

Ossicular Chain Status in Chronic Suppurative Otitis Media

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Abstract: the Observational Study Is Done To Find Out Different Ossicular Involvement In Chronic Suppurative Otitis Media With Cholesteatoma And Granulations In Relation To The Hearing Loss And Possibility Of Ossicular Reconstruction.

Abbreviation: High-Resolution Computed Tomography (HRCT), Chronic Suppurative Otitis Media (CSOM), Air Bone Gap (ABG).

Keywords: Tubotympanic, Attico-Antral, Cholesteatoma, Granulations And Ossicule.

I. Introduction

CSOM, A Common Condition In Otorhinolaryngology, Is Characterized By Chronic, Intermittent Or Persistent Discharge Through A Perforated Tympanic Membrane. Both Types Of CSOM, Tubotympanic Which Is Considered Safe, As Well As Attico-Antral Which Is Considered Unsafe, May Lead To Erosion 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. The Proposed Mechanism For Erosion Is Chronic Middle Ear Inflammation As A Result Of Overproduction Of Cytokines—TNF Alpha, Interleukin-2, Fibroblast Growth Factor, And Platelet Derived Growth Factor, Which Promote Hyper Vascularisation, Osteoclast Activation And Bone Resorption Causing Ossicular Damage^[1, 2]. CSOM Is Thus An Inflammatory Process With A Defective Wound Healing Mechanism. This Inflammatory Process In The Middle Ear Is More Harmful The Longer It Stays And The Nearer It Is To The Ossicular Chain^[1, 2]

II. Materials And Methods

All Patients Presenting With CSOM Who Were Planned For Mastoid Exploration Surgery In Department Of ENT, Gauhati Medical College And Hospital Within A Period Of Two Year – From 1st January, 2013 To 31st December, 2015, Were Taken Up For The Study. This Prospective Study Was Conducted To Find Out The Status Of Ossicles In Cases Of Unsafe Chronic Suppurative Otitis Media. The Selected Patients Were Subjected To A Detailed History And Complete ENT Examination. The Ears Were Examined By Otoscopy Initially And Subsequently Under Microscope To Establish A Preoperative Diagnosis Of Unsafe Disease.

All Patients Underwent A Preoperative Pure Tone Audiometry, To Find Out The Hearing Status And Obtain Documentary Evidence For The Same, And HRCT Mastoid To Assess The Pathology And Surgical Anatomy Of The Mastoid.

Intra-Operative Middle Ear Findings Including Ossicular Chain Status, Erosion Of The Individual Ossicles, And Continuity Of The Malleo-Incudal And Incudo-Stapedial Joint Were Recorded And Analysed.

III. Results

A Total Of 167 Patients Were Included In This Study Out Of 99,208 Patients Attending ENT OPD In Tertiary Care Institute During The Two Years Study Period. The Results Of Our Study Showed Age Distribution Of The Patients Ranges From 4 – 60 Years With A Mean Age Of 23.17 Years. Commonest Age Group Was 11- 20 Years With 66 Patients Followed By 21- 30 Years With 41 Patients. Out Of All, 115 Cases Were Male And 52 Cases Were Female, Which Gives A Male: female ratio of 2.21:1. Chronic ear discharge with hearing loss was the main clinical presentation (60.7%). The duration of ear discharge ranged from 6 months to 50 years (Mean duration 11.30 years). Forty six (27.5%) cases had duration of ear discharge Between 10 And 15 Years. The Incidence Of Bilateral Disease Was Found In 38 Cases In The Studied Sample. All The 167 Ears Were Planned For Intervention Based On Clinical, Audiological And Radiological Findings & Operated Depending Upon Intra-Operative Picture. None Of The Patients With Disease In The Opposite Ear Were Operated During The Study Period And Are Under Regular Follow-Up.

The Malleus Was Found To Be The Most Resistant Ossicle To Erosion In CSOM. The Malleus Was Found Intact In 63 (37.33%) And Eroded In 25 (15.33%) And Absent In 79 (67.33) Cases. The Handle Of Malleus In 19 (11.37%) Cases, Was The Most Commonly Necrosed Part Of Malleus.

Incus Was The Ossicle Most Commonly Found Eroded In Our Study. Incus Was Observed To Be The Most Common Ossicle To Get Necrosed In Cases Of CSOM. In Our Study, Incus Was Found Intact In 47 (28.14%) Cases, Eroded In 16 (9.58%) Cases And Absent In 104 (62.27%) Cases.

