



COMPARATIVE STUDY BETWEEN HRCT TEMPORAL BONE FINDINGS AND INTRA-OPERATIVE FINDINGS IN PATIENTS WITH CSOM – A HOSPITAL BASED CROSS SECTIONAL STUDY

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ABSTRACT **Objectives:** To analyze the variations in anatomy of HRCT temporal bone with intra operative findings **Methods :** Hospital based cross-sectional study was conducted in 30 patients presenting to ENT dept with CSOM Disease who are willing to under go HRCT temporal bone followed by surgery for CSOM were included in the study and Patients with past history of ear surgery, Head injury, Congenital ear disease will be excluded from the study. The HRCT findings were comparison with the intraoperative findings. Parameters of comparison for status of malleus, incus, stapes, facial bone dehiscence, low lying dura , anteriorly placed sigmoid sinus, scutum erosion. **Results :** A total of 30 patients were included in the analysis: 14 male and 16 female patients. The age range was 12 to 61 years. It was found that Minor discrepancies are seen for the malleus, incus, and stapes, where intraoperative findings detected slightly more EROSION compared to HRCT. However, the p-values indicate these differences are not statistically significant. HRCT shows good agreement with intraoperative findings, particularly for structures like the tegmen tympani, low dura, and LSCC dehiscence, where both methods reported identical results. **Conclusions :** The present study concludes that HRCT can be recommended in all cases of CSOM Despite its pitfalls such as more radiation exposure and higher cost, IT delineates the location and extent of the disease to know the extent of disease and the presence of anatomical variations, which CAN alert the surgeon and guide in surgical approach and treatment plan.

KEYWORDS : HRCT Temporal bone Findings, intra operative findings in csom surgeries, variations in HRCT temporal bone

INTRODUCTION

Chronic suppurative otitis media is chronic inflammation of the middle ear and mastoid mucosa, with recurrent discharge (at least 2 weeks) through a chronic perforation of the tympanic membrane.

World health organization estimated that 65–330 million people worldwide are affected by COM, of whom 50% suffer from hearing impairment and approximately 28 000 deaths per annum are attributable to the complications of otitis media. In India as in any other developing country'.

THE chronic otitis media is a common disease entity. It is a curable disease and with the advent of newer antibiotics, advanced operative microscopes, advance in radiological imaging techniques and the microsurgical operating instruments it can be successfully treated.

The Temporal bone is known as an area of difficult anatomy. HRCT TEMPORAL BONE SCAN Plays a important role in evaluating temporal bone status with respect to its variations in anatomy or diseases. High-resolution computed tomography (HRCT), a modification of the routine computed tomography (CT), provides a direct visual window into the temporal bone providing vision of unavailable minute structural details. With this HRCT scan it is possible to study the middle and inner pathology prior to undertaking surgery.

MATERIAL AND METHODS

This study was performed on 30 patients of either sex, suffering from CSOM both safe and unsafe undergoing HRCT Temporal Bone and CSOM surgery

- Institutional ethical clearance was taken.
- A written informed consent was taken.

Inclusion Criteria

Patient presenting with CSOM Disease who are willing to undergo HRCT temporal bone and surgery for CSOM

Exclusion Criteria

Patients with past history of ear surgery, Head injury, Congenital ear disease, unfit for surgery

The observations are made and recorded as follows:

1. Detailed clinical history and ENT examination was done and recorded on a Performa..
2. HRCT scan without contrast was done with Computed tomography model- uct 528, Pure Tone Audiometry will be done with Amplaidd 311 type I IEC 645 Audiometer, each patient will be reviewed for status of malleus, incus, stapes, anteriorly placed sigmoid sinus/erosion, facial bone dehiscence, Tegmen tympani erosion, Scutum erosion, lateral semicircular canal dehiscence in

HRCT and findings obtained was compiled pre-operatively.

3. Intra-operative findings was compared with Pre-operative HRCT findings.

Statistical Analysis

Study Design: Hospital based cross-sectional study.

Plan For Statistical Analysis Of The Study:

- Statistical analysis was done using SPSS software 19.0.
- Data obtained was tabulated in the Excel sheet and was analysed.
- All values are expressed as mean $\pm$ standard deviation and nonparametric data will be expressed as median and min-max values.
- Chi-square test for proportions in qualitative data.
- Student's unpaired t – test for Quantitative data.
- Tests of diagnostic accuracy such as Sensitivity, specificity, Positive predictive value, and negative predicti value with 95% confidence level will be calculated
- $P < 0.05$ was considered statistically significant

RESULTS

This study observed notable variations in the findings when comparing HRCT findings to intraoperative observations. The interpretation of the comparative analysis is as follow

