

Comparison of Preoperative High Resolution Computed Tomography Temporal Bone Findings with Intraoperative Findings in patients with Cholesteatoma

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ABSTRACT

Background: Since many years, CT-scan of the temporal bone is a widely accepted investigation in preoperative evaluation of patients with cholesteatoma in the middle ear.

Aim: To compare the preoperative HRCT findings with intraoperative findings in the patients with atticointral CSOM

Study design: Comparative cross-sectional study

Setting: Department of ENT Sir Ganga Ram Hospital Lahore

Duration: February 1st 2022 to January 31st 2023

Methods: After taking approval from board of studies, IRB & ASRB of FJMU, 50 patients fulfilling inclusion criteria were admitted in Department of ENT, Sir Ganga Ram Hospital Lahore. Firstly patients were seen in outdoor, history and otoscopy followed by examination under microscope was done, then the diagnosis of atticointral CSOM was established. HRCT temporal bone of the cases diagnosed as atticointral type CSOM was done. The patients were then admitted for mastoid exploration. Informed consent was obtained. Demographic information was recorded. HRCT temporal bone was reported by consultant radiologist from Department of Radiology, Sir Ganga Ram Hospital in all cases. Intraoperative findings like soft tissue mass, dural & sinus plate, ossicular status, status of semicircular canal, facial canal and scutum was noted and compared with the preoperative HRCT findings. Then the data was collected in accordance to patients Proforma.

Results: The mean age of patients was 22.32±10.42 years. Among patients 56% were male and 44% were female. HRCT was closely in agreement with intraoperative findings for detection of soft tissues mass in middle ear [HRCT:92% & IOF: 100%], dural plates [HRCT:98% & IOF: 98%], Sigmoid sinus plates [HRCT:92% & IOF: 92%], erosion of malleus [HRCT:56% & IOF: 62%], Incus [HRCT:56% & IOF: 26%], stapes [HRCT:60% & IOF: 66%], lateral semicircular canal [HRCT:96% & IOF:96%], facial canal nerve [HRCT:96% & IOF: 94%] and scutum [HRCT:70% & IOF: 74%] respectively. This would be of great help to the otologists in anticipating the possible complications, developing treatment strategy, counseling the patient regarding the procedure and in taking consent about expected complications.

Conclusion: In patients of atticointral CSOM HRCT effectively helps in preoperative assessment of the site & extent of the disease process, Ossicular erosion and status of various important anatomical structure.

Keywords: Preoperative, HRCT, Intraoperative, Atticointral, CSOM, Mastoidectomy, Ossicular necrosis.

INTRODUCTION

Since ancient time chronic suppurative otitis media (CSOM) has been identified as an important cause of disease in middle ear.¹In the developing countries like ours CSOM is considered as one of the important causes of preventable disabling hearing impairment (DHI).Worldwide prevalence rates of CSOM varies from 1% to 46%.² Almost about 65–330 million people are estimated to have discharging ears worldwide, out of which 60% suffer from remarkable hearing impairment³.

As per the World Health Organization (WHO) data prevalence of CSOM is 1.4% in South East Asia⁴. Clinically CSOM are of 2 types: Tubotympanic (Mucosal type) and CSOM with cholesteatoma or atticointral (squamous type)⁵. Cholesteatoma is a benign keratinizing epithelial lined cystic structure found in mastoid & middle ear⁶. Acquired cholesteatoma often arises from posterosuperior retraction pocket of tympanic membrane or as an attic cholesteatoma⁷. It can progressively enlarge and erode into neighboring structures, giving rise to temporal, extra-temporal and serious intracranial complications⁶. This occurs probably due to the release of enzymes by mononuclear inflammatory cells and osteoclasts⁷. A study conducted by Gulay Madan et.al showed that HRCT is highly compatible in detecting erosion of lateral semicircular canal and dural plate, whereas it reported moderate compatibility for facial canal dehiscence and tympanic segment

dehiscence⁸. Variable results obtained from limited number of studies done in this subject donot give us exact approximation of relationship between intraoperative findings (gold standard) with that of preoperative HRCT in above discussed parameters.The finding that are obtained from preoperative HRCT will be compared with intraoperative finding and if those finding are comparable then it will be of great help to the surgeon in planning the exact procedure, exact approach, in preventingunwanted complications as well as in counselling the patient. Detection of site, disease extent and preoperative knowledge of asymptomatic complications which could due to bony destruction, would be of great help to the otologists in anticipating the possible complications, developing treatment strategy, counselling the patient regarding the procedure and in taking consent about expected complications.

