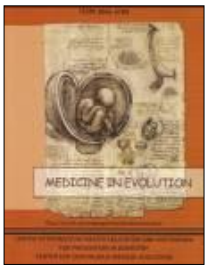
OSSICULAR CHAIN STATUS IN THE OTOLOGICAL PATHOLOGY OF THE ENT CLINIC TIMISOARA



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ABSTRACT

The status of the ossicular chain is important when reconstructing the transmission mechanism of the ear and to establish the prognosis for the patients with middle ear pathology.

This study analysed the status of the ossicular chain in the patients with middle ear pathology admitted in the ENT Clinic Timisoara between 2006 and 2009.

The ossicle the most frequently involved was the incus, while the malleus was found to be the most resistant ossicle to erosion.

Ossicular erosion was found to be much more common in unsafe CSOM (chronic suppurative otitis media).

***Key words**: safe CSOM, unsafe CSOM, malleus, incus, stapes.*

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INTRODUCTION

The middle ear functions to convey sound pressures from the air into the fluids of the inner ear is accomplished by the ossicular chain. It is an impedance-matching system that ensures that energy is not lost.

The normal human middle ear couples sound from low impedance sound energy in the ear canal through the tympanic membrane and ossicles to the relatively high impedance fluid within the cohlea.

The acoustic transformation theory states that this occurs with three lever systems: the tympanic membrane lever, the ossicular lever and the hydraulic lever[1]. As a result of these three lever systems, the acoustic transformer theory predicts a middle ear gain of approximately 27 to 34 dB [2].

MATERIAL AND METHOD

This was a prospective study, carried out in ENT Clinic Timisoara, between 2006 and 2009. A total of 346 patients were included in the study.

The criteria of inclusion in the study were: age over 18 years, pathology of the middle ear except otosclerosis and malignancy posted for middle ear surgery, no history of otologic interventions.

The exclusion criteria were: age less than 18 years, malignancy of the middle ear, otosclerosis, otitis externa, and previous history of ear surgery. Otosclerosis was excluded because it is a particular pathology of the middle ear with restrained implications on working protocols regarding the reconstruction of the tympano-ossicular chain.

The selected patients were subjected to a detailed history and complete ENT examination. The ears were examined by otomicroscopy to establish a preoperative diagnosis. All patients underwent a preoperative pure tone audiometry, to find out the hearing status and obtain documentary evidence and mastoid X-ray (bilateral Schuller's view) to assess the pathology and surgical anatomy of the middle ear. Intra-operative middle ear findings including ossicular chain status, erosion of the individual ossicles and continuity of the meleo-incudal and incudo-stapedial joint were noted.

RESULTS

The study group was formed by 184 males (53.17%) and 162 females (46.82%). The patinets were aged between 18 and 54 years (the median age was 31.2 with DS 12.9). The largest group in the study was formed by patients aged between 18 and 30 years (265 patients- 76.58%).

The primary complaints of the patients were ear discharge, present in 97.10% of the patients, followed by hearing loss in 89.59% of the cases.

According the ethiopathogeny of the lesions, 158 patients have been diagnosed with safe CSOM (45.66%), 178 with unsafe CSOM (51.44%), 5 with atelectatic otitis (1.44%), 4 with posttraumatic lesions (1.15%) and 1 with malformation of the ossicular chain (0.02%) (Table 1).

Table 1– Proportion of the cases according the ethiopathogeny

PATHOLOGY	NUMBER OF CASES
Safe CSOM	158
Unsafe CSOM	178
Posttraumatic	4
Malformations	1
Atelectatic CSOM	5

The ossicular chain was found intact in 134 of the cases (38.72%): in 122 patients with safe CSOM and in 12 patients with unsafe CSOM, who presented only perforations of the tympanic membrane (see fig. 1). Of the 346 patients included in the study, 212 (61.27%) presented discontinuity of the ossicular chain. The malleus was the most resistant ossicle to erosion in our study. It was found intact in 322 patients in the study group (93.06%) and in 188 of the cases with discontinuity of the ossicular chain (88,67%). 4 patients in the study group (1.15%) presented necrosis of the head of the malleus and in 20 of them (5.78%) it was absent (fig 2).

