



ORIGINAL RESEARCH PAPER

Otorhinolaryngology

CORRELATION BETWEEN PRE-OPERATIVE HRCT-TEMPORAL BONE FINDINGS WITH THAT OF SURGICAL FINDINGS IN PATIENTS OF UNSAFE CSOM

KEY WORDS:

CSOM,HRCT,TNF,FGF,PD
GF,FC,IAC,CC,CR,VA,PS

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ABSTRACT

Chronic suppurative otitis media (CSOM) is defined as chronic inflammation of the middle ear and mastoid. The disease manifests most commonly as hearing loss and intermittent otorrhea. CSOM can be seen with or without cholesteatoma. Acquired cholesteatoma which occurs as a sequela to the chronic otitis media is an important and common cause of middle ear diseases and its complications challenge both Otologists and Radiologists. Acquired cholesteatoma develops with keratin epithelium invading the middle ear. It is a potentially dangerous disease due to its characteristics of growth, erosion, and local destruction. Cholesteatoma can be recognized by the presence of attic squames, marginal perforation, and retraction pockets on otoscopic examination. High Resolution Computed Tomography is most valuable for the detection of non-dependent soft tissue opacification suggestive of cholesteatoma, as well as the extent and site of cholesteatoma and its sac, assessing the ossicles, evaluating the facial nerve, tegmen, and sinus plate, and determining dural, sigmoid sinus, jugular bulb positions and complications of cholesteatoma. Due to its high sensitivity, HRCT is the imaging modality of choice for the evaluation of cholesteatoma. It assists the surgeon to decide on the type of surgical procedure and also alerts the surgeon to possible intra- and post-operative complications. Since ossicles are commonly eroded, the prognosis of hearing can be predicted. The purpose of this study is to correlate temporal bone HRCT scans with the intraoperative findings and assess the accuracy of scans in patients with unsafe CSOM. It will also demonstrate the advantage of a temporal bone CT scan in the detection of tympanic cholesteatoma, mastoid cholesteatoma, and the status of ossicles to help in predicting the prognosis of hearing and reveal the diagnostic value of HRCT Temporal bone scans.

Material and methods:

Study design: The study design is a prospective observational study.

Study Area:

The study was conducted on the patients presenting in the outpatient department and in-patient department of the Department of E.N.T., Gajra Raja Medical College, and Jayarogya Group of Hospitals, Gwalior, Madhya Pradesh. It is a teaching and a tertiary referral hospital. Study Period: The study was conducted for a period of one and a half years from January 2021 to June 2022. Inclusion criteria: cholesteatoma was detected by otoscopy, marginal tympanic membrane perforation, posterosuperior retraction and granulation, history of scanty purulent blood, and foul-smelling discharge, pure tone audiometry was done, modified radical mastoidectomy was planned, and surgical finding correlated will be included in this study. Exclusion criteria: Patients with known intracranial/intratemporal complications, patients undergone previous mastoid surgery, suspicious of ear pathology to be malignancy or granulomatous disease patients were excluded from the study. Special investigations- HRCT Temporal bone.

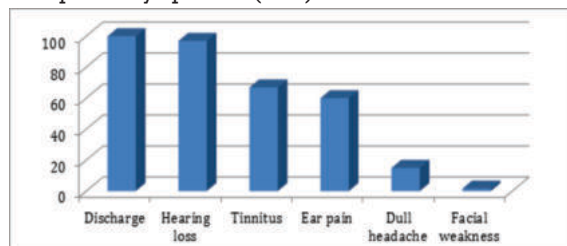
Observation:

Figures and tables: Table 1: Presenting Symptoms

Symptoms	No. of patients	Percentage
Discharge	60	100%
Hearing Loss	58	97%
Tinnitus	40	67%
Ear pain	36	60%
Dull headache	9	15%
Facial weakness	1	1.67%

Most common presenting complain in this study was ear

discharge, seen in all 60 patients (100%) followed by hearing loss (97%), tinnitus (67%) and ear pain (60%). Dull headache was reported by 9 patients (15%).



