Original Article

High-resolution Computed Tomography of Temporal Bone as a Diagnostic Technique for Early Diagnosis of Cholesteatoma and Prevention of Its Severe Complications

Sahana K. Reddy, Ravi Kumar, Tejas Halkude

Department of Radiodiagnosis, Shri B. M. Patil Medical College, Hospital and Research Centre, BLDE (Deemed to be University), Vijayapura, Karnataka, India

Abstract

Background: Cholesteatoma is a locally destructive lesion of the temporal bone characterized by progressive bone erosion and potential extracranial and intracranial complications. High-resolution computed tomography (HRCT) plays a crucial role in early detection and preoperative assessment. **Objective:** To evaluate the diagnostic performance of HRCT in detecting cholesteatoma and its complications through correlation with intraoperative findings. **Materials and Methods:** This prospective observational study included 77 patients with clinically suspected cholesteatoma over 18 months. HRCT of the temporal bone was performed using a 32-slice multidetector CT scanner with thin-section (0.6–1 mm) bone algorithm reconstruction. Parameters assessed included soft tissue presence, scutum erosion, ossicular erosion, mastoid involvement, tegmen tympani erosion, sigmoid plate erosion, facial canal erosion, lateral semicircular canal fistula, and sinus tympani involvement. Surgical findings served as the reference standard, and diagnostic performance was calculated. **Results:** The mean age was 40.64 ± 16.28 years, with peak incidence in the 21–40-year group. Conductive hearing loss (57.1%) and ear discharge (32.5%) were common presentations. HRCT demonstrated excellent concordance with surgery for scutum erosion (98.7%), ossicular erosion (97.4%), and facial canal erosion (100%). Sensitivity ranged from 68% (sinus tympani involvement) to 100% (scutum and facial canal erosion), while specificity was 90.9%–100%. Overall diagnostic accuracy ranged from 89.6% to 100%. Histopathology confirmed cholesteatoma in 94.8% of cases. **Conclusion:** HRCT of the temporal bone demonstrates high diagnostic accuracy and strong surgical correlation in cholesteatoma evaluation, supporting its role as a reliable preoperative imaging modality for early detection and complication assessment.

Keywords: Cholesteatoma, facial canal, high-resolution computed tomography, ossicular erosion, temporal bone

Résumé

Contexte: Le cholestéatome est une lésion localement destructrice de l'os temporal, caractérisée par une érosion osseuse progressive et des complications potentielles, tant extracrâniennes qu'intracrâniennes. La tomodensitométrie à haute résolution (HRCT) joue un rôle crucial dans le dépistage précoce et l'évaluation préopératoire. **Objectif:** Évaluer la performance diagnostique de l'HRCT dans la détection du cholestéatome et de ses complications, par corrélation avec les constatations peropératoires. **Matériel et méthodes:** Cette étude observationnelle prospective a inclus 77 patients présentant une suspicion clinique de cholestéatome sur une période de 18 mois. Une HRCT de l'os temporal a été réalisée à l'aide d'un scanner multidétecteur à 32 barrettes, avec une reconstruction par algorithme osseux en coupes fines (0,6 à 1 mm). Les paramètres évalués comprenaient la présence de tissus mous, l'érosion du scutum, l'érosion ossiculaire, l'atteinte mastoïdienne, l'érosion du tegmen tympani, l'érosion de la plaque sigmoïde, l'érosion du canal facial, la présence d'une fistule du canal semi-circulaire latéral et l'atteinte du sinus tympani. Les constatations chirurgicales ont servi de référence standard, et la performance diagnostique a été calculée. **Résultats:** L'âge moyen était de 40,64 ± 16,28 ans, avec un pic d'incidence dans la tranche d'âge des 21 à 40 ans. La surdité

Address for correspondence: Dr. Ravi Kumar, Department of Radiodiagnosis, Shri B. M. Patil Medical College, Hospital and Research Centre, BLDE (Deemed to be University), Vijayapura, Karnataka, India.
E-mail: dr.raviradiology@gmail.com

Access this article online

Quick Response Code:

Website: www.annalsafrmed.org

DOI: 10.4103/aam.aam_169_26

How to cite this article: Reddy SK, Kumar R, Halkude T. High-resolution computed tomography of temporal bone as a diagnostic technique for early diagnosis of cholesteatoma and prevention of its severe complications. Ann Afr Med 0;0:0.