The purpose of my study is to determine whether preoperative HRCT findings in a case of CSOM will be helpful in identifying the status of various structures which are commonly involved in atticointral type of CSOM

MATERIALS AND METHOD

This comparative cross-sectional designed study was carried out in the Department of ENT Sir Ganga Ram Hospital Lahore w.e.f February 1st 2022 to January 31st 2023. Sample size (n) of 50 patients is estimated by using 95% confidence level, 8% absolute precision, with expected percentage of High resolution computerized tomography findings as 96% and intraoperative findings as 96%¹

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$$n = Z^2_{1-\alpha/2} [P_1(1-P_1) + P_2(1-P_2)] / d^2$$

- $Z_{1-\alpha/2}$ = confidence level 95% =1.96
- P_1 = Population proportion I =96%
- P_2 = Population proportion II =96%
- d = Absolute precision = 8%

Non-probability, convenient sampling technique was used and patient of either sex diagnosed as CSOM-atticoantral type with cholesteatoma based on history and examination under microscope were included where as those with congenital cholesteatoma (EUM),clinically tubotympanic CSOM (history), past surgery of temporal bone, patient not giving consent for surgery were excluded.

Data Collection Procedure: After taking approval from board of studies, IRB& ASRB of FJMU, 50 patients fulfilling inclusion criteria were admitted in Department of ENT, Sir Ganga Ram Hospital Lahore. Firstly patients were seen in outdoor by taking history and performing otoscopy followed by examination under microscope, and then the diagnosis of atticoantral CSOM was established. HRCT temporal bone of the cases diagnosed as atticoantral type CSOM with cholesteatoma was done. The patients were then admitted for mastoid exploration. Informed consent was obtained. Demographic information was recorded. HRCT temporal bone was reported by consultant radiologist from Department of Radiology, SIR Ganga Ram Hospital in all cases. Intraoperative findings like soft tissue mass, dural & sinus plate, ossicular status, status of semicircular canal, facial canal and scutum was noted and compared with the preoperative HRCT findings. Then the data was collected in accordance to patient's proforma. Data was collected and analyzed on SPSS 20 version. Quantitative variables like age and duration will be presented as mean±SD. Qualitative variables like gender was presented as frequency and percentage. Comparison of preoperative HRCT findings and intraoperative findings were done by applying chi-square test. P-value ≤0.05 was taken as significant.

RESULTS

Mean age of patients in this study was 22.32±10.42 years. Among patients 28(56%) were male and 22(44%) were female patients. On HRCT 46(92%) patients and intraoperative findings 50(100%) patients were diagnosed with soft tissue mass in middle ear. Findings regarding dural plates (Intact/Eroded) and sigmoid sinus plate were similar for both HRCT and intraoperative findings. i.e. Dural plates [Intact: 49(98%) & Eroded:1(2%)], Sigmoid sinus plate [Intact: 46(92%) & Eroded:4(8%)]. Ossicular status (Malleus) was intact in 28(56%) on HRCT and in 31(62%) patients on intraoperative findings. While HRCT and intraoperative findings showed that it was eroded in 22(44%) patients and in 19(38%) patients respectively.

According to HRCT findings 28(56%) patients had intact and 22(44%) patients had eroded incus however as per intraoperative findings 13(26%) patients had intact and 37(74%) patients had eroded incus. Stapes was eroded in 20(40%) patients according to HRCT and as per intraoperative findings it was eroded in 17(34%) patients. For both HRCT and intraoperative findings showed that Lateral semicircular canal was eroded in 2(4%) patients. As per HRCT findings facial canal was eroded in 2(4%) patients and intraoperative findings showed that it was eroded in 3(6%) patients. HRCT findings showed that scutum was eroded in 15(30%) patients while intraoperative findings showed that it was eroded in 13(26%) respectively.

On intraoperative findings all patients were diagnosed with presence of soft tissue mass. However on HRCT 4(8%) patients were not diagnosed with presence of soft tissue mass. As a result only sensitivity was calculated for HRCT. Sensitivity and PPV for HRCT was 92% and 100% respectively.

Sensitivity and specificity of HRCT for diagnosis of eroded dural plate was 100%. PPV and NPV was also 100% for HRCT. Overall diagnostic accuracy of HRCT was 100%. Sensitivity and specificity of HRCT for diagnosis of eroded sigmoid sinus plate

was 97.83% and 75% while PPV and NPV was also 97.83% and 75%. However overall diagnostic accuracy was 96%.