- **Malleus:**
 - o HRCT identified 60% normal structures compared to 53% identified intraoperatively. This 7% difference may result from the inherent limitations of HRCT in detecting subtle erosions or deformities obscured by bone density or imaging artifacts.
 - o Abnormal findings were more prominent intraoperatively (47%) than on HRCT (40%), suggesting some variations were only detectable upon direct visualization during surgery.
- **Incus:**
 - o A significant variation was observed, with HRCT identifying 57% normal findings, whereas only 40% of cases were confirmed intraoperatively. This disparity highlights challenges in distinguishing incus abnormalities due to its smaller size and position in the middle ear cavity.
 - o Abnormalities were more frequently noted intraoperatively (60%) compared to HRCT (43%). Such discrepancies underline the importance of supplementing imaging findings with surgical assessments.
- **Stapes:**
 - o The stapes demonstrated the highest concordance between HRCT and intraoperative findings, with HRCT identifying normal structures in 70% of cases and intraoperative findings confirming 80%. This consistency underscores the ability of HRCT to accurately depict stapes anatomy as shown in table 2

Demographic and Other Anatomical Observations

Other anatomical variations, including the tegmen tympani, anterior sigmoid sinus, and scutum, showed high concordance rates, with p-values consistently above 0.5, indicating strong agreement between HRCT and intraoperative findings. These results affirm the reliability of HRCT in identifying major anatomical landmarks while acknowledging limitations for smaller or more intricate structures shown in table 3

Clinical Implications

The findings advocate for the routine use of HRCT in preoperative evaluations while highlighting its limitations. Surgeons must maintain a critical approach, using HRCT as a complementary tool rather than a standalone diagnostic method.

- Discrepancies noted in ossicular chain evaluations underline the importance of detailed intraoperative assessment. This approach ensures that subtle variations or pathologies missed on imaging are addressed effectively.
- Expanding the application of advanced imaging techniques or combining HRCT with adjunct modalities, such as MRI, could enhance diagnostic accuracy and preoperative planning in future practices

Table 1: Demographic and Clinical Characteristics of Study Population.

Sl.no	Variable	
1	Age	
	Mean	Std dev
	31.4	14.2
2	Gender	
	Male	Female
	14	16
3	Laterality	
	Right	Left
	14	16

Table 1: Presents the demographic data, including age, gender, and laterality, of the study participants. The mean age, gender distribution, and side preference are summarized, along with their respective values

Table 2: Comparative Analysis of Ossicles

Ossicle	HRCT Normal n (%)	HRCT Abnormal n (%)	Intraoperative Normal n (%)	Intraoperative Abnormal n (%)	P value
Malleus	18 (60%)	12 (40%)	16 (53%)	14 (47%)	0.602
Incus	17 (57%)	13 (43%)	12 (40%)	18 (60%)	0.196
Stapes	21 (70%)	9 (30%)	24 (80%)	6 (20%)	0.371

Table 2 : represents the comparison of ear ossicles status with HRCT and Intraoperative findings

Table 3

Sl. no	Group	Normal n(%)	Abnormal n(%)	P value
1.		Malleus		0.602
	High Resolution Computed Tomography	18 (60%)	12(40%)	
	Intra operative findings	16 (53%)	14(47%)	
2.		Incus		0.196
	High Resolution Computed Tomography	17 (57%)	13(43%)	
	Intra operative findings	12 (40%)	18(60%)	
3.		Stapes		0.371
	High Resolution Computed Tomography	21 (70%)	9 (30%)	
	Intra operative findings	24 (80%)	6 (20%)	
4.		Anterior placed sigmoid/Erosion		0.533
	High Resolution Computed Tomography	29 (96%)	1 (4%)	
	Intra operative findings	28 (93%)	2 (7%)	
5.		Facial bone dehiscence		0.554
	High Resolution Computed Tomography	29 (96%)	1 (4%)	
	Intra operative findings	28 (93%)	2 (7%)	
6.		Tegmen tympani		1.000
	High Resolution Computed Tomography	28 (93%)	2 (7%)	

	Intra operative findings	28 (93%)	2 (7%)	
7.		Scutum erosion		0.718
	High Resolution Computed Tomography	25 (83%)	5 (17%)	
	Intra operative findings	26 (86%)	4 (14%)	
8.		LSCC dehiscence		--
	High Resolution Computed Tomography	30 (100%)	0	
	Intra operative findings	30 (100%)	0	

Table3: Highlights the distribution of normal and abnormal anatomical variations in the temporal bone as detected by High-Resolution Computed Tomography temporal bone and confirmed during intraoperative exploration, with associated p-values for statistical significance.

DISCUSSION

Preoperative imaging of the temporal bone plays an important role in assessment of patients with chronic suppurative otitis media of both mucosal and squamosal disease by giving preoperative information of the closed spaces of the middle ear. However, radiological evaluation of the temporal bone is difficult owing to complicated anatomical structure of the middle ear and inner ear. A major advance in imaging of the ear structures has occurred with the development of HRCT

Our study Focused on comparing HRCT temporal bone findings with intraoperative observations in 30 chronic suppurative otitis media of both mucosal and squamosal disease, assessing several anatomical landmarks, including ossicles and structures like the facial canal and sigmoid plate. Chi-square tests were used to evaluate statistical significance.