Graph 1: Presenting symptoms

Table 2: High Resolution Computed Tomography (HRCT) Temporal Bone Findings

Structures Involved	No. of patients	Percentage
Scutum erosion	60	100%
Tegmen plate erosion	7	11.67%
Sinus plate erosion	2	3.33%
Semicircular canal erosion	2	3.33%
Ossicular chain necrosis	60	100%
Soft tissue density	60	100%

Every patient underwent HRCT temporal bone before the operative procedure to know about the ossicular status and extent of disease. The most consistent and important observation seen radiologically was Scutum erosion, Ossicular chain necrosis which was present in all 60 patients

(100%) enrolled in the study group. Along with it presence of soft tissue density in mastoid cavity or middle ear cavity was diagnosed in every patient (100%). Tegmen plate erosion which was seen in 15 patients (20%) and sinus plate erosion seen in 11 patients (11.67%). Out of 60 patients in the study, erosion of Otic capsule (semicircular canal) and sinus plate erosion was seen in 2 patient each (3.33%).

Graph 2: High Resolution Computed Tomography (HRCT) Temporal Bone Findings

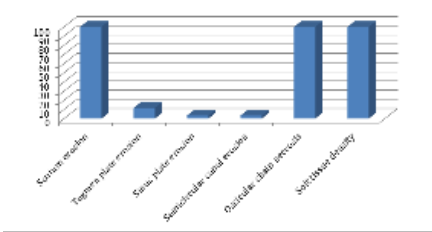
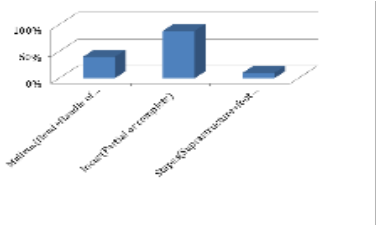


Table 3: Intraoperative Ossicular Chain Status in patients undergoing Mastoidectomy

Ossicles	No. of patients	Percentage
Malleus (Head+Handle of Malleus)	23	38.33%
Incus (Partial or Complete)	53	88.33%
Stapes (Suprastructure + foot plate)	06	10%

The operative procedure done was Modified Radical Mastoidectomy in majority of cases. Only few cases were converted to Radical Mastoidectomy depending upon the extent of bony erosion and presence of cholesteatoma.

Intraoperative examination of the middle ear cavity revealed that all the patients had Ossicular Chain Erosion. Ossicles were either absent or present or found eroded and embedded between the soft tissue or cholesteatoma. It was observed that out of the three ossicles, Incus was found to be most eroded, found in 53 patients (88.33%) followed by malleus which was eroded in 24 patients (38.33%) . Stapes was found eroded in 06 patients (10%).



Graph 3: Intraoperative Ossicular Chain Status in patients undergoing Mastoidectomy

Table 4: Parts of Ossicles involved in necrosis

Ossicle erosion	No. of patients	Percentage
Malleus		
Handle	1	1.67%
Head	24	40%
Incus		
Short process	20	33.33%
Body	30	50%
Long process	46	76.67%
Stapes		
Suprastructure	6	10%
Footplate	1	1.67%

In this study, it was found that long process of incus was the most commonly affected part and found eroded in 46 patients

(76.67%). Body of incus was found eroded in 30 patients (50%) The least affected part of incus undergoing erosion was the short process which was found eroded in 20 patients (33.33%). Malleus was the second most commonly involved ossicle in the erosion process. Head of malleus was found eroded in 24 patients (40%) while the handle of malleus was found eroded in 1 patient (1.67%). The least commonly involved ossicle was stapes. The suprastructure of stapes was absent in 6 patients (10%) while the footplate of stapes was absent in 1 patient (1.67%).

