

A Study on Ossicular Erosion in Chronic Suppurative Otitis Media

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Abstract

Introduction: Chronic suppurative otitis media (CSOM) is a common condition in otorhinolaryngology and it is characterized by chronic, intermittent or persistent discharge through a perforated tympanic membrane. Poor living conditions, overcrowding, poor hygiene, and nutrition have been suggested as the basis for the widespread prevalence of CSOM in developing countries.

Aim: To study the incidence of ossicular erosion with respect to each type of perforation of tympanic membrane.

Materials and Methods: Patients aged more than 16 years, diagnosed with CSOM and posted for middle ear surgery were included. Patients who were <16, had malignancy of middle ear, otitis externa, or previous history of ear surgery were excluded.

Results: In this study of 164 patients, the predominant type of CSOM was mucosal type. Among the pre-operative otoscopic examination results, the most common type of tympanic membrane perforation was subtotal perforation (43.2%), followed by perforation being small all quadrant central perforation (20.1%). Most common ossicle to erode in CSOM cases is a long process of incus (24.4%).

Conclusion: Ossicular erosion was found to be much more common in unsafe CSOM than in safe CSOM. Malleus was found to be the most resistant ossicle to erosion whereas incus was found to be the most susceptible.

Key words: Cholesteatoma, Chronic suppurative otitis media, Ossicles

INTRODUCTION

Chronic suppurative otitis media (CSOM) is a prevalent middle ear pathology that constitutes of tympanic membrane perforation together with a chronically inflamed middle ear mucosa. CSOM can occur with or without cholesteatoma which is an in-growth of eardrum skin into the middle ear cavity.¹ CSOM is the leading cause of conductive hearing impairment in adults which is secondary to damage of the ear drum and middle ear ossicles induced by chronic inflammation present in the tympanic cavity. Ossicular erosion, a frequent complication of CSOM, may lead to total failure of middle ear mechanics and resulting in substantial hearing loss.² Both

types of CSOM, tubotympanic which are considered safe, as well as atticotympanic which is considered unsafe, may lead to erosion of the ossicular chain.³ This propensity for ossicular destruction is much greater in cases of unsafe CSOM, due to the presence of cholesteatoma and/or granulations.⁴ The proposed mechanism for erosion is chronic middle ear inflammation as a result of overproduction of cytokines – tumor necrosis factor (TNF) alpha, interleukin-2, fibroblast growth factor, and platelet-derived growth factor, which promote hypervascularization, osteoclast activation, and bone resorption causing ossicular damage. TNF-alpha also produces neovascularization and hence granulation tissue formation. CSOM is, thus, an inflammatory process with a defective wound healing mechanism.⁵ This inflammatory process in the middle ear is more harmful the longer it stays and the nearer it is to the ossicular chain.

Aim

The aim of the study was to study the incidence of ossicular erosion with respect to each type of perforation of tympanic membrane.

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www.ijss-sn.com

Month of Submission : 06-2017
Month of Peer Review : 07-2017
Month of Acceptance : 08-2017
Month of Publishing : 08-2017

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MATERIALS AND METHODS

This was a prospective study, conducted in the Department of Otorhinolaryngology, Tirunelveli Medical College Hospital, Tirunelveli. Patients aged more than 16 years, diagnosed with CSOM and posted for middle ear surgery were included. According to the pro forma, detailed history was taken then through ENT, and systemic examination was done. The ears were examined by otoscopy initially and otoendoscopy to establish a preparative diagnosis of safe or unsafe disease. All patients underwent a pure tone audiometry, to find out the hearing status and obtain documentary evidence for the same, and X-ray mastoid (bilateral Schueller's view) to assess the pathology and surgical anatomy of the mastoid. Exclusion criteria: History of previous mastoidectomy, previous stapedotomy or stapedectomy, malignancy of middle ear, and CSOM in congenitally defective ears.

RESULTS

A total of 164 patients with CSOM were recruited for this study. Of 164 patients, 40.9% were males and 59.1% were females Table 1. 33 patients had both ears included which were operated sequentially Table 2. Tubotympanic disease: This is also known as safe disease because it is bereft of any serious complications. The infection is limited to the mucosa and the antero inferior part of the middle ear cleft (Table 3). Out of 164 cases that were prepared for mastoidectomy, 90.85% cases were CSOM mucosal type, and 6.09% were CSOM squamous type. Maximum number of tympanic membrane perforations that presented to us were subtotal perforations. Small quadrant perforations were the next most common presentation Table 4. In 24.4% cases, long process of incus was eroded, proving to be the most common ossicular erosion in CSOM cases. Only 7.9% cases had stapes erosion in our study Table 5. Thus, stapes is also one among the resistant ossicles in the pathology of CSOM. In atticoantral type of CSOM, long process of incus is the most common erosion found in our study. Percentage of erosion of each ossicle is higher in atticoantral than in tubotympanic Table 6. In CSOM mucosal type, ossicles were mostly intact, compared to squamous type. Among the eroded ossicles, long process of incus is most commonly eroded. Maximum cases were managed by cortical mastoidectomy with Type 1 tympanoplasty. In few cases, when the remaining ossicles were unhealthy for ossicular reconstruction, we tried harvesting a bone graft from posterior canal wall, and drilling and grafting were done in such bone grafts, and ossiculoplasty was done. Such cases are also included in our study. 15 cases were managed by transposition of incus between malleus and suprastructure of stapes. Conchal cartilage was grafted in few cases in ossiculoplasty and in all these cases, the cartilage graft was placed medial to

Table 1: Gender distribution

Gender	Frequency (%)
Male	67 (41)
Female	97 (59)

