IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)
e-ISSN: 2279-0853, p-ISSN: 2279-0861.Volume 24, Issue 11 Ser. 1 (November. 2025), PP 33-40
www.iosrjournals.org

Usefulness Of Preoperative HRCT In Middle Ear Cholesteatoma: A Study Done In Katihar

Dr. Suman Maurya, Dr Md Akbar Ali, Dr. A. K. Singh, Dr Md Shahbuddin, Dr. S.K. Mandal, Dr Maroof Shahedi

[1](3rd Year PG Resident Department Of ENT, Katihar Medical College And Hospital, India)
[2,4](Professor, Department Of ENT, Katihar Medical College And Hospital, India)
[3](Head Of Department, Department Of ENT, Katihar Medical College And Hospital, India)
[5](Assistant Professor, Department Of ENT, Katihar Medical College And Hospital, India)
[6](Senior Resident, Department Of ENT, Katihar Medical College And Hospital, India)

Abstract:
Background*: To assesses the usefulness of a preoperative HRCT temporal bone and establish HRCT as an efficacious tool for diagnosis of the extent and involvement of adjacent structures by Cholesteatoma.*
Materials and Methods*: The study group includes 52 patients with Unsafe CSOM (atticoantral), who presented to the ENT OPD at a tertiary care in Eastern India over a period of 18 months, who underwent HRCT temporal bone followed by surgical exploration of middle ear and or mastoid, for the removal of Cholesteatoma.*
Results*: From the observation and results obtained from this study, we can conclude that the HRCT can be used as a standard radiological imaging modality for the evaluation of temporal Bone pathology*
Conclusion: *Despite its pitfalls such as more radiation exposure and higher cost, delineates the location and extent of the disease and provides critical information regarding anatomical variations and complications. It serves as a roadmap to assist the surgeon during surgery.*
Key Word*: CSOM unsafe · Attico-antral disease ·HRCT temporal bone · Preoperative · Surgical findings*

Date of Submission: 24-10-2025 Date of Acceptance: 04-11-2025

I. Introduction

Otitis media is defined as ‘‘an inflammation of the middle ear without reference to aetiology or pathogenesis.’’ [1]. Chronic otitis media (COM) is a chronic inflammatory process in the middle-ear space that insidiously, in long- term, leads to, or more often, permanent changes in the tympanic membrane including atelectasis, dimer (formerly ‘‘monomer‘‘) formation, permanent perforation, tympanosclerosis, development of retraction pocket, or cholesteatoma formation.

World health organization (WHO) 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.

Cholesteatoma (Johannes Muller 1838) is a benign keratinizing epithelial lined cystic structure found in the middle ear cavity and mastoid. It can cause destruction of the local structures – ossicular chain and otic capsule, thereby leading to complications such as hearing loss, vestibular dysfunction, facial paralysis and intracranial disease or infection.

In India as in any other developing country, the active squamous chronic otitis media is a common disease entity. It is a curable disease and with the advent of newer antibiotics, advanced operative microscopes and the microsurgical operating instruments it can be successfully treated.

The diagnosis of aural cholesteatoma can be made on otoscopic examination, otoendoscopy and examination under microscope (EUM). Examination of the ear with a microscope is the ‘gold standard’ for the diagnosis of COM. History taking and investigations are an aid to management rather than to diagnosis. However, to reach the final and confirmed diagnosis surgical exploration followed by histopathological examination is important.

In spite of thorough clinical examination, the otorhinolaryngologist can diagnose most Cholesteatoma but one cannot determine the size and extent of the lesion. A major advance in radiological imaging techniques has occurred in the form of HRCT. With the advent of HRCT temporal bone a revolution in imaging of the temporal bone and ear structures has occurred. By means of special algorithms, thin section HRCT allows imaging of osseous structures up to a spatial resolution of 0.45–0.65 mm.

An HRCT temporal bone scan is useful for determining the site of cholesteatoma and its sac and its extension into various sub sites of middle ear cleft and beyond, planning the surgical approach, assessing the ossicular assembly, evaluating the fallopian canal, tegmen tympani and sinus plate, and determining anatomical variations in positions of dura, sigmoid sinus, and jugular bulb [2].

However the use of HRCT in the preoperative evaluation of the patient with COM is still controversial nowadays. Some surgeons incorporated HRCT in their routine protocols for pre-operative evaluation of the extension of the disease, which helps them to plan the surgical strategy to ensure the complete removal of pathology, reduce the postoperative risks and complications [3] while some others reserve its utilization for cases with high risk or suspicion or evidence of complication, recurrence or doubt in diagnosis, using the surgical indication only for the clinical profile presented [4]. Here the need arises to do a study in order to assess the utility of a preoperative HRCT temporal bone and establish HRCT as an efficacious tool for diagnosis of the extent and involvement of adjacent structures by cholesteatoma.