Submitted: 17-Feb-2026 **Revised:** 21-Mar-2026
Accepted: 27-Apr-2026 **Published:** 05-Jun-2026

de transmission (57,1 %) et l'otorrhée (32,5 %) constituaient les modes de présentation les plus fréquents. L'HRCT a démontré une excellente concordance avec les données chirurgicales concernant l'érosion du scutum (98,7 %), l'érosion ossiculaire (97,4 %) et l'érosion du canal facial (100 %). La sensibilité variait de 68 % (atteinte du sinus tympani) à 100 % (érosion du scutum et du canal facial), tandis quela spécificité se situait entre 90,9 % et 100 %. La précision diagnostique globale variait de 89,6 % à 100 %. L'examen histopathologique a confirmé la présence d'un cholestéatome dans 94,8 % des cas. **Conclusion:** L'HRCT de l'os temporal fait preuve d'une grande précision diagnostique et d'une forte corrélation avec les données chirurgicales dans l'évaluation du cholestéatome, confirmant ainsi son rôle en tant que modalité d'imagerie préopératoire fiable pour le dépistage précoce et l'évaluation des complications.

Mots-clés: Cholestéatome, canal facial, tomodensitométrie à haute résolution, érosion ossiculaire, os temporal

Introduction

The temporal bone is one of the most complex osseous structures in the human body, housing the delicate organs of hearing and balance and forming a region of immense clinical importance in otolaryngology.[1] The evolution of temporal bone imaging mirrors the progress of diagnostic radiology, advancing from plain radiography and conventional tomography to high-resolution computed tomography (HRCT), which now serves as the cornerstone of temporal bone evaluation.[1,2] Among the pathologies affecting this region, cholesteatoma represents a unique clinical entity. Despite its misleading nomenclature, cholesteatoma is not a neoplasm but a locally destructive lesion characterized by the accumulation of keratinizing stratified squamous epithelium within normally pneumatized spaces of the middle ear and mastoid. Progressive bone erosion occurs through enzymatic activity, inflammatory mediators, and pressure effects, making a timely and accurate diagnosis essential to prevent serious sequelae.[3] Cholesteatoma may be congenital or acquired, with the latter being more common and typically associated with chronic suppurative otitis media and tympanic membrane retraction or perforation.[4] Clinical presentation ranges from chronic otorrhea and conductive hearing loss to vertigo, facial nerve palsy, or signs of intracranial extension in advanced disease.[4,5]

Complications of cholesteatoma are broadly categorized into extracranial and intracranial types, both associated with significant morbidity if not promptly managed.[6] Extracranial complications include ossicular erosion leading to conductive hearing loss, labyrinthine fistula causing vestibular symptoms, facial nerve canal involvement resulting in paralysis, and mastoid cortex destruction with abscess formation.[6,7] Although less common in the antibiotic era, intracranial complications such as meningitis, epidural or subdural abscess, brain abscess, sigmoid sinus thrombosis, and otitic hydrocephalus remain potentially life-threatening.[6,7] Early detection of bone erosion and disease extension is therefore critical to reduce morbidity and prevent catastrophic outcomes.