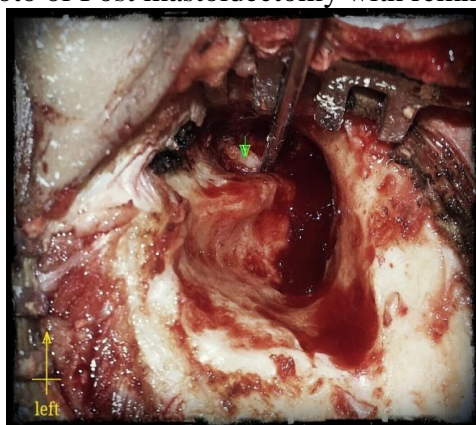
Stapes Was Found Intact In 56 (33.35%) Cases While In 111 (66.46%) The Superstructure Of Stapes Was Found Eroded By The Disease. The Footplate Was Found Intact In All Cases.

The Malleo-Incudal Joint Was Found Intact In 88 (52.69%) And Discontinuous In 79 (47.30%) Cases. The Incudo-Stapedial Joint Was Found Intact Only In 47 (28.14%) Cases And Discontinuous In 120 (71.85%) The Ossicular Chain Was Found Intact (M+I+S+) In 47 Cases. Intact Malleus With Eroded Incus And Stapes Was Seen In 9 Cases. All Ossicles Were Absent Except Stapes Superstructure In 79 Cases.

Table 1. Status of ossicles

Ossicle	Intact	Eroded	Absent
Malleus	63	25	79
Incus	47	16	104
Stapes superstructure	56	13	98

Figure 1: Intra-operative photo of Post mastoidectomy with remnant stapes superstructure



IV. Discussion

Abnormal Extension Of The Keratinizing Epithelium Of The External Acoustic Meatus Into The Middle Ear Cavity Through Tympanic Membrane Is Considered To Be The Main Cause Of Middle Ear Cholesteatoma [3, 4]. Ingrowths Of Cholesteatoma Result In Erosion Of Surrounding Bony Structures. Bony Erosion Is Related To Combined Effects Of Hyperaemic Osteoclastic Bone Resorption, Cholesteatoma Mass & Collagenase Activity [1]. The Possible Consequences Of Such An Osteolysis Are Complications Including Ossicular Destruction, Automastoidectomy, Meningitis, Dural Sinus Thrombosis, Facial Nerve Palsy, Labyrinthine Fistula, And Extension To The Petrous Bone [4].

Among The Ossicles, The Long Process Of Incus, Stapes Crurae, Body Of Incus And Manubrium Are Involved In That Order Of Frequency [5]. The Reason That The Long Process Of Incus And Stapes Superstructure Is Most Frequently Affected Is Likely To Be Due To Their Delicate Structure And Location [5], Rather Than Their Tenuous Blood Supply [6]. Continuous Mechanical Pressure Effect Of The Retraction Pocket, Granulation Or Cholesteatoma On The Ossicles, Osteoclastic enzymes released by disease activity and bacterial activity in case of associated infections may play minor roles. [6] Malleus and stapes are more resistant to necrosis. [6]

Pure tone Audiometry is traditionally used to suspect conductive hearing loss due to ossicular component. The erosion of each ossicle contributes in a graded and independent manner to the increase in ABG, with the status of the incus having the most statistically significant association with ABG [7]. In CSOM without cholesteatoma, the ABG of 20 dB or less at 500 Hz and 30dB or less at 1 kHz decreased possibility of ossicular discontinuity from 33 % to % .6% and 15.5% respectively. ABG level greater than 30 dB at 2 kHz and greater Than 40 Db At 4 Khz Increased The Probability Of Ossicular Disruption From 33 % To 51 % And 89 %. In Presence Of Cholesteatoma The Chances Are 88%. The Ability Of ABG To Alter Probability Of Ossicular Disruption Was Not Significant In Presence Of Cholesteatoma. [8]

Incus Was Most Significantly Affected Ossicle. Furthermore, Destruction Of Malleus And Stapes Was Often Accompanied By Destruction Of Incus. A Partially Eroded Incus Caused Significantly Increase In ABG

From That Of An Intact Incus With Cholesteatoma Abutting. A Partially Eroded Incus And A Partially Eroded Stapes Caused Significantly Increase In ABG Compared To A Partially Eroded Incus. A Completely Eroded Incus Caused Significantly Increase In ABG Compared To A Partially Eroded Incus. False Fibre-Connected Would Significantly Influence On ABG In Some Ossicular Chain Erosion Patterns. Cholesteatoma Abutting An Intact Ossicle Significantly Altered Average ABG Compared To A Normal Ossicle.^[9]

HRCT Is Most Valuable For Detection Of Early Erosive Changes In The Ossicles, Particularly In Smaller Parts, As Well As In Detection Of Non-Dependent Soft Tissue Opacification Suggestive Of Cholesteatoma, Usually Made On Otologic Examination.^[10]

In This Study We Studied A Total Of 167 Patients Of CSOM To Assess The Intra-Operative Ossicular Status. The Duration Of Disease In Unsafe Cases Was Generally Seen To Be Longer. Chronic Ear Discharge With Hearing Loss Was The Main Clinical Presentation (60.7%). The Duration Of Ear Discharge Ranged From 6 Months To 50 Years (Mean Duration 11.30 Years). Fourty Six (27.5%) Cases Had Duration Of Ear Discharge Between 10 And 15 Years. The Duration Of Hearing Loss Was In All Cases Found To Be Lesser Than The Duration Of Discharge. This May Be Attributed To Difficulty In Appreciating Minor Degrees Of Hearing Loss By The Patient. The Hearing Loss Would Be Noticed Only When The Disease Has Progressed Sufficiently To Cause A Significant Impairment Of Hearing By Perforation Or Ossicular Destruction.