The implication of this study is to determine whether a pre-operative HRCT temporal bone is competent and useful for the assessment of the status of middle ear structures, in the presence of cholesteatoma or not. Its aim is to correlate the findings of preoperative HRCT temporal bone with the intra-operative findings and establish HRCT as an efficacious tool for diagnosis of the extent and involvement of adjacent structures by cholesteatoma.

II. Material And Methods

This cross-sectional study was conducted at the pediatric outpatient department (OPD) in Department of ENT at Katihar Medical College and Hospital, Katihar, Bihar from November 2023 to November 2024. The study consisted of 52 patients with Unsafe CSOM (atticoantral) presenting to the ENT OPD of a tertiary care centre in Central India over a period of 18 months, who underwent HRCT temporal bone followed by surgical exploration of middle ear and or mastoid.

Clearance from Institutional Research Advisory Committee (RAC) and getting Institutional ethical clearance (IEC) was obtained before starting the study. All unsafe CSOM patients who underwent HRCT temporal bone and got operated for the same were included in the study. Patients with congenital ear disease, malignant ear pathology, safe CSOM, patients unfit / not given consent for surgery or anaesthesia, previously operated ear cases were excluded from the study.

All patients underwent thorough history taking and examination, including Examination under Microscope. Assessment of Hearing status was done by Pure Tone Audiometry according to the age and compliance of the patient. All patients were duly investigated for surgery. HRCT temporal bone with serial 1 mm thick sections was obtained in both axial and coronal planes. Axial images were obtained parallel to the orbitomeatal plane. Coronal sections were done in scanning angle that is parallel to vertical ramus of the mandible. All patients underwent mastoid exploration under general anaesthesia and the type of surgery was determined by the intra operative findings. The intra-operative findings such as type and extent of disease, ossicular erosion and complications were studied during surgery and compared with findings of HRCT temporal bone. After taking written informed consent, clinical performa was filled up for each patient incorporating details regarding particulars of the patient, history, clinical examination and investigations and data analysed.

Statistical analysis

Data collection was done with structured data collection sheet which included demographic variables, necessary history and examination as well as investigation findings. Data analysis was performed using SPSS version 20 (SPSS, Chicago, IL). The analysis of patient demographics and baseline outcome variables were summarized using descriptive summary measures: expressed as mean ± standard deviation for continuous variables and frequencies and percentage for categorical variables. Appropriate statistical test (e.g., Chi-square test, unpaired t-test,) was applied for data analysis. $P<0.05$ was considered statistically significant. The purpose and procedure of the study were properly explained to the parents/guardian and informed written consent was taken from them. The study did not involve any additional burden on the patients. All participants in a research study had a right to have the information that they provided to be kept confidential.

III. Result

Total study patients taken were 52, The youngest patient studied was 9 years of age and the oldest was 56 years old. As shown in the above table the maximum incidence of cholesteatoma occurred in the 3rd decade of life. The mean age in this series was 23.2. There were 26 males and 26 females in this study producing a male to female ratio of 1:1.

Commonest presenting complaint was otorrhoea (100%) followed by hearing loss (98.1%). Chronic otitis media with cholesteatoma often describe scant but persistent, and foul smelling otorrhoea. Our study was

in concordance with it, all of the cases had the otorrhoea with characteristic feature of an attico antral type. About 12(23.1%) patients presented with blood tinged discharge.

In presentation, 51 (98.08%) patients were having hearing loss, 35 (67.3%) patients presented with tinnitus, 11(21.2%) patients had complaint of dull headache and only 1 (1.92%) patient had facial weakness of grade 4, which significantly improved to grade 1 postoperatively.

Most of the patients, 51(98.1%) showed hearing impairment of various degrees. Maximum number of patients, 23 (44.2%) were having moderate degree of hearing loss, while in one patient there was no hearing loss, which did not correlate with the surgical findings in this case showing extensive bony and ossicular erosion, but rather had increased hearing impairment following surgery. This preservation of hearing is supposedly due the cholesteatoma that bridges the gap between the functioning part of the ossicular chain and the inner ear (cholesteatoma hearer).