Table 2: Side affected

Side	Frequency (%)
Right	64 (39)
Left	67 (41)
B/L	33 (20)

Table 3: Classification of CSOM

Classification	Frequency (%)
TT	149 (91)
AA	10 (6)
Others (Grade 4 RET, aural polyp)	5 (3)

CSOM: Chronic suppurative otitis media, RET: Retraction

Table 4: Pre-operative otoscopic finding

Otoscopy finding	Frequency (%)
PSR	9 (5)
Posterior	21 (13)
Subtotal perforation	71 (43)
Central perforation	33 (20)
Attic	1 (1)
Anterior	24 (15)
Grade 4 RET	4 (2)
Aural polyp	1 (1)

PSR: percentage of signal intensity recovery, RET: Retraction

Table 5: Status of ossicles

Ossicles	Frequency (%)
Malleus	
Handle eroded	14 (8)
Head and handle eroded	3 (2)
Intact	147 (90)
Incus	
Long process eroded	40 (25)
Completely eroded	2 (1)
Intact	122 (74)
Stapes	
Suprastructure eroded	13 (8)
Intact	151 (92)

temporalis fascia graft to prevent retraction of the graft Table 7.

DISCUSSION

Thomsen *et al.*⁶ reported that bone erosion in chronic otitis media was more prevalent when cholesteatoma was present, but it still occurred in the absence of cholesteatoma.

Table 6: Classification of ossicular erosion based on tubotympanic and atticoantral type of CSOM

Ossicles	Frequency (%)		
	Tubotympanic	Atticoantral	Others
Malleus			
Handle	8 (5)	3 (30)	2 (40)
Head and handle	0 (0.00)	3 (30)	0 (0)
Intact	141 (95)	4 (40)	3 (60)
Incus			
Long process	31 (21)	7 (70)	2 (40)
Completely eroded	0 (0)	2 (20)	0 (0)
Intact	118 (79)	1 (10)	3 (60)
Stapes			
Suprastructure	6 (4)	6 (60)	2 (40)
Intact	143 (96)	4 (40)	3 (60)

CSOM: Chronic suppurative otitis media

Table 7: Classification of surgeries done

Surgeries performed	Frequency (%)
CM, bone graft from post canal wall, over footplate articulate with M	1 (1)
CM, bone graft from post canal wall, over footplate arti with neovascularization TM	2 (1)
CM, I reshaped and kept bet M and SS	15 (9)
CM, I reshaped between SS and neovascularization TM	1 (1)
CM, M reshaped between footplate and neovascularization TM, conchal Cover M	3 (2)
CM, M reshaped between SS and neovascularization TM	2 (1)
CM, M reshaped between SS and neovascularization TM, conchal cartilage over M	1 (1)
CM, Type 1 tympanic	114 (68)
CM, Type 1 tympanic, conchal cartilage under the handle	2 (1)
CM, Type 2 tympanic	1 (1)
CM, Type 3 tympanic	5 (3)
CM, Type 3 tympanic, conchal cartilage cover SS	2 (1)
CM, M reshaped and placed over SS	3 (2)
MRM, bone graft from post canal wall, over footplate	2 (1)
MRM, M reshaped between footplate and neovascularization TM	1 (1)
MRM, Type 1 tympanic, conchal cartilage under the handle	1 (1)
MRM, Type 3 tympanic	3 (2)
MRM, Type 4 tympanic	4 (2)
MRM, M reshaped and kept over footplate	1 (1)

MRM: Modified radical mastoidectomy, CM: Cortical mastoidectomy, TM: Tympanic membrane, SS: Stapes superstructure, PSR: Posterosuperior retraction, RET: Retraction

Mathur *et al.*,⁷ in 1991, observed erosion of incus in 22% of cases and Quaranta *et al.*,⁸ in 1995, reported same in 27% cases.

Udaipurwala *et al.* have probably considered the lenticular process to be a part of the long process of incus, since they have not mentioned it separately.⁹ Austin reported the most common ossicular defect to be the erosion of incus, with intact malleus and stapes, in 29.50% cases.¹⁰ Kartush

found erosion of long process of incus with an intact malleus handle and stapes suprastructure (Type A) as the most common ossicular defect.¹¹ Shrestha *et al.* and Mathur *et al.* also reported similar findings in unsafe CSOM.^{7,12}

It is hypothesized that middle ear ossicles damage in CSOM is induced by an active phenomena of osteoclastic osseous resorption rather than by a passive avascular necrosis.¹³ The suggested mechanism for bone erosion is excessive formation of inflammatory mediators in the tympanic cavity which induces osteoclast activation and bone resorption resulting in ossicular destruction. The duration of the inflammatory process and its vicinity to the ossicular chain are factors which appear to be the most harmful for the ossicles.^{14,15} The factors that may explain that the incus lenticular and long processes being more vulnerable are possibly their tenuous blood supply, noticeable bone marrow, and their exposure to the external milieu, especially in posterior perforations.^{16,17}

Resorption of malleus handle is more common in subtotal perforations where the handle is completely exposed to the external environment together with the cumulative effect of reduced blood supply from the drum.

CONCLUSION

In this study, we found the malleus to be the most resistant ossicle to erosion in CSOM whereas incus was found to be the most susceptible. The incidence of ossicular erosion was found to be much greater in unsafe CSOM than in safe CSOM.

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How to cite this article: Balasubramanian C, Santhanakrishnakumar B, Anandan H. A Study on Ossicular Erosion in Chronic Suppurative Otitis Media. Int J Sci Stud 2017;5(5):94-97.

Source of Support: Nil, **Conflict of Interest:** None declared.