Malleus Was Found To Be The Most Resistant Ossicle, Found Intact In 63 (37.3%) Cases In Our Study. It Was Eroded In 25 (15.33%) And Absent In 79 (47.3%) Cases. The Handle Of Malleus In 19 (11.37%) Cases, Was The Most Commonly Necrosed Part Of Malleus. These Findings Were Consistent With Those Of Udaipurwala Et Al.^[11] Sade Et Al. Found In Unsafe Disease Malleus Necrosis In 26.00% Cases.^[2]

Incus Was Observed To Be The Most Common Ossicle To Get Necrosed In Cases Of CSOM. In Our Study, Incus Was Found Intact In 47 (28.14%) Cases, Eroded In 16 (9.58%) Cases And Absent In 104 (62.27%) Cases. The Commonest Defect Was Erosion Of The Long Process In 16 (19.58%) Cases. Udaipurwala Et Al. Had A Incidence Of Necrosis Of The Incus At 41.00%.^[11] The Long Process Of Incus Was Found To Be The Most Commonly Necrosed Part Similar As Compared To Our Study. Austin Reported The Most Common Ossicular Defect To Be Erosion Of Incus, With Intact Malleus And Stapes, In 29.50% Cases^[12]. Kartush Found Erosion Of Long Process Of Incus With An Intact Malleus Handle And Stapes Superstructure As Most Common Ossicular Defect^[13].

Stapes Was Found Intact In 56 Cases And Involvement Of Stapes Superstructure Was Noted In 111 Cases. The Footplate Was Found Intact In All Cases. The Incidence Of Stapedial Necrosis In Our Study Was Found To Be Much Higher Than Other Available Studies Probably Due To Late Presentation. Udaipurwala Et Al. Found The Superstructure To Be Necrosed In 21.00% Cases, Which Matches With Our Findings^[11]. Austin Reported Erosion Of Stapes At Around 15.50%^[13]. Sade Et Al. Reported Stapes Involvement In Unsafe CSOM To Be 36.00%^[2].

CT Is Substantially Reliable In Determination Of Status Of Ossicular Chain. These Results Are In Concordance With Other Studies In Literature. Fine Structures Of The Auditory Ossicles Could Be delineated Clearly In Images Reconstructed Using The Multislice Scan CT, Which Allows A Slice Thickness Of 0.5 Mm^[14] High-Resolution Computed Tomography (HRCT) Is Most Valuable For The Detection Of Early Erosive Changes In The Ossicles, Particularly In The Smaller Parts Such As The Incudo-Stapedial Junction^[14]. Pre-Operative Knowledge Of The Status Of The Ossicular Chain Would Allow The Surgeon To Be Ready For Ossicular Chain Reconstruction And To Better Advise The Patient On The Degree Of Hearing Attainable After Surgery.

Presence Of Cholesteatoma Is A Chronic Phenomenon And It Seems That Patients Are Only Referred For Treatment In The Later Stages Of The Disease, Which Suggests A Lack Of Information, Education, Training, And Shortage Of Health Care. To Decrease Morbidity, Physicians Need To Be Alert And Informed About Chronic Otitis Media And The Extensive Cholesteatoma. Due To The Extensive Damage To The Ossicles & Extensive Disease, The Difficulty Of Restoring The Hearing During A Single Procedure, The Probable Need For Several Surgeries, The Outcome Of Attempts To Restore Hearing Can Be Limited In These Patients. Patients Must Therefore Be Fully Informed About The Potential Issues Before Surgery.

V. Conclusion

Malleus Is Found To Be The Most Resistant Ossicle To Erosion In Chronic Suppurative Otitis Media Whereas Incus Was Found To Be The Most Susceptible One. Early Detection Of Disease With Minimal Ossicular Damage Is Best For Good Ossiculoplasty Procedure And Thereby Utmost Hearing Outcome With Disease Control. Pre-Operative Knowledge Of The Status Of The Ossicular Chain Would Allow The Surgeon To Be Ready For Proper Ossicular Chain Reconstruction And To Better Advise The Patient On The Degree Of Hearing Attainable After Surgery

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