HRCT of the temporal bone has revolutionized the evaluation of cholesteatoma by providing exquisite visualization of the intricate osseous anatomy.[8] Modern multidetector CT scanners with submillimeter collimation and dedicated bone reconstruction algorithms allow accurate depiction of subtle erosions and small soft tissue masses.[8,9] On HRCT, cholesteatoma typically appears as a nondependent soft tissue density within the epitympanum or mastoid antrum, accompanied by characteristic bone destruction. The hallmark imaging features include scutum erosion, ossicular chain involvement, tegmen tympani defects, facial nerve canal dehiscence, sigmoid plate erosion, and, in advanced cases, otic capsule breach.[10,11]

Beyond diagnosis, HRCT plays a pivotal role in preoperative planning and surgical decision-making. It delineates the full extent of disease, identifies hidden recess involvement such as the sinus tympani, and detects anatomical variants that may increase operative risk.[12] Early identification of cholesteatoma is particularly important, as progressive disease results in cumulative structural damage and increased surgical complexity. The ability of HRCT to detect early ossicular erosion and subtle bone destruction before overt complications arise underscores its importance in modern otologic practice.[13,14] The present study aimed to evaluate the diagnostic performance of HRCT in the early detection of cholesteatoma and its complications through systematic correlation with intraoperative findings, thereby establishing its clinical utility in guiding surgical management and preventing severe complications.

Materials and Methods

This prospective observational study was conducted in the Department of Radiodiagnosis in collaboration with the Department of Otorhinolaryngology over 18 months from February 2024 to July 2025. Institutional Ethics Committee approval was obtained before study initiation, and written informed consent was secured from all participants.

Sample size

The sample size was calculated using the formula: $n = (Z^2 \times P \times (1 - P))/d^2$, based on a previously reported prevalence of epitympanum involvement of 95.2%.[15] With a confidence level of 96% (Z = 2.05), a margin of error of 5% (d = 0.05), and P = 0.952, the calculated sample size was 77 patients.

Study population

Patients with otoscopically evident cholesteatoma, refractory otorrhea despite medical management, marginal or attic tympanic membrane perforation, and posterosuperior tympanic membrane retraction were included in the study. Patients who had undergone prior temporal bone surgery were excluded from the study to avoid confounding factors related to postoperative anatomical changes.

Clinical evaluation

All patients underwent a detailed clinical assessment, including history, otoscopic examination, and pure tone audiometry. Demographic data (age, gender, and side affected), presenting complaints, and duration of symptoms were recorded in a structured case record form.

High-resolution computed tomography imaging protocol

HRCT of the temporal bone was performed using a 32-slice multidetector CT scanner. Noncontrast helical scans were obtained with the patient in the supine position, and the gantry was aligned parallel to the infraorbitomeatal line. Scanning parameters included 120 kVp, thin-section acquisition (0.6–1 mm slice thickness), and reconstruction using a high-resolution bone algorithm. Images were reconstructed with a 512 × 512 matrix and a field of view of 10–15 cm. Axial images were acquired with multiplanar coronal reconstructions for comprehensive evaluation.

Image analysis

All HRCT images were interpreted independently by experienced radiologists using standardized bone window settings (window level: 700 HU, window width: 4000 HU). The following parameters were systematically evaluated: presence and extent of soft tissue, scutum erosion, ossicular chain integrity (malleus, incus, and stapes), mastoid involvement, tegmen tympani erosion, sigmoid plate erosion, facial canal dehiscence, lateral semicircular canal (LSCC) fistula, and sinus tympani involvement. Anatomical variants relevant to surgical planning were also documented.

Surgical correlation and histopathology

Patients diagnosed with cholesteatoma underwent appropriate surgical management. Intraoperative findings regarding disease extent, ossicular erosion, bony defects, facial canal involvement, labyrinthine fistula, and intracranial extension were recorded by the operating surgeon using a standardized proforma. HRCT findings were correlated with surgical observations on a case-by-case basis. Histopathological examination of excised specimens was performed to confirm the diagnosis.

Statistical analysis

Data were analyzed using Statistical Package for the Social Sciences (SPSS) version 26.0 (IBM Corp., Armonk, New York, USA). Continuous variables were expressed as mean and standard deviation and categorical variables as frequency and percentage. The diagnostic performance of HRCT was assessed using surgical findings as the reference standard. Concordance between HRCT and intraoperative findings was determined using percentage agreement. $P < 0.05$ was considered statistically significant.