Sensitivity and specificity for diagnosis of eroded malleus on HRCT was 67.74% and 63.16%. PPV and NPV for HRCT was 75% and 54.55% respectively. Sensitivity, specificity, PPV and NPV of HRCT for diagnosis of incus was 92.31%, 56.76%, 42.86% and 95.45%. Overall diagnostic accuracy of HRCT was 66% for Incus. For Stapes Sensitivity, specificity, PPV and NPV of HRCT was 78.79%, 76.47%, 86.67% and 65% respectively. For lateral semicircular canal Sensitivity, specificity, PPV and NPV of HRCT was 97.92%, 50%, 97.92% and 50% respectively, however overall diagnostic accuracy of HRCT for lateral semicircular canal was 96%. For facial canal Sensitivity, specificity, PPV and NPV of HRCT was 97.87%, 33.33%, 95.83% and 50% respectively. For scutum sensitivity, specificity, PPV and NPV of HRCT was 83.78%, 69.23%, 88.57% and 60% respectively. Overall diagnostic accuracy of HRCT was 80% for diagnosis of scutum.

Table-1: Age of patients

N	50
Mean	22.32
SD	10.42
Minimum	6
Maximum	55

Table-2: Gender of patients

	Frequency	Percent
Male	28	56%
Female	22	44%
Total	50	100%

DISCUSSION

High-resolution computed tomography (HRCT) in comparison to routinely performed CT, provides a better view of the temporal bone with detailed information of minute structures. The HRCT findings of an acquired cholesteatoma are presence of soft tissue density mass with bony erosion, Ossicular erosion, erosion of scutum, opacification of middle ear, presence of labyrinthine fistula & auditus/antrum widening.⁹ In this study incus (78%) was the commonly eroded ossicles followed by malleus (38%) and stapes (34%). The hallmarks of disease are presence of soft tissue density mass in middle ear cleft, erosions of ossicles, erosions of the boundaries of middle ear and nearby structures. These findings when present with bony expansions of the middle ear cleft and auditus- ad antrum are pathognomic of cholesteatoma¹⁰. In this study sensitivity of HRCT for detection of soft tissue mass was 92%. All patients were diagnosed with soft tissue mass in intraoperative findings so specificity was not calculated. Chakenahalli P reported 84% sensitivity and 88% specificity in identifying soft tissue mass on HRCT¹¹. Specificity & sensitivity of HRCT was lower for diagnosis of erosions for malleus (Sensitivity: 67.74% & Specificity: 63.16%) as compared to incus (Sensitivity: 92.31% & Specificity:56.76%). However for stapes erosion sensitivity and specificity for HRCT was 78.79% and 76.47% respectively. These findings are consistent with the findings reported by Mariam Aljehani who showed lower sensitivity and specificity for erosion of malleus (Sensitivity=78% & Specificity=96%) & higher specificity & sensitivity for stapes and incus erosion.¹² Although the value of sensitivity and specificity values in this study for malleus was lower as compared to Mariam Aljehani study but the pattern of findings follow the trend similarly as that of reported by Mariam Aljehani. Chakenahalli P. Nanjara and his team members reported that HRCT is 100% sensitive and specific to diagnose malleus erosion which contradicts the findings of this study as in this study specificity & sensitivity of HRCT for malleus was quite lower.¹³In the same study specificity & sensitivity of HRCT for detecting erosion of stapes was 100% & 75% respectively. Although sensitivity is almost similar as reported in this study but specificity was quite higher as that of this study.

Zhang X et al who found that HRCT was poor in detecting Stapes erosion¹⁴.

Contrary to our results, various study in literature show that presence of malleus could be predicted with highest accuracy^{15,16}. Meeta Bathla in his study showed that erosion of the stapes was not always visualized on HRCT. Other studies also showed the similar findings¹⁷. Erosion of the scutum or ossicles is key point to differentiate a cholesteatoma from otitis media any benign debrinous collection on CT, although cholesteatoma cannot be excluded merely by the absence of osseous erosion¹⁸.

CONCLUSION

Results of this study demonstrate that HRCT effectively helps in preoperative assessment of the site & extent of the disease process, ossicular erosion and status of various important anatomical structures in the patients with atticointral CSOM with cholesteatoma.

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