Table no 1: Comparison of structures involved as seen in HRCT temporal bone and intraoperative findings

Structures involved	Findings (N=52)	HRCT	Intraoperative
		N (%)	N (%)
Tympanic Membrane	Retracted and Unspecified Pathology	52(100.0%)	0(0.0%)
	Specified Pathology	0(0.0%)	52(100.0%)
Mastoid Pneumatisation	Pneumatised	0 (0.0%)	0 (0.0%)
	Sclerosed	52(100.0%)	52(100.0%)
Scutum	Intact	0 (0.0%)	0 (0.0%)
	Eroded	52(100.0%)	52(100.0%)
Tegmen Tympani	Intact	40(76.9%)	50(96.2%)
	Eroded	12(23.1%)	2(3.8%)
Sinus plate	Intact	50(96.2%)	51(98.1%)
	Eroded	2(3.8%)	1(1.9%)
Facial canal	Intact	50(96.2%)	48(92.3%)
	Eroded	2(3.8%)	4(7.7%)
LSCS	Intact	50(96.2%)	50(96.2%)
	Eroded	2(3.8%)	2(3.8%)
Koerner's septum	Present	4(7.7%)	4(7.7%)
	Absent	48(92.3%)	48(92.3%)
Maleus	Normal	4(7.7%)	8(15.4%)
	Eroded	48(92.3%)	44(84.6%)
Incus	Normal	7(13.5%)	5(9.6%)
	Eroded	45(86.5%)	47(90.4%)
Stapes	Normal	30(57.7%)	30(57.7%)
	Eroded	22(42.3%)	4(7.7%)
	Only Foot Plate Present	0(0.0%)	18(34.6%)

Table 1 reveals structures involved due to Cholesteatoma in association with HRCT Finding compared with intra-operative findings among study subjects.

In HRCT, Tympanic membrane appeared retracted, no comments could be made on any specific pathology in tympanic membrane, in all 52 cases, while intra operatively tympanic membrane showed specified pathology among all 52 cases. Chi square test was applied to find significance difference between HRCT & intra operative findings. There was statistical highly significant difference found between HRCT Finding and Intra-operative findings with respect to tympanic membrane status among study subjects (P = 0.001).

Mastoid was found sclerosed among all 52 cases in HRCT & intra-operatively both. It showed 100% association between HRCT & Intra operative findings. Scutum was found eroded among all 52 cases in HRCT & intra- operatively both. It showed 100% association between HRCT & intra operative findings.

Tegmen tympani was found eroded among 12 cases in HRCT while it was found eroded only in 2 cases intra- operatively. It was intact in 40(76.9%) cases by HRCT and in 50(96.2%) intra-operatively. There was statistically significant association was found between HRCT finding and intra-operative findings in respect to status of tegmen tympani (P = 0.004).

Sinus plate was found eroded among 2(3.8%) cases in HRCT while it was found eroded 1(1.9%) case intra-op- eratively. It was intact in 50(96.2%) cases by HRCT and in 51(98.1%) intra-operatively. There was statistically no significant difference found between HRCT finding and intra-operative findings (P = 0.558).

Facial canal was found eroded among 2(3.8%) cases in HRCT while it was found eroded in 4(7.7%) cases intra- operatively. It was intact in 50(96.2%) cases by HRCT and in 48(92.3%) intra-operatively. There was statistically no significant difference found between HRCT finding and intra-operative findings in respect to status of facial canal (P = 0.400).

LSCC was found eroded among 2(3.8%) cases in HRCT while it was also found same eroded in 2(3.8%) cases intra-operatively. It was intact in 50(96.2%) cases by HRCT and in 48(92.3%) intra-operatively. There was

statistically no significant difference found between HRCT Finding and intra-operative findings with respect to status of lateral semicircular canal (LSCC) (P = 1.000).

KOERNERS SEPTUM was present among 4(7.7%) cases in both HRCT and intra-operative. There was sta- tistically no significant difference found between HRCT Finding and intra-operative findings with respect to pres- ence of KOERNER'S SEPTUM. (P = 1.000).

Malleus was found eroded among 48(92.3%) cases by HRCT while it was seen eroded only in 44(84.6%) cases intra operatively. It was found normal in 4(7.7%) by HRCT and in 8(15.4%) cases intra operatively. There was statistically no significant difference found between HRCT Finding and Intraoperative findings with respect to status of 'MALLEUS' (P = 0.220).

Incus was found eroded among 45(86.5%) cases by HRCT while it was seen eroded in 47(90.4%) cases intra operatively. It was found normal in 7(13.5%) by HRCT and in 5(9.6%) cases intra operatively. There was statistically no significant difference found between HRCT finding and intra-operative findings with respect to status of 'INCUS' (P = 0.539).