Results

The study included 77 patients with a mean age of 40.64 ± 16.28 years, with the highest proportion in the 21–40 year age group (33.8%), followed by 41–60 years (28.6%), indicating a predominance in young to middle-aged adults. Gender distribution was nearly equal with a slight male preponderance (51.9%). The right ear was more frequently affected (62.3%) compared to the left (37.7%), showing right-sided predominance in this cohort [Table 1].

Ear discharge was the most common presenting complaint (32.5%), either alone or in combination with hearing loss (23.4%), reflecting the chronic suppurative nature of the disease. The mean duration of symptoms was 22.2 ± 18.6 months, with most patients presenting within 1 year (44.2%). Conductive hearing loss was the predominant audiological finding (57.1%), while mixed hearing loss was observed in 22.1%, and only a small proportion had normal hearing or sensorineural hearing loss [Table 2].

Table 1: Demographic characteristics (*n*=77)

Parameters	Category	*n* (%)
Age distribution	≤20 years	14 (18.2)
	21–40 years	26 (33.8)
	41–60 years	22 (28.6)
	>60 years	15 (19.5)
	Mean±SD	40.64±16.28
Gender	Male	40 (51.9)
	Female	37 (48.1)
Side affected	Right	48 (62.3)
	Left	29 (37.7)

SD=Standard deviation

Table 2: Clinical presentation (*n*=77)

Parameters	Category	*n* (%)
Chief complaint	Ear discharge	25 (32.5)
	Ear discharge + HL	18 (23.4)
	HL	14 (18.2)
	Ear pain	10 (13.0)
	Others	10 (13.0)
Duration (months)	≤12	34 (44.2)
	13–24	26 (33.8)
	>24	17 (22.1)
	Mean±SD	22.2±18.6
Hearing status	Conductive HL	44 (57.1)
	Mixed HL	17 (22.1)
	Normal	11 (14.3)
	SNHL	5 (6.5)

SD=Standard deviation, HL: Hearing loss, SNHL=Sensorineural HL

Table 3: High-resolution computed tomography location of soft tissue (*n*=77)

Location	*n* (%)
Epitympanum	23 (29.9)
Epitympanum + antrum	22 (28.6)
Antrum	10 (13.0)
Epitympanum + mesotympanum	8 (10.4)
Mesotympanum	7 (9.1)
All compartments	4 (5.2)
No soft tissue	3 (3.9)

Table 4: High-resolution computed tomography -surgical correlation and diagnostic performance (*n*=77)

Parameters	HRCT, *n* (%)	Surgery, *n* (%)	Concordance (%)	Sensitivity (%)	Specificity (%)	Accuracy (%)
Scutum erosion	67 (87.0)	66 (85.7)	98.7	100.0	90.9	98.7
Ossicular erosion	61 (79.2)	62 (80.5)	97.4	98.4	100.0	98.7
Mastoid involvement	55 (71.4)	61 (79.2)	96.1	90.2	100.0	92.2
Tegmen tympani erosion	16 (20.8)	20 (26.0)	92.2	80.0	100.0	94.8
Sigmoid plate erosion	14 (18.2)	15 (19.5)	98.7	93.3	100.0	98.7
Facial canal erosion	16 (20.8)	16 (20.8)	100.0	100.0	100.0	100.0
LSCC fistula	7 (9.1)	10 (13.0)	90.9	70.0	100.0	96.1
Sinus tympani involvement	17 (22.1)	25 (32.5)	85.7	68.0	100.0	89.6

LSCC=Lateral semicircular canal

Table 5: Surgery outcomes (*n*=77)

Parameters	Category	*n* (%)
Surgery performed	Modified radical mastoidectomy	31 (40.3)
	Cortical mastoidectomy	17 (22.1)
	Canal wall procedures	23 (29.9)
	Attic exploration	6 (7.8)
Postoperative complications	None	62 (80.5)
	Wound infection	10 (13.0)
	Facial nerve weakness	2 (2.6)
	CSF leak	1 (1.3)
	SNHL	1 (1.3)
	Vertigo	1 (1.3)
Follow-up outcome	Disease-free	62 (80.5)
	Recurrence	11 (14.3)
Histopathology	True cholesteatoma	73 (94.8)
	Noncholesteatoma	4 (5.2)

HRCT=High-resolution computed tomography, SNHL=Sensorineural hearing loss, CSF=Cerebrospinal fluid

On HRCT evaluation, soft tissue most commonly involved the epitympanum (29.9%) or extended to the antrum (28.6%), consistent with typical pars flaccida cholesteatoma. Isolated antral or mesotympanic involvement was less frequent, and only 3.9% showed no detectable soft tissue on imaging, underscoring HRCT's high detection rate [Table 3].

