

Original Research Article

## High Resolution Computed Tomography Evaluation of Temporal Bone Lesions

Dr. Amit Shankhwar<sup>1</sup>, Dr Yogita Dixit<sup>2</sup>, Dr. Prachi Shukla<sup>3</sup>, Dr. Arun Nagar<sup>3</sup>

<sup>1</sup>Assistant Professor, Department of Radiodiagnosis, MGM Medical College, Indore, MP, India

<sup>2</sup>Assistant Professor, Department of Otorhinolaryngology, Modern Institute of Medical Sciences, Indore, MP, India

<sup>3</sup>Resident, Department of Radiodiagnosis, MGM Medical College, Indore, MP, India

### \*Corresponding author

Dr. Amit Shankhwar

Email: [drpstripathi@gmail.com](mailto:drpstripathi@gmail.com)

---

**Abstract:** Many imaging modalities are available for the evaluation of the temporal bone of which high-resolution computed tomography (HRCT) plays a crucial role in demonstrating the detailed anatomy of the temporal bone and assessing the disease extent. Careful and thorough evaluation is needed for middle and inner ear lesions for the early diagnosis and treatment of the disease, to prevent complications and to determine the best surgical approach. The purpose of this study is primarily to understand the capability of HRCT in diagnosis and detection of pathologies of the temporal bone.

**Keywords:** Computed tomography; disease; HRCT; middle ear; temporal bone; erosion

---

### INTRODUCTION

Diseases of middle and inner ear can result in hearing loss which remains a significant health problem in terms of prevalence, economics and sequel. Clinical and otoscopic examination can determine lesions of external ear and some middle ear lesions. However further imaging is required to know the extent of disease, inner ear involvement, and intracranial extension and to decide appropriate medical and surgical management. Temporal bone imaging is challenging especially in relation to High Resolution Computed Tomography (HRCT) imaging.

Many imaging modalities are available for the evaluation of the temporal bone, including plain radiographs, contrast cisternography, computed tomography (CT), and magnetic resonance imaging (MRI).

HRCT excels in the evaluation of the middle ear disease process and adjacent bone. In certain cases, Magnetic Resonance Imaging is used as a next step for further characterization and evaluation of vascular lesions.

Careful and thorough evaluation is needed for middle and inner ear lesions for the early diagnosis and treatment of the disease, to prevent complications and determine their surgical approach.

The purpose of this study is primarily to understand the capability of HRCT in diagnosis and detection of pathologies of the temporal bone.

### AIMS & OBJECTIVES

The aims and objective of the study was to characterize the middle and inner ear lesions; to know the extent of middle ear lesions and to study the diagnostic efficacy in correlation with histopathological/ surgical findings.

### MATERIALS AND METHODS

40 patients were included in the study who were referred to the Department of Radio-diagnosis Mahatma Gandhi Memorial Medical College & M.Y. Hospital, Indore from ENT clinic in MY Hospital and MIMS, Indore with clinical history and symptoms like Otalgia (acute/chronic), otorrhea (acute/chronic), hearing loss (conductive or mixed) or tinnitus.

### Exclusion Criteria

Patients with cochlear implants, congenital malformations of ear and trauma were excluded from the study.

### Equipments & Techniques

All the HRCT scans were performed on 64 slice CT scanner after written consent of the patients.

The scan was done in axial and coronal axis commencing from the lower margin of the external auditory meatus and extended upward to the arcuate eminence of the superior semicircular canal. Contiguous 2 mm thick slices were obtained at 3 mm interval. The visualization of small bone structures, location and extent of lesions and the radiological changes were evaluated. The contra lateral temporal bone was included for comparison. The images were reconstructed with a bone algorithm.

Intravenous contrast was administered to study Hypervascular lesions like glomus tumours and Intracranial or extracranial extension of middle ear disease.

## RESULTS AND DISCUSSION

The purpose of the study was primarily to understand the capability of HRCT in diagnosis and detection of pathologies of temporal bone, to characterize the middle and inner ear lesions and to know the extent of middle ear lesions and its complications.

In this study, the youngest patient was 15 months and the oldest was 66 years. Maximum patients were in the age group 21 to 30yrs (30%) which is similar to study by Gerami *et al* [1].

Male: Female ratio was 3:2 which is in accordance with Vlastarakos *et al.* [2]. The most common presenting symptom was otorrhea (100%) followed by hearing loss (40%) and otalgia (33%). In the study, Middle ear is most commonly involved.

On tympanic membrane examination, most commonly central perforation was found which was seen in 37%, marginal perforation in 21%, attic perforation in 18% and in 24% tympanic membrane was not visualized. Non-dependent soft-tissue opacity was present in 88% of patients with CSOM with cholesteatoma.

Ossicle erosion was seen in 75% of patients. Incus was the commonest ossicle to be involved in 30%. Stapes was second most common seen in 24% and malleus least common seen in 21% patients. The findings are consistent with Gaurano JL *et al* [3].

Scutum erosion was seen in 70% cases with cholesteatoma. However, HRCT detected scutum erosion accurately in all cases. Hence, HRCT is 100% sensitive and specific to detect scutum erosion as per this study. Similar findings was seen by Thripathi Rai [4].

Facial nerve dehiscence was present in 6% of patients with cholesteatoma but was found in 18.75%

intra-operatively. Thukral *et al* [5] in their study also found similar result. Tegmen erosion was seen in 12%.