Stapes was found eroded among 22(42.3%) cases by HRCT while it was seen eroded only in 4(7.7%) cases intra operatively. It was found normal in 30(57.7%) by HRCT and in 30(57.7%) cases intra operatively. Only stapes foot plate was seen in 18(34.6%) cases intra operatively. There was statistically significant difference found between HRCT Finding and intra-operative findings with respect to status of 'STAPES' (P = 0.001).

Table 2 reveals comparison of HRCT Finding and intra- operative findings with respect to pathology present in middle ear cleft among study subjects. In HRCT all 52 cases showed unspecified soft tissue density while intra operatively 10(19.2%) cases showed granulation, 11(21.2%) cases showed cholesteatoma, 29(55.8%) cases had cholesteatoma with granulation and only 2(3.8%) had glue. There was statistically significant difference found in pathologies seen in HRCT and intra-operatively among study subjects (P = 0.001).

Table no 2: Association of HRCT findings with intra-operative findings with respect to pathology

Pathology	HRCT	Intraoperative
	N (%)	N (%)
Unspecified soft tissue density	52(100.0%)	0(0.0%)
Granulation	0 (0.0%)	10(19.2%)
Cholesteatoma	0 (0.0%)	11(21.2%)
Glue	0 (0.0%)	1(1.9%)
Cholesteatoma with granulations	0 (0.0%)	30(57.7%)
Total	52(100.0%)	52(100.0%)

Table 3 reveals Association of HRCT Finding with intra-operative findings with respect to extension of disease in middle ear cleft, among study subjects. Extent of canal was seen to epitympanum, mesotympanum and hypotympanum in 52, 41, & 29 cases in HRCT and in 50, 26, 13 cases intra operatively. It was seen in facial recess also in 17 cases in HRCT and in 15 cases intraoperatively. There was statistically not significant difference found in extent of disease seen by HRCT and intraoperatively (P = 0.496).

Table no 3: Association of HRCT findings with intra-operative findings with respect to extent of disease

Extent of Disease	HRCT	Intraoperative
	N =52	N =52
Prussaks space	6	1
External auditory canal	1	0
Epitympanum	52	50
Mesotympanum	41	26
Hypotympanum	29	13
Protympanum	5	4
Sinus tympani	5	3
Aditus	41	41
Antrum	44	39
Mastoid	10	4
Facial Recess	17	15

IV. Discussion

Active squamous epithelial disease is a retraction pocket filled with keratinous debris more commonly found in poorly pneumatized sclerotic bones, but whether the sclerosis is relevant to the aetiology of the disease or is caused by it has also not been fully resolved. In our study mastoid was found sclerosed among all 52 cases. Poor eustachian tube function and reduced middle ear cleft volume has been known to be characteristic of ears with cholesteatoma. In our study eustachian tube was found blocked among 39(75.0%) cases and was found patent among 13(25%) cases.

Classically, active squamous COM presents with scanty foul smelling otorrhoea and hearing impairment. In this study also, we found ear discharge as the commonest symptom. Out of 52 patients, among 51(98.1%) patients pus discharge was scanty and in 1 patient it was moderate. Among all 52 (100%) patients pus had foul smell. It was haemorrhagic among 12(23.1%).

However, many patients complain only of hearing impairment and are unaware of any discharge from their ear as the quantities of pus are small and these dry up and form crusts. In this study, hearing impairment was second most common symptom. Among study subjects, out of 52 patients, among most of 23(44.2%) & 16(30.8%), hearing loss was mild & moderate respectively. Profound hearing loss was found among 2 (3.8%) patients, while in one patient there was no hearing loss, which did not correlate with the surgical findings in this case showing extensive bony and ossicular erosion, but rather had increased hearing impairment following surgery. This preservation of hearing is supposedly due the cholesteatoma that bridges the gap between the functioning part of the ossicular chain and the inner ear (cholesteatoma hearer).

Complications are common in chronic otitis media with cholesteatoma, however it is not a rule, and complications can be prevented by early diagnosis and prompt management. Among our study subjects we have encountered one patient who presented with facial palsy of grade 4, which significantly improved gradually to grade 1 later after surgery. In addition, 2 (3.8%) patients presented with post- aural abscess and 1 (1.9%) patient with post aural fistula, 1 (1.9%) patient had only mastoid tenderness, while rest of the patients showed no significant findings.