HRCT demonstrated excellent correlation with surgical findings across most parameters. Scutum erosion and ossicular erosion showed high concordance (98.7% and 97.4%, respectively) with diagnostic accuracy approaching 99%. Facial canal erosion showed perfect agreement and 100% diagnostic performance. While mastoid involvement and sigmoid plate erosion also demonstrated high accuracy (>92%), HRCT showed comparatively lower sensitivity for tegmen erosion (80.0%), LSCC fistula (70.0%), and sinus tympani involvement (68.0%), though specificity remained 100% for most complications [Table 4].

Modified radical mastoidectomy was the most commonly performed procedure (40.3%), reflecting the extent of disease. Postoperative complications were infrequent, with 80.5% experiencing none, and recurrence was observed in 14.3% during follow-up. Histopathological examination confirmed true cholesteatoma in 94.8% of cases, validating the radiological and intraoperative diagnosis [Table 5].

Discussion

The present study evaluated the diagnostic performance of HRCT of the temporal bone in 77 patients with cholesteatoma and demonstrated excellent correlation with intraoperative findings. The mean age of 40.64 years with peak incidence in the 21–40 year age group (33.8%) is comparable to findings reported by Pandey *et al*. and Rajesh Kumar *et al*., who observed similar age distributions in their cohorts.[16,17] The nearly equal gender distribution (51.9% males and 48.1% females) aligns with most contemporary studies, although Lahel *et al*.(2023) reported a slight male predominance (60%).[18] Clinically, ear discharge (32.5%) and conductive hearing loss (57.1%) were the most common presenting features in our study, consistent with established patterns described in previous literature.[19,20] The mean duration of symptoms of 22.2 months further reflects the chronic and insidious progression of the disease.

Scutum erosion, a hallmark of pars flaccida cholesteatoma, showed excellent agreement (98.7%) between HRCT and surgical findings in the present study, with high sensitivity (100%) and specificity (90.9%). These findings closely parallel Lahel *et al*., who reported similar concordance rates, and Kapoor *et al*., who documented 90% sensitivity and 100% specificity for scutum erosion detection.[18,19] Soft tissue detection on HRCT demonstrated 94.8% agreement with surgical confirmation, with high sensitivity and accuracy, corroborating findings from Rajesh Kumar *et al*. and Ram *et al*., who also reported strong radiologic–surgical correlation for middle ear soft tissue localization.[17,20] The predominant involvement of the epitympanum (29.9%), either alone or in combination with the antrum, is consistent with the typical anatomical predilection of acquired cholesteatoma and aligns with observations by Khale *et al*.[21]

Ossicular erosion was detected in 79.2% on HRCT and confirmed surgically in 80.5%, with excellent concordance (97.4%) and accuracy (98.7%). The incus was the most frequently eroded ossicle, consistent with its anatomical vulnerability and tenuous vascular supply, a finding also supported by Shah *et al*. and Jain *et al*.[22,23] Mastoid involvement similarly demonstrated high agreement (96.1%). Among complications, tegmen tympani erosion showed slightly lower sensitivity (80.0%) but high specificity (100%), comparable to the 90% sensitivity reported by Dashottar *et al*.[24] Facial canal erosion demonstrated

perfect concordance (100%) in our study, emphasizing the reliability of HRCT in identifying this clinically significant complication; comparable high sensitivity has been reported by Kapoor *et al*., while Khavasi *et al*. documented slightly lower sensitivity (86.67%).[19,25]