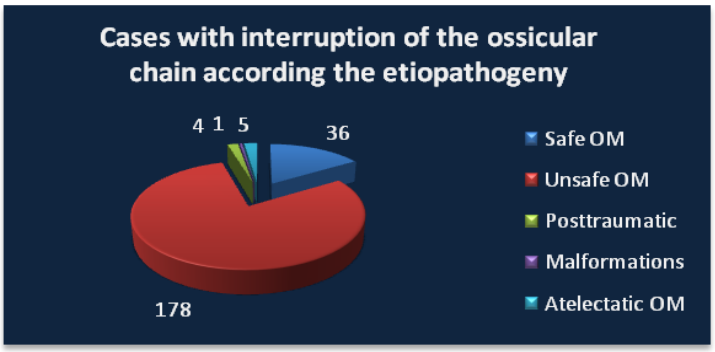

Fig.1 Cases with interruption of the ossicular chain according the etiopathogeny.

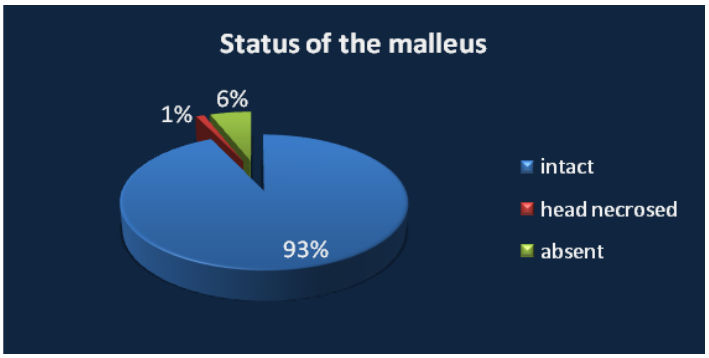

Fig.2 Status of the malleus.

Incus was the ossicle the most commonly eroded in our study. It was found intact in 143 of the 346 cases included in the study (41.32%) and in only 9 of the 212 cases with discontinuity of the ossicular chain (4.24%). 11 of the patients with safe CSOM presented necrosis of the lenticular process (6.96%) and 25 (15.82%) necrosis of the long process.

In 37 of the cases with unsafe CSOM (20.78%) we found necrosis of the lenticular process and in 30 of these patients (16.85%) necrosis of the long process.

In 28 of them (15.73%) only the incus was absent, in 47 (26.40%) the absence of the incus was associated with the necrosis of the superstructure of the stapes and 20 cases (11.23%) with the involvement of the entire ossicular chain. In 3 of the 5 cases with atelectatic CSOM (60%) we found necrosis of the long process of the incus. One case with trauma presented fracture of the long process of the incus and in one case the long process was congenitally absent (fig. 3). The stapes was found intact in 279 of the 346 patients in the study group (80.63%) and in 145 of the 212 patients with discontinuity of the ossicular chain (68.39%). In 47 of the cases with unsafe CSOM (26.4%) the necrosis of the superstructure of the stapes was associated with the absence of the incus and in 20 cases (11.23%) it was associated with the involvement of the entire ossicular chain (fig. 4).

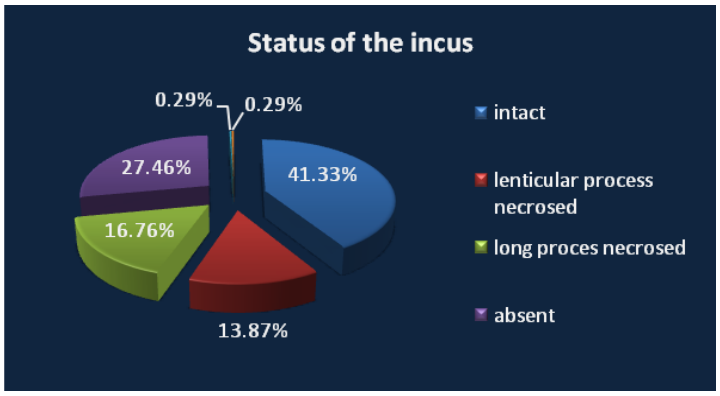

Fig.3 Status of the incus.

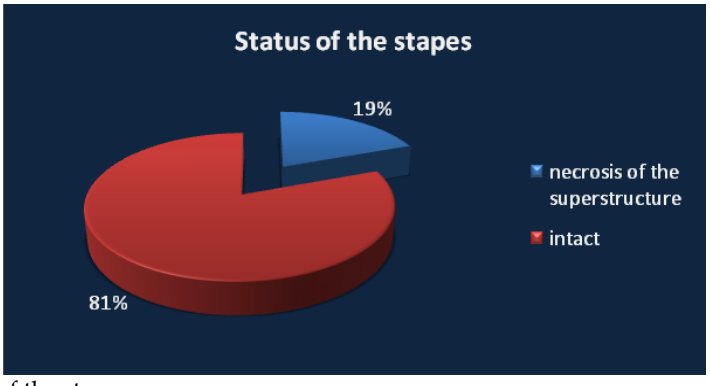

Fig.4 Status of the stapes.