Otoscopic Examination

Examination of the ear with a microscope is the 'gold standard' for the diagnosis of COM although to reach an acceptable standard requires training, aided by operative experience exploring ears that have previously been otoscopically assessed. History taking and investigations are an aid to management rather than to diagnosis.

Bluestone et al. stated that, the cholesteatoma can be diagnosed most effectively with otoscopy or, more accurately, with the examination under microscope [5]. In this study the most common finding was Cholesteatoma which was found in 33(63.5%) cases, with or without granulation tissue or polyp. Granulation tissue and Polyp were found in 25(48.1%) was 7(13.5%) cases respectively. All these were in agreement with the surgical findings. In the setting of coexistent severe inflammation, a cholesteatoma may not be visible at the first presentation. Sometimes there is a polyp or extensive granulation tissue or crusts of dried up discharge, obscuring the view of attic or posterior pars tensa; such a case should be assumed to be a cholesteatoma until proved otherwise.

Perforation was found among 4(7.6%) cases. Attic & marginal perforation was found among 2 (3.8%) cases. Attic Retraction was found among 19(36.5%) and Posterior superior retraction was found in 20(38.5%).

Further otoscopy in our study subjects revealed Postero Superior Canal Wall Sagging among 7(13.5%) and cavity was seen in 2(3.8%). Remaining subjects 43(82.7%) showed normal External Auditory Canal.

Association Between HRCT Temporal Bone Findings and Intraoperative Findings

High resolution Computed Tomography provides a more detailed depiction of the anatomic extent of the diseases of the temporal bone. The hallmarks of cholesteatoma are the presence of soft tissue density in the middle ear cavity, ossicular erosions, smooth erosions of the middle ear borders and adjacent structures. These changes, when associated with bony expansion of the middle ear cavity, are highly suggestive of cholesteatoma.

Ability to Differentiate Soft Tissue Mass in Middle Ear

In our study we have found that, the preoperatively per- formed HRCT scan in all the 52 patients, had shown presence of homogenous soft tissue density in various sub divisions of middle ear cleft. Intra-operatively 10(19.2%) cases showed granulation, 11(21.2%) cases showed cholesteatoma, 30(57.7%) cases had cholesteatoma with granulation and only 1(1.9%) had glue. which could not be radiographically distinguished. Although cholesteatoma is said to show a lower attenuation than granulation tissue the difference is subtle and only magnetic resonance imaging can differentiate these. However Mafee et al. [6] stated that low attenuation value cholesteatoma can be used to identify cholesteatoma. Our result in this regard is in concordance with Jackler et al. [4] and Garber et al. [7] who found HRCT to be less sensitive and specific in this regard. Most other authors are also in agreement with this finding. Johnson et a1 [8] found that the presence of a well-defined edge to mass was a sure indication of cholesteatoma.

Ability to Specify Tympanic Membrane Pathology

Our study reveals Association of HRCT Finding with intra- operative findings among study subjects regarding status of tympanic membrane. In HRCT, tympanic membrane only showed retraction and pathology of tympanic membrane could not be specified, in all 52 cases while intra operatively tympanic membrane showed specified pathology among all 52 cases. Chi square test was applied to find significance difference between HRCT & intra operative findings. There was statistical highly significant difference found between HRCT findings and

intra-operative findings regarding status of tympanic membrane among study subjects. (P = 0.001) thus one can clearly specify the pathology related to tympanic membrane intra operatively which is not possible with HRCT temporal bone.

Pneumatization of Mastoid

The present study reveals association of HRCT findings with intra-operative findings among study subjects with respect to status of mastoid air cell system. Mastoid was found sclerosed among all 52 cases in HRCT & intraoperatively both. It showed 100% association between HRCT & Intra operative findings. Our results are in concordance with the results reported by Jackler et al. [4], Vlastarakos et al. [9] Rai [10] and Datta et al. [11] who also reorted a strong agreement between HRCT and intra-operative findings in respect to mastoid air cell system.

Scutum Erosion

In our study we evaluated association of HRCT findings in respect to scutum erosion with intra-operative findings among study subjects. Scutum was found eroded among all 52 cases in HRCT & intra-operatively both. It showed 100% association between HRCT & Intra operative findings.