Detection of labyrinthine fistula showed good agreement (90.9%), although sensitivity was lower (70.0%), indicating that very small fistulae may be missed, a limitation also noted by Ram *et al*.[20] Sinus tympani involvement demonstrated the lowest concordance (85.7%) and sensitivity (68.0%), reflecting the known difficulty in evaluating this hidden recess, a challenge similarly described by Lahel *et al*.[18] Despite these limitations, overall diagnostic performance in the present study was excellent, with sensitivity ranging from 68% to 100%, specificity from 90.9% to 100%, and accuracy from 89.6% to 100%. These findings are consistent with multiple contemporary studies reporting high reproducibility and reliability of HRCT in cholesteatoma evaluation across diverse populations.[16-25] The high concordance observed reinforces the pivotal role of HRCT in early detection, surgical planning, and prevention of severe complications associated with cholesteatoma.

This study has certain limitations that should be acknowledged. The sample size was relatively modest and derived from a single tertiary care center. Although surgical findings were used as the reference standard, subtle erosions, particularly in anatomically complex regions such as the sinus tympani and small labyrinthine fistulae, may have been underestimated on HRCT due to inherent spatial resolution constraints. In addition, long-term follow-up was limited, restricting assessment of residual or recurrent disease. Future multicenter studies with larger cohorts and standardized imaging review protocols would further strengthen the evidence base.

Conclusion

The present study demonstrates excellent concordance between HRCT findings and intraoperative observations in patients with cholesteatoma, confirming its high diagnostic accuracy in assessing disease extent, ossicular erosion, and major complications. HRCT reliably identified critical structures such as the scutum, ossicular chain, facial canal, and tegmen tympani, thereby facilitating precise preoperative planning and risk stratification. Although minor limitations were noted in evaluating hidden recesses such as the sinus tympani and small labyrinthine fistulae, overall diagnostic performance remained robust. These findings support the role of HRCT as a valuable preoperative imaging modality in clinically suspected cholesteatoma, contributing to improved surgical preparedness and optimized patient outcomes.

Acknowledgment

The authors acknowledge the support of the Department of Radio-Diagnosis, Shri B.M. Patil Medical College, Hospital and Research Centre, Vijayapura, for technical and academic assistance in conducting this study.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