Findings and Correlations

1.Ossicular Erosion

Malleus – It was found eroded among 12(40%) cases by HRCT while it was seen eroded in 14(47%) cases intra operatively. It was found normal in 18(60%) by HRCT and in 16(53%) cases intra operatively. There was statistically no significant difference found between HRCT findings and intra-operative findings regarding malleus erosion (P = 0.602).

A specificity rate of 100% was also reported by Rai², Rocher et al³. and Zhang et al⁴, however, they all reported HRCT to be 100% sensitive, which was higher as compared to the present study

Incus – It was found eroded among 13(43%) cases by HRCT while it was seen eroded in 18(60%) cases intra operatively. It was found normal in 17(57%) by HRCT and in 12(40%) cases intra operatively. There was statistically no significant difference found between HRCT Finding and intra-operative findings in respect to status of incus (P = 0.196)

Results comparable to the present study were also reported by Zhang et al⁴. A good radio-surgical correlation was reported by Datta et al⁵, Rai², Chee and Tan⁶ for incus.

Stapes – It was found eroded among 9(30%) cases by HRCT while it was seen eroded only in 6(20%) cases intra operatively. It was found normal in 21(70%) by HRCT and in 24(80%) cases intra operatively. There was statistically significant difference found between HRCT findings and intra-operative findings in respect to stapes erosion (P = 0.371)

Chee and Tan⁶ have reported a good radio-surgical correlation for stapes while Zhang et al⁴. and Datta et al⁵. have reported HRCT to be poor in detecting stap

Sigmoid Sinus Plate Erosions

This study reveals Sinus plate was found Anterior/eroded among 1(4%) cases in HRCT while it was found eroded 2(7%) cases intra-operatively. It was intact in 29(96%) cases by HRCT and in 28(93%) intra-operatively. There was statistically no significant difference found between HRCT finding and intra-operative findings in respect to sinus plate. (P = 0.553) thus there is good agreement between HRCT and intra operative finding with respect to this variable. Datta et al⁵. reported results similar to that documented by the present study

Facial Bone Dehiscence

In present study facial canal was found eroded among 1(4%) cases in

HRCT while it was found eroded in 2(7%) cases intra-operatively. It was intact in 29(96%) cases by HRCT and in 28(93%) intra-operatively. There was statistically no significant difference found between HRCT finding and intra-operative findings in respect to facial canal ($P=0.554$).

Similar results were also observed by Alzoubi et al⁷, and Rai² but poor and insignificant correlation between the two was reported by Jackler et al⁸, O'Reilly et al⁹, Rocher et al³, Chee and Tan⁶, Zhang et al⁴, Gerami et al¹⁰ and Rogha et al¹¹. Mafee et al¹² however reported HRCT to be 100% accurate.

Tegmen Tympani

On comparing the HRCT findings with intra-operative findings in the present study regarding status of tegmen tympani, our results revealed between the two among study subjects. Tegmen tympani was found eroded among 2(7%) cases in HRCT which showed same as in intra-operatively. It was intact in 28(93%) cases by HRCT and in 28(93%) intra-operatively. There was statistically significant association was found between HRCT findings and intra-operative findings in respect to tegmen tympani. ($P = 1$) thereby implying that there was no statistically significant difference between the HRCT report when it was compared to the gold standard (intraoperative findings).

A similar value of 100% similarity of HRCT and intra operative findings was also reported by Rocher et al³, Zhang et al⁴, Alzoubi et al⁸, and Datta et al⁵.

A poor sensitivity rate of HRCT to detect tegmen tympani erosion was also reported by Jackler et al⁸, and O'Reilly et al⁹, while a moderate association was seen by Vlastarakos et al¹⁰ and Chee and Tan⁶.

Scutum Erosion

In our study, scutum was found to be eroded in 5 cases and intact in 25 cases but intraoperatively it was found to be eroded in 4 cases and intact in 26 cases only.

In study done by Shreedhar et al¹⁴, Lyngwa G et al¹⁵ and Rocher Pet al³ high sensitivity (100%) was found in scutum erosion.

Lateral Semicircular Canal Dehiscence (LSC)

Lateral semicircular canal was documented to be normal in 30 cases on HRCT also intraoperatively it was found to be normal in 30 cases reporting 100% sensitivity, specificity similar results were seen in Datta et al⁵, Alzoubi et al⁷, Chee et al⁶, Rocher P et al³. Whereas Gerami et al¹⁰ reported a weak correlation between HRCT temporal bone and intra-operative findings.

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