Fig-1: Erosion of bony ossicles with sclerosis of left mastoid air cells



Fig-2: Cholesteatoma in left middle ear

Labyrinthine fistula was seen in 15% of patients with cholesteatoma. Out of this 12% were seen in Lateral semicircular canal and 3% in cochlear promontory.

Mastoid cortex erosion was seen in 12% of patients with cholesteatoma. HRCT was also found to be 100% to detect cortical erosion of mastoid.

HRCT was 25% sensitive in detecting Lateral semicircular canal erosion. HRCT was found to be excellent to detect the other complications such as mastoiditis and mastoid abscess with 100% sensitivity and specificity.

Intracranial complications were 1 each case of sigmoid sinus thrombosis, meningitis (diagnosed clinically) with pneumocephalus, subdural empyema and brain abscess diagnosing all correctly giving it high sensitivity and specificity i.e. 100%.

Majority of the cases were attico-antral disease (AAD) that is 64% and remaining 36% were tubo-tympanic disease (TTD).

The extent of involvement of middle ear and mastoid in cholesteatoma in HRCT are as follows: Epitympanum, antrum, aditus, mastoid air cells, posterior tympanum, mesotympanum, hypotympanum, protympanum, and peri-labyrinthine air cells are 88%, 88%, 84%, 75%, 48%, 42%, 42%, 33%, and 24% respectively. This is similar to studies by Sirigiri and Dwaraknath [6].

HRCT is 100% sensitive and specific to know the type of mastoid pneumatisation. Sensitivity, specificity, PPV & NPV of HRCT in diagnosing CSOM (with cholesteatoma and mastoiditis) was found to be 100% each. The findings are in concordance with the study of Kanotra *et al* [7].

Tumours is the second most common lesion in our study with number of cases 7(17.5%). Peak age incidence of tumours was from 51-60yrs.

Acoustic neuroma was found to be most common CP angle tumour involving temporal bone in our study accounting for 60% of CP angle tumours.

HRCT diagnosed tumours as 4 cases of Acoustic neuroma, 1 Glomus tympanicum and 1 Metastasis. On surgical follow up, it was found that one case of Meningioma was falsely diagnosed as Acoustic neuroma on HRCT and also one case of inflammatory polyp was falsely branded as neoplastic polyp by HRCT. Therefore Sensitivity and Specificity for diagnosing Malignancy by HRCT in our study was found to be 85.7% & 97% respectively and PPV & NPV for diagnosing Malignancy by HRCT was found to be 85.7% & 97% respectively.

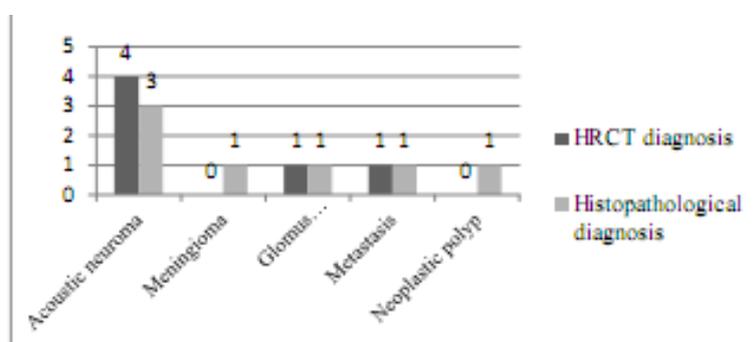


Fig-3: Correlation of HRCT diagnosis with Histopathological diagnosis

## CONCLUSION

For any middle ear pathology age, clinical history, location and imaging characteristics would enable us in making a correct diagnosis. HRCT helps us to know about the extent of the disease, anatomical variants, and possible complications. HRCT has got high reliability for the parameters such as scutum erosion, ossicular erosion, mastoid pneumatisation, anterior lying sigmoid, Korner's septum, cholesteatoma extension, presence of complications such as mastoiditis and mastoid abscess, sigmoid sinus plate erosion, facial canal dehiscence, labyrinthine fistula, and intracranial complications.

## REFERENCES

1. Gerami H, Naghavi E, Wahabi-Moghadam M, Forghanparast K, Akbar MH; Comparison of pre-operative computerized tomography scan imaging of temporal bone with intra-operative findings in patients undergoing mastoidectomy. Saudi Med J., 2009; 30:104-8.
2. Vlastarakos PV, Kiprouli C, Pappas S, Xenelis J, Maragoudakis P, Troupis G, Nikolopoulos TP; CT scan versus surgery: how reliable is the preoperative radiological assessment in patients

with chronic otitis media?. European Archives of Oto-rhino-laryngology, 2012; 269(1):81-6.

3. Gaurano JL, Joharjy IA; Middle ear cholesteatoma: characteristic CT findings in 64 patients. Ann Saudi Med., 2004; 24(6): 442-7.
4. Rai T; Radiological study of temporal bone in chronic otitis media: prospective study of 50 cases. Indian Journal of Otolaryngology. 2014; 20(2): 48-55.
5. Thukral CL, Singh A, Singh S, Sood AS, Singh K; Role of HRCT in evaluation of pathologies of temporal bone; J.clin Diagn Res., 2015; 9(9): TC07-10.
6. Sirigiri RR, Dwaraknath K; Correlative study of HRCT in attico-antral disease. Indian J Otolaryngol Head Neck Surg., 2011; 63:155-8.
7. Kanotra S, Gupta R, Gupta N, Sharma R, Gupta S, Kotwal S; Correlation of high-resolution computed tomography temporal bone findings with intra-operative findings in patients with cholesteatoma. Indian J Otol., 2015; 21:280-5.