The melleo-incudal joint was found intact in 322 cases (93.06%) and discontinuous in 24 cases (6.94%). All of the 24 cases were diagnosed with unsafe CSOM. The incudo-stapedial joint was found intact in 141 patients (40.75%). It 205 cases it was discontinuous (59.25%): in 36 of the 158 cases with safe CSOM (22.78%), in 162 of the 178 patients with unsafe CSOM (91.01%), in 3 of the 5 patients with atelectatic OM (60%).

In 3 cases we found posttraumatic luxations of the incudo-stapedial joint and in one case its discontinuity was congenital.

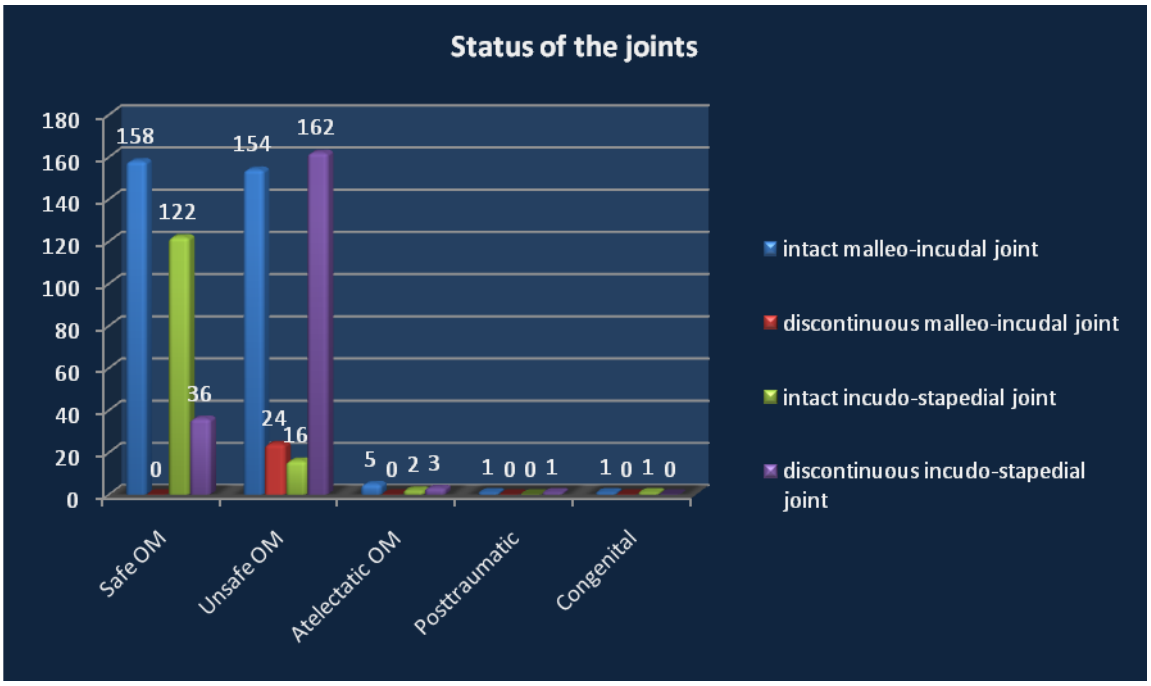

Fig.5 Status of the joints.

DISCUSSIONS

The most frequent pathology encountred in our study is the inflamatory one: 158 patients of the 346 studied suffered from safe CSOM, while 178 were diagnosed with unsafe CSOM. The ossicular chain was interrupted in 22.78% of the cases with safe CSOM and in 93.25% of the cases with unsafe CSOM. Both types of CSOM, tubotympanic which is considered safe, as well as attico-antral which is considered unsafe, may lead to errosion of the ossicular chain. This propensity for ossicular destruction is much greater in cases of unsafe CSOM, due to the presence of cholesteatoma and/or granulations[3]. The proposed mechanism for erosion is chronic middle ear inflamation as a result of overproduction of citokines – TNF α, interleukin 2, fibroblast growyh factor and platelet derived growth factor, which promote hipervascularisation, osteoclast activation and bone resorbtion causing ossicular damage. TNF α also produces neovascularisation and hence granulation tissue formation. CSOM is thus an inflamatory process with a defective wound healing mechanism [4]. This inflamatory process in the middle ear is more harmful the longer it stays and the nearer it is to the ossicular chain[5].