Graph 4: Parts of ossicles involved in necrosis

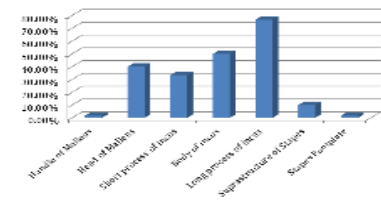


Table 5: Pattern of ossicular necrosis found

Parts	No. of Patients	Percentage
Only malleus	7	11.67%
Malleus + Incus	15	25%
Malleus+Incus+Stapes	1	1.67%
Only Incus	32	53.33%
Incus +Stapes	5	8.33%
Only Stapes	0	0%
Malleus+Stapes	0	0%
Total	60	100%

In this study it was found that necrosis of only incus with intact malleus and stapes was found in majority of patients. Necrosis of incus alone was found in 32 patients (53.33%).

Second most common pattern of ossicular necrosis found intraoperatively during mastoidectomy was necrosis of incus along with malleus which was found in 15 patients (25%) followed by necrosis of incus along with stapes which was found in 5 patients (8.33) %. Isolated necrosis of malleus bone was found in 8 patients (11.67%) . Only 1 patient (1.67%) was found to have all ossicles involved in destruction process. There was no case found where there was necrosis of only stapes or necrosis of stapes along with malleus.

Graph 5: Pattern of ossicular necrosis found

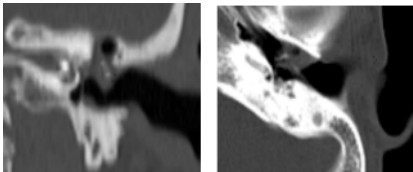
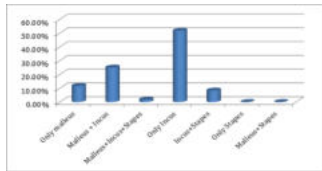


Figure 1: Cholesteatoma with blunting of scutum and pars tensa perforation: A coronal; B, axial computed tomography scans.

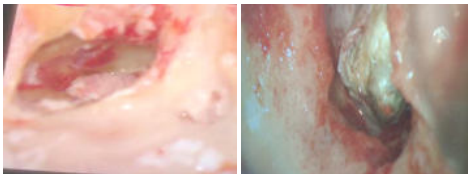


Figure 2: Acquired Cholesteatoma

The results of our study are as follows:

scutum erosion-It was found in HRCT scans and intra operatively in all 60 patients, revealing the sensitivity and specificity as 100%. tegmen plate erosion-It was seen on CT scan in 7 patients and intra operatively in 8 patients. The sensitivity came as 87.5% and specificity as 100%. sinus plate erosion-It was seen on CT scan and intra operatively in 2 patients. The sensitivity and specificity were 100%. semicircular canal erosion-It was found eroded in 2 patient intra operatively and 2 patients on HRCT scan. The sensitivity and specificity were 100%. ossicular erosion-Malleus erosion was found in 22 cases on HRCT scans while surgery revealed the same in 23 patients. So, the sensitivity and specificity of the investigation were 95.65% and 100% respectively.

Incus erosion – imaging by HRCT temporal bones showed erosion of incus in 53 cases while the same was seen in 53 cases during surgery. Hence it was found that the sensitivity to detect ossicular erosion of incus was 100% and specificity was 100%.

Stapes erosion was found in 5 cases on HRCT scans while surgery revealed the same in 6 patients. So, the sensitivity and specificity of the investigation were 95.65% and 100% respectively. As far as ossicular chain disruption on CT temporal bones in cases of chronic suppurative otitis media was concerned, incus erosion was most commonly detected followed by malleus and stapes. soft tissue density-the soft tissue density was seen in 60 patients operatively and 60 patients on HRCT scan. Both the sensitivity and specificity came out as 100%.