Extension of Soft Tissue

Our study also assessed association of HRCT finding with intra-operative findings with respect to extension of soft tissue in various subdivisions of middle ear cleft, among study subjects. Extent of disease was seen to epitympanum, mesotympanum and hypotymanum in 52, 41, & 29 cases in HRCT and in 50, 26, 13 cases intra operatively. It was seen in facial recess also in 17 cases in HRCT and in 15 cases intra-operatively. There was statistically not significant difference found in extent of disease seen by HRCT and intra-operatively (P = 0.496). Thus HRCT helps in predicting the extension of soft tissue mass in various subdivisions of middle ear cleft, particularly in difficult to access and visualise hidden areas like sinus tympani and facial recess. This is very important for the complete removal of disease. This finding is in agreement with that of Walshe et al. [12] and Sirigiri and Dwaraknath [13] who reported a sensitivity of 90% and 87.5%, respectively.

Tegmen Erosion

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 12 cases in HRCT while it was found eroded only in 2 cases intra-operatively. It was intact in 40(76.9%) cases by HRCT and in 50(96.2%) intra-operatively. There was statistically significant association was found between HRCT findings and intra-operative findings in respect to tegmen tympani. (P = 0.004) thereby implying that there was no statistically significant difference between the HRCT report when it was compared to the gold standard (intra- operative findings). A similar specificity rate of 95% was reported by Gerami et al. [14] and a specificity rate of 91.93% and negative predictive value of 100% were also reported by Prata et al. [15] and Datta et al. [11] A similar value of 100% sensitivity, of HRCT, was also reported by Rocher et al. [16], Zhang et al. [17], Alzoubi et al. [18] and Datta et al. [11] Gerami et al. [14] reported the sensitivity, positive and negative predictive value to be 6%, 50%, and 60%, respectively, quite low as compared to the present study. A poor sensitivity rate of HRCT to detect tegmen tympani erosion was also reported by Jackler et al. [4] and O'Reilly et al. [19] while a moderate association was seen by Vlastarakos et al. [9] and Chee and Tan [20].

Sigmoid Sinus Plate Erosions

This study reveals association of HRCT findings with intra- operative findings among study subjects regarding status of sinus plate. Sinus plate was found eroded among 2(3.8%) cases in HRCT while it was found eroded 1(1.9%) cases intra-operatively. It was intact in 50(96.2%) cases by HRCT and in 51(98.1%) intra-operatively. There was statistically no significant difference found between HRCT finding and intra-operative findings in respect to sinus plate. (P = 0.558) thus there is good agreement between HRCT and intra operative finding with respect to this variable. Datta et al. [11] reported results similar to that documented by the present study.

Lateral Semicircular Canal Fistula

In our study, LSCC was found eroded among 2(3.8%) cases in HRCT while it was also found same eroded in 2(3.8%) cases intra-operatively. It was intact in 50(96.2%) cases by HRCT and in 48(92.3%) intra-operatively. There was statistically no significant difference found between HRCT Finding and intra-operative findings in respect to LSCC (P = 1.000).

Datta et al. [11], Alzoubi et al. [18], Chee and Tan [20], Mafee et al. [6], and Rocher et al. [16] also reported HRCT to be 100% sensitive in predicting lateral semi-circular canal fistulas which is similar to our

results. However Rai [10] reported it to be only 25% sensitive. Gerami et al. [14] reported a weak association between HRCT temporal bone and intra-operative findings.

Dehiscent Fallopian Canal

In present study facial canal was found eroded among 2(3.8%) cases in HRCT while it was found eroded in4(7.7%) cases intra-operatively. It was intact in 50(96.2%) cases by HRCT and in 48(92.3%) intra-operatively. There was statistically no significant difference found between HRCT finding and intra-operative findings in respect to facial canal (P = 0.400). Similar results were also observed by Alzoubi et al. [18], and Rai [10] but poor and insignificant correlation between the two was reported by Jackler et al. [4], O'Reilly et al. [19], Rocher et al. [16], Chee and Tan [20], Zhang et al. [17], Gerami et al. [14] and Rogha et al. [21], Mafee et al. [6], however, reported HRCT to be 100% accurate. Datta et al. [11] reported the specificity, positive and negative predictive value to be comparable to the present study but a higher sensitivity of 75%, while Magliulo et al. [22] in their study, observed a sensitivity and specificity of 69% and 87%, respectively.

Ossicular Erosion

Malleus was found eroded among 48(92.3%) cases by HRCT while it was seen eroded only in 44(84.6%) cases intra operatively. It was found normal in 4(7.7%) by HRCT and in 8(15.4%) cases intra operatively. There was statistically no significant difference found between HRCT findings and intra-operative findings regarding malleus erosion (P = 0.220).

