 cases of ear conduct wound and 3 cases of CSF leak. Vestibular examination showed a spontaneous nystagmus in 10 cases.

Various degrees of peripheral facial paralysis were seen in 9 cases. Varying degrees of hearing loss existed in all cases: A conductive loss with a pure tone average of 43 dB in 18 cases, mixing hearing loss with an average speech frequency air conduction hearing loss of 35 dB in 11 cases and one case of deafness.

CT imaging showed a temporal bone fracture in all cases. Twenty of these were longitudinal and ten were transverse.

We found 9 cases of facial nerve channel lesions, 2 cases of pneumolabyrinth. Ossicular fractures were found in 10 cases: the malleus in 3 cases, the incus in 6 cases and the stapes in one case.

Ossicular dislocation was found in 20 cases with 11 cases of incudomalleolar luxation (Figure 1); 3 cases of incudostapedial luxation; 5 cases of both and one case of stapedovestibular luxation (Figure 2).



Figure 1: Axial section CT scan of the left temporal bone showing a longitudinal fracture with uncudo-malleolar dislocation (red arrow).



Figure 2: Axial section CT scan of the left temporal bone showing stapedo-vestibular luxation (red arrow).

DISCUSSION

According to the literature, 31% of temporal bone fractures in general population were caused by traffic accident followed by falls and assaults [4]. Bilateral temporal bone fractures occurred in 8% to 29% of patients [4,5]. In our series, 60% of ossicular lesions were caused by traffic accident. Men are four times vulnerable to trauma than women [5].

The structures threatened by fracture of the temporal bone are located in the bone itself or in its direct surrounding. They include the facial nerve, cochlea, labyrinth, ossicles, tympanic membrane, external auditory canal, jugular vein, carotid artery, dura and inferior cranial nerves [5,6].

The most common complication following temporal bone trauma is hearing loss, with a reported incidence ranging from 24% to 81% [7].

75% of patients reported hearing loss in the first week following head trauma with temporal bone trauma, decreasing to 37% after 3 weeks to 6 weeks. [7].

Post-traumatic conductive hearing loss (CHL) may be due to ossicular chain disruption.

Should hearing loss occur after a trauma, symptom chronology must be evaluated and an audiogram is required. In the first few days following injury, hearing may be difficult to evaluate, especially because of hemotympanum, which may lead to a transient CHL [8]. When conductive hearing loss persists more than 6 weeks after injury Ossicular chain dislocation must be considered.

CT scan with Axial images should be acquired at less than 1-mm thickness, and can be reconstructed in the coronal or sagittal plane. CT findings of ossicular injury may be difficult to appreciate early due to hemotympanum [8].

Temporal bone fracture is classified into two types based on the direction of the fracture line. 80% of temporal bone fractures are longitudinal and Ossicular chain damage complicates 15%-20% of these longitudinal fractures [9]. In deed Longitudinal fractures are more likely to involve the ossicular chain and result in conductive hearing loss (CHL), whereas transverse fractures are more likely to involve the otic capsule and result in sensorineural hearing loss (SNHL) [9,10].

According to Lantos and al Five types of ossicular dislocation have been described [8]:

1. Incudostapedial dislocation is the most common type it is mainly caused by a simultaneous tetanic contraction of the tensor tympani tendon and stapedius tendon.
2. Incudomalleal dislocation.
3. Incus dislocation.
4. Incudomalleal complex dislocation and Stapediovestibular dislocation which is extremely rare [7].

Incus is the most commonly injured ossicle because it's the largest, heaviest and has the fewest ligamentous attachments [8].

Stapes fracture is usually associated hemotympanum this is why there is poor detection sensitivity in the acute phase for stapes fractures.

Fracture of the footplate happens after a transverse fracture passing through the oval window, and may cause a peri lymphatic fistula with pneumolabyrinth [7].

Malleus fractures concern mainly the Handle and should be suspected in cases of sudden hearing loss after digital manipulation of the external auditory canal. Fractures of the incus concerns mainly its long process because of its fragility, fracture of the body or the lenticular process is Rare [8].

A Spontaneous recovery of traumatic conductive hearing loss is reported in 77% with conservative treatment.

According to Besson When hearing loss persists for six to seven weeks after trauma and exceeds 30 dB, surgical exploration is indicated [11].

CONCLUSION

In the event of trauma, the assessment and treatment of life-threatening injuries is tackled first, while the investigation of problems such as hearing loss is delayed. This may explain the delay in diagnosis and management of hearing loss resulting from trauma.

Damage to the middle ear should be suspected and recognized as early as possible, so that appropriate measures can be taken. A basic audiometric examination and a long follow-up period are important for patients suffering from temporal bone trauma and hearing loss.

Many different approaches are possible for surgical reconstruction of the ossicular chain.

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