The status of the ossicular chain is important when electing the type of intervention, but also in order to establish the prognosis, as it is shown by the Middle Ear Risk Index described by Kartouch (table 2).

The most commonly affected age group was between 18 and 30 years. This early presentation may be due to increased awareness to health issues and difficulty in hearing affecting the efficiency of work, leading patients and parents to seek early medical intervention.

Similar results were finding by othar authors too[6-8].

Table 2–Middle Ear Risk Index described by Kartouch

Risk factor	Value
Othoreea (Belucci)	
I. Dry middle ear	0
II. Occasionnally wet middle ear	1
III. Constantly wet middle ear	2
IV. Constantly wet middle ear and attical perforation	3
Perforation	
• absent	0
• present	1
Cholesteatoma	
• absent	0
• present	1
Ossicular status (Austin/Kartouch)	
O: M+I+S+ (intact ossicular chain)	0
A: M+S+ (malleus present, stapes present)	1
B: M+S- (malleus present, stapes absent)	2
C: M-S+ (malleus absent, stapes present)	3
D: M-S- (malleus absent, stapes absent)	4
E: fixation of the head of the malleus	2
F: fixation of the stapes	3
Middle ear granulations or effusions	
• No	0
• Yes	1
History of surgery	
• No	0
• First look	1
• Revision	2

The ratio between male and female patients was 1.13:1. The majority of cases were diagnosed with CSOM. The predominance of the male can be explained by the fact that they work more outdoor and they are more prone to atmospheric and climate changes.

The incus was the most affected ossicle. It was found intact in only 41.32% of the cases, eroded in 31.5% of the cases and absent in 27.46% of them. The most common defect encountred was the necrosis of the long process (16.76%), followed by the necrosis of the lenticular process (13.87%). In 43.10% of the cases, the necrosis of the long process was due to the safe CS.OM and in 51.72% of them by the unsafe CSOM. The necrosis of the lenticular process was due to the safe CSOM in 22.91% of the cases and to the unsafe CSOM in 77.08%. Similar results are reported by other authors, too. Austin reported the most common ossicular defect to be the eroasion of incus, with intact malleus and stapes, in 29.5% of the cases[9]. Kartoush found the erosion of the long process of the incus with intact malleus handle and stapes superstructure as the most common

ossicular defect [10]. Shreshta et al. and Mathur et al. also reported similar results[11-12]. Goldenberg reports lesions of the incus in 96.6% of the unsafe CSOM[13], while Buchheim et al. in 88% of the cases[14].

The most resistant ossicle was the malleus. It was intact in 93% of the patients in the study group. In 6% of the cases it was absent and in 1% there was found necrosis of its head. All 4 patients were diagnosed with unsafe CSOM. Sade et al. found erosion of the malleus in 6% of the cases.

The mechanism of the ossicular lesions varies with the pathology. In the normal ear the mucosa that covers the ossicles is constituated by a respiratory epithelium that rests on a basal membrane which separates it from the connective tissue. The connective tissue is constituated by collagen fibers, cells – fibrocytes, fibroblats, hystiocytes, mast cells- and blood vessels. When inflamation occurs in safe CSOM, this tissue is replaced by granulation tissue. The bone loses its cortical; it becomes irregular and is invaded by inflamatory tissue. The presence of the granulations, rich in lysosomes is associated with enzymatic distruction. The matrix of the collagen is degraded either by a specific collagenase, either by nonspecific agents like the lysosomes or the acid hydrolase[15]. In unsafe CSOM, the lesions are caused by the presence of the keratinised squamous epithelium in the middle ear. It is perceived like a foreign body and determines the formation of the inflamatory granuloma, which is twice more distructive for the ossicles than the inflamation in the safe CSOM. The evolutive and invasive character of the cholesteatoma causes lesions that can extend to all the middle ear and even beyond that.

Yuasa showed the presence in the cholesteatoma of five volatile fat acides that destruct the hydroxiapatite cristals[16].

CONCLUSIONS

In this study we found the malleus to be the most resistant ossicle, while the incus was the most susceptible.

The ossicular lesions are more frequent in unsafe CSOM, which proves its destructive capacity and its worse prognosis.

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