A specificity rate of 100% was also reported by Rai [10], Rocher et al. [16] and Zhang et al. [17], however, they all reported HRCT to be 100% sensitive, which was higher as compared to the present study. The sensitivity, specificity, and positive predictive value of the present study were comparable to the study conducted by Datta et al. [11] whereas the negative predictive value of the present study was higher 84.21% as compared to 66.66% reported by Datta et al. [11]. According to a study conducted by Rogha et al. [21] there is a good radio-surgical correlation for malleus while Chee and Tan [20] reported an excellent correlation.

Incus was found eroded among 45(86.5%) cases by HRCT while it was seen eroded in 47(90.4%) cases intra operatively. It was found normal in 7(13.5%) by HRCT and in 5(9.6%) cases intra operatively. There was statistically no significant difference found between HRCT Finding and intra-operative findings in respect to status of incus (P = 0.539).

Datta et al. [11] and Rai [10] also observed a positive predictive value of 100%, but the sensitivity was slightly low (87% and 85%, respectively) as compared to the pre- sent study. Results comparable to the present study were also reported by Zhang et al. [17] whereas Tok et al. [23] reported a sensitivity rate of 84.6% and a positive predictive value of 97.1%. A good radio-surgical correlation was reported by Rogha et al. [19] and Chee and Tan [20] for incus.

Stapes was found eroded among 22(42.3%) cases by HRCT while it was seen eroded only in 4(7.7%) cases intra operatively. It was found normal in 30(57.7%) by HRCT and in 30(57.7%) cases intra operatively. Only stapes foot plate was seen in 18(34.6%) cases intra operatively. There was statistically significant difference found between HRCT findings and intra-operative findings in respect to stapes erosion (P = 0.001).

According to Rai et al. [10] HRCT is 100% specific but less sensitive (75%), and a similar observation was made by O Donoghue [24] Tok et al. [23] reported a sensitivity of 71.2%, specificity = 100%, positive predictive value = 100%, and negative predictive value = 76.2%. Chee and Tan [20] have reported a good radio-surgical correlation for stapes while Zhang et al. [17] and Datta et al. [11] have reported HRCT to be poor in detecting stapes.

Limitations

In our study, we have found that the H R CT temporal bone findings are in good agreement with the intra operative findings and thus has high reliability for the parameters such as mastoid pneumatization, scutum erosion, presence of soft tissue density, extension of cholesteatoma to various sub sites of middle ear cleft particularly the hidden areas of middle ear cavity, assessment of ossicular status. It has also shown good association with intra operative findings and thus helpful pre operatively to certain the presence of Complications such as sigmoid sinus plate erosion, dural plate erosion, fallopian canal dehiscence, erosion of semi- circular canal.

However it cannot differentiate between the cholesteatoma and soft tissue of any other variety, it has also shown disagreement with the status of stapes particularly foot plate region and pathology of tympanic membrane. From the observation and results obtained from this study, we can conclude that the HRCT can be used as a standard radiological imaging modality for the evaluation of temporal Bone pathology. Despite its pitfalls such as more radiation exposure and higher cost, delineates the location and extent of the disease and provides critical information regarding anatomical variations and complications. It serves as a roadmap to assist the surgeon during surgery.

V. Conclusion

AH tended to lead to mandibular retrusion and high mandibular plane angle. The prevalence of AH among children attending at pediatric outpatient department was 2%, of them 18% had an indication for adenoidectomy. Allergic sensitivity to house dust was the most common risk factor. The most common two clinical presentations were mouth breathing and nasal obstruction and most common complication was obstructive sleep apnea.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