References

1. Kuo CL, Liao WH, Shiao AS. A review of current progress in acquired cholesteatoma management. Eur Arch Otorhinolaryngol 2015;272:3601-9.
2. Mafee MF, Levin BC, Applebaum EL, Campos M, James CF. Cholesteatoma of the middle ear and mastoid. A comparison of CT scan and operative findings. Otolaryngol Clin North Am 1988;21:265-93.
3. Olszewska E, Wagner M, Bernal-Sprekelsen M, Ebmeyer J, Dazert S, Hildmann H, *et al.* Etiopathogenesis of cholesteatoma. Eur Arch Otorhinolaryngol 2004;261:6-24.
4. Yorgancılar E, Yildirim M, Gun R, Bakir S, Tekin R, Gocmez C, *et al.* Complications of chronic suppurative otitis media: A retrospective review. Eur Arch Otorhinolaryngol 2013;270:69-76.
5. Osma U, Cureoglu S, Hosoglu S. The complications of chronic otitis media: Report of 93 cases. J Laryngol Otol 2000;114:97-100.
6. Swartz JD, Harnsberger HR, Mukherji SK. The temporal bone. Contemporary diagnostic dilemmas. Radiol Clin North Am 1998;36:819-53, vi.
7. Baráth K, Huber AM, Stämpfli P, Varga Z, Kollias S. Neuroradiology of cholesteatomas. AJNR Am J Neuroradiol 2011;32:221-9.
8. Gaurano JL, Joharjy IA. Middle ear cholesteatoma: Characteristic CT findings in 64 patients. Ann Saudi Med 2004;24:442-7.
9. Corrales CE, Blevins NH. Imaging for evaluation of cholesteatoma: Current concepts and future directions. Curr Opin Otolaryngol Head Neck Surg 2013;21:461-7.
10. Vartiainen E, Vartiainen J. Effect of aerobic bacteriology on the clinical presentation and treatment results of chronic suppurative otitis media. J Laryngol Otol 1996;110:315-8.
11. Castle JT. Cholesteatoma pearls: Practical points and update. Head Neck Pathol 2018;12:419-29.
12. De Foer B, Vercruysse JP, Bernaerts A, Meersschaert J, Kenis C, Pouillon M, *et al.* Middle ear cholesteatoma: Non-echo-planar diffusion-weighted MR imaging versus delayed gadolinium-enhanced T1-weighted MR imaging – Value in detection. Radiology 2010;255:866-72.
13. Locketz GD, Li PM, Fischbein NJ, Holdsworth SJ, Blevins NH. Fusion of computed tomography and PROPELLER diffusion-weighted magnetic resonance imaging for the detection and localization of middle ear cholesteatoma. JAMA Otolaryngol Head Neck Surg 2016;142:947-53.
14. Lips LM, Nelemans PJ, Theunissen FM, Roele E, Van Tongeren J, Hof JR, *et al.* The diagnostic accuracy of 1.5 T versus 3 T non-echo-planar diffusion-weighted imaging in the detection of residual or recurrent cholesteatoma. J Magn Reson Imaging 2019;50:250-8.
15. Uz Zaman S, Rangankar V, Muralinath K, Shah V, Gowtham KG, Pawar R. Temporal bone cholesteatoma: Typical findings and evaluation of diagnostic utility on high resolution computed tomography. Cureus 2022;14:e22730.
16. Pandey N, Ranjan RK, Rai N, Toppo SK, Xalxo AR, Agrawal R, *et al.* HRCT scan evaluation of temporal bone cholesteatoma and its correlation with peroperative findings. J Pharm Bioallied Sci 2025;17:S1341-3.
17. Rajesh Kumar A, Sreelatha S, Paul Ravi Kumar V, Mrudula B. Cholesteatoma: A study on preoperative HRCT and intraoperative correlation. J Popul Ther Clin Pharmacol 2025;32:799-808.
18. Lahel RS, Tripathi S, Chail A. Comparative analysis of pre-operative high-resolution computed tomography temporal bone and intraoperative surgical findings in cases of cholesteatoma. J Marine Med Soc 2023;25:255-60.
19. Kapoor AA, Kapoor A, Nimkar NU, Soni HD, Ojha VS, Biswas R. High-resolution computed tomography and intraoperative correlation in cholesteatoma: Enhancing preoperative evaluation and surgical management. Cureus 2023;15:e44333.
20. Ram B, Gujral GS, Sarkar K, Sharma P. Comparative study of

pre-operative high-resolution computed tomography in middle ear cholesteatoma with per-operative findings. Int J Res Med Sci 2023;11:1568-72.
21. Khale A, Baviskar S, Chandak T, Baviskar P, Bagle T, More M. Role of HRCT temporal bone in pre-operative evaluation in unsafe ear diseases. A hospital record based retrospective study in Thane, Maharashtra. Int J Otorhinolaryngol Head Neck Surg 2023;9:553-9.
22. Shah CK, Gupta S, Gupta DP, Prajapati BJ, Prajapati V. Role of high resolution computed tomography of temporal bone in patients with cholesteatoma, in a tertiary care health center. Indian J Otolaryngol Head Neck Surg 2022;74:681-5.
23. Jain SK, Rastogi R, Neha, Rani S, Chaterjee P, Pathak V. Evaluation of temporal bone cholesteatoma with high resolution computed tomography (HRCT). Asian J Med Radiol Res 2019;7:195-8.
24. Dashottar S, Bucha A, Sinha S, Nema D. Preoperative temporal bone HRCT and intra-operative findings in middle ear cholesteatoma: A comparative study. Int J Otorhinolaryngol Head Neck Surg 2018;5:79-85.
25. Khavasi P, Malashetti S, Chandrashekarayya SH. An evaluation of preoperative high resolution computed tomography of temporal bone in cholesteatoma. Int J Otorhinolaryngol Head Neck Surg 2018;4:413-7.