Discussion:

HRCT temporal bones showed good correlation for ossicular destruction during surgery, as has been the results of most studies; the incus being seen to eroded in more cases than malleus or stapes. Similarly, our study showed moderate correlation for tegmen plate erosion, good correlation for lateral semicircular canal erosion and excellent correlation for congenital anomaly like Korner's septum and other anatomical variations. Hence HRCT temporal bones as a preoperative tool demonstrates fine bony details and the extent of the disease process along with minute details about the hidden areas within the tympanic cavity which could not be assessed adequately prior to the advent of high-resolution CT temporal bones. So, complete disease clearance has become a reality these days. In addition, the better understanding of the temporal bone anatomy with reference to the adjacent critical neurovascular structures results in avoidance of inadvertent complications. Our study also found CT scan a good tool to assess the extent of disease process so that the surgeon could plan preoperatively itself regarding the best surgical approach for complete exenteration of the pathology which would ultimately result in better quality of life for the patient.

CONCLUSION:

Chronic suppurative otitis media is a disease entity that an otorhinolaryngologist encounters frequently in his day-to-day practice. HRCT temporal bones is emerging as an imaging tool that would guide the surgeon regarding the extent and location of the pathology in these patients such that the appropriate line of management can be chalked out in the mind of the treating surgeon. The study conducted at our centre regarding the role of CT temporal bones in patients with unsafe CSOM with respect to the variables like ossicular erosion- malleus handle, malleus head, incus, stapes; facial canal dehiscence, LSCC erosion, mastoid cortex dehiscence, cholesteatoma, and anatomical variants like Korner's septum, high jugular bulb and forward lying sigmoid sinus were as follows It showed excellent correlation for anatomical variations like Korner's septum, anteriorly placed sigmoid sinus; good correlation for ossicular destruction – incus being the most commonly eroded ossicle. A moderate correlation was seen in cases of diagnosis of cholesteatoma on CT and on

table. CT was found to be more accurate in detection of atticointral pathology when there were associated changes of bony destruction. CT temporal bones were not found to be so reliable for predicting facial canal dehiscence and lateral semicircular canal dehiscence due to the partial averaging effects of the imaging modality. HRCT temporal bone is a useful preoperative tool in patients who present with chronic suppurative otitis media due to its ability to demonstrate fine bony details, delineation of important adjacent anatomical structures and avoid inadvertent injury, plan the surgical approach, detect complications, aids in good and effective surgical clearance.

Summary:

The summary of the study is as follows, Maximum number of patients had duration of disease between 5-10 years (60%). Most common presenting complain in this study was hearing ear discharge, seen in all 60 patients (100%) followed by hearing loss (97%) and Ear pain (60%). Conductive hearing loss was most common (75%) type of hearing loss seen in study group. In examination under microscope, cholesteatoma was most consistent finding seen in all patients. High resolution CT of temporal bone showed presence of soft tissue density and ossicular chain necrosis in all patients. Incus was the most commonly involved ossicle in the erosion process (88.33%). Long process of incus was the most eroded structure (76.67%) followed by body (50%) and short process (33.33%). Least eroded structure was handle of malleus and foot plate of stapes (1.67% each). The most common pattern of ossicular necrosis was isolated partial or complete erosion of incus (88.33%).

Abbreviation

CSOM : Chronic Suppurative Otitis Media ,EUM : Examination Under Microscope ,PTA : Pure Tone Audiometry ,HRCT : High Resolution Computed Tomography ,C : Cochlea ,M : Malleus ,S : Stapes ,I : Incus ,TNF : Tumor Necrotic Factor ,FGF : Fibroblast Growth Factor ,PDGF : Platelet Derived Growth Factor ,FC : Facial Canal ,IAC : Internal Auditory Canal ,V : Vestibule ,CC : Carotid Canal ,W : Lateral Attic Wall ,T : Tensor tympani canal ,CR : Common crus ,HS : Horizontal Semicircular canal ,PS : Posterior Semicircular canal ,VA : Vestibular Aqueduct.

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