References

[1]. Bluestone CD, Gates GA, Klein JO Et Al (2002) Panel Reports: 1. Definitions, Terminology, And Classification Of Otitis Media. Ann Otol Rhinol Laryngol 111(Suppl):8–18
[2]. O'Donoghue GM, Bates GJ, Anslow P, Rothera MP (1987) The Predictive Value Of High Resolution Computerized Tomography In Chronic Suppurative Ear Disease. Clin Otolaryngol Allied Sci 12:89–96
[3]. Banerjee A, Flood LM, Yates P, Clifford K (2003) Computed Tomography In Suppurative Ear Disease: Does It Influence Management? J Laryngol Otol 117:454–458
[4]. Jackler RK, Dillon WP, Schindler RA (1984) Computed Tomography In Suppurative Ear Disease: A Correlation Of Surgical And Radiographic Findings. Laryngoscope 94:746–752
[5]. Bluestone Charles D, Klein JO (1990) Intracranial Complications And Sequelae Of Otitis Media. In: Bluestone CD (Ed) Paediatric Otolaryngology, Vol 1, 2nd Edn. WB Saunders, Philadelphia, Pp 738–740
[6]. Mafee MF, Levin BC, Applebaum EL, Campos M, James CF (1988) Cholesteatoma Of The Middle Ear And Mastoid A Com- Parison Of CT Scan And Operative Findings. Otolaryngol Clin North Am 21:265–293
[7]. Garber LZ, Dort JC (1994) Cholesteatoma: Diagnosis And Staging By CT Scan. J Otolaryngol 23:121–124
[8]. Johnson DW (1984) CT Of The Post Surgical Ear. Radiol Clin North Am 22:67–75
[9]. Vlastarakos PV, Kiprouli C, Pappas S, Xenelis J, Maragoudakis P, Troupis G Et Al (2012) CT Scan Versus Surgery: How Reliable Is The Preoperative Radiological Assessment In Patients With Chronic Otitis Media? Eur Arch Otorhinolaryngol 269:81–86
[10]. Rai T (2014) Radiological Study Of The Temporal Bone In Chronic Otitis Media: Prospective Study Of 50 Cases. Indian J Otol 20:48–55
[11]. Datta G, Mohan C, Mahajan M, Mendiratta V (2014) Correlation Of Preoperative HRCT Findings With Surgical Findings In Unsafe CSOM. J Dent Med Sci 13:120–125
[12]. Walshe P, Mcconn Walsh R, Brennan P, Walsh M (2002) The Role Of Computerized Tomography In The Preoperative Assessment Of Chronic Suppurative Otitis Media. Clin Otolaryngol Allied Sci 27:95–97
[13]. Sirigiri RR, Dwaraknath K (2011) Correlative Study Of HRCT In Attico-Antral Disease. Indian J Otolaryngol Head Neck Surg 63:155–158
[14]. Gerami H, Naghavi E, Wahabi-Moghadam M, Forghanparast K, Akbar MH (2009) Comparison Of Preoperative Computerized Tomography Scan Imaging Of Temporal Bone With The Intra-Oper- Ative Findings In Patients Undergoing Mastoidectomy. Saudi Med J 30:104–108
[15]. Prata AA, Antunes ML, Abreu CE, Frazatto R, Lima BT (2011) Comparative Study Between Radiological And Surgical Findings Of Chronic Otitis Media. Int Arch Otolaryngol 15:72–78
[16]. Rocher P, Carlier R, Attal P, Doyon D, Bobin S (1995) Contri- Bution And Role Of The Scanner In The Preoperative Evaluation Of Chronic Otitis. Radiosurgical Correlation Apropos Of 85 Cases. Ann Otolaryngol Chir Cervicofac 112:317–323
[17]. Zhang X, Chen Y, Liu Q, Han Z, Li X (2004) The Role Of High- Resolution CT In The Preoperative Assessment Of Chronic Otitis Media. Lin Chuang Er Bi Yan Hou Ke Za Zhi 18:396–398
[18]. Alzoubi FQ, Odat HA, Al-Balas HA, Saeed SR (2009) The Role Of Preoperative CT Scan In Patients With Chronic Otitis Media. Eur Arch Otorhinolaryngol 266:807–809
[19]. O'Reilly BJ, Chevretton EB, Wylie I, Thakkar C, Butler P, Sathanathan N Et Al (1991) The Value Of CT Scanning In Chronic Suppurative Otitis Media. J Laryngol Otol 105:990–994
[20]. Chee NW, Tan TY (2001) The Value Of Pre-Operative High Res- Olution CT Scans In Cholesteatoma Surgery. Singap Med J 42:155–159
[21]. Rogha M, Hashemi SM, Mokhtarinejad F, Eshaghian A, Dad- Gostar A (2014) Comparison Of Preoperative Temporal Bone CT With Intraoperative Findings In Patients With Cholesteatoma. Iran J Otorhinolaryngol 26:7–12
[22]. Magliulo G, Colicchio MG, Appiani MC (2011) Facial Nerve Dehiscence And Cholesteatoma. Ann Otol Rhinol Laryngol 120:261–267
[23]. Tok S, Adapinar B, Incesulu A, Gurbuz MK (2013) The Exami- Nation Of Middle Ear Ossicles With Preoperative 64-Detector Computed Tomography In Cases With Chronic Otitis Media And Cholesteatoma And Comparison Of Operation Findings. Int Adv Otol 9:349–352
[24]. O'Donoghue GM (1987) Cholesteatoma: Diagnosis And Staging By CT Scan. J Otolaryngol 12:157–160