

High Resolution Computed Tomography of Temporal Bone Pathologies with CT based Diagnosis - An Experience from Tertiary Health Centre in Kerala

Dr. Fiza Hamza ¹
 Dr. Akhil R Nambiar ²
 Dr. Shinto Sebastian ³
 Dr. Sinni K V ⁴

^{1,2,3} Resident, Department of Radiodiagnosis, Government Medical College, Thrissur, Kerala, India

⁴ Associate Professor, Department of Radiodiagnosis, Government Medical College, Thrissur, Kerala, India

Abstract:- Background: HRCT plays an important role in evaluation of middle ear, particularly for ossicles, bony structures and inner ear canals. This study is an attempt to document HRCT/CECT findings in middle ear pathologies and to categorize these pathology into radiological diagnosis.

Methods: 40 cases of HRCT temporal bone were studied which included all age groups and both sexes. The radiological diagnosis were defined and broadly classified into infection, neoplastic or radiologically normal.

Results and observation: Among the 40 cases, there were 67.5 percent cases of infections (30% Otomastoiditis: , 32.5% Cholesteatoma: 5% Mastoiditis:), 5% of neoplasms and 27.5% radiologically normal.

Conclusions: HRCT is a non-invasive easily available investigation for middle and inner ear, best suited for the preoperative evaluation of temporal bone anatomy and ossicular chain disruption.

Keywords: High Resolution Computed Tomography, Radiological Diagnosis, Temporal Bone.

I. INTRODUCTION

The non-invasive evaluation of the middle ear has been revolutionized by the use of modalities like CT and MRI. CT allows excellent delineation of calcifications, cortical bone, air, and fat. Hence, CT of temporal bone can be used to visualize external ear, middle ear soft tissue and bony structures (ossicles, tegmen, facial nerve canal) and inner ear structures like semicircular canal, cochlea etc. Although MRI offers much better, more specific, and more distinctive soft tissue characterization, (1) CT can easily assess ossicles, their erosions and extent of soft tissue lesions. High Resolution Computed Tomography outweighs the conventional modalities of investigations and provides higher spatial resolution and better soft tissue contrast.(2)

Contrast Enhanced CT of temporal bone is rarely indicated, except for documenting the enhancement in some tumors (where again, MRI is preferred, but use is restricted due to its availability). (3)

For the assessment of middle-ear infections, a close clinical correlation is essential to evaluate the nature of middle-ear soft tissue masses as cholesteatoma is mimicked by many other middle-ear pathologies.

Antico Antral Disease is an "unsafe" type of chronic otitis media (COM) due to its association with cholesteatoma which has a property of bone erosion and intraoperative complications. (4)

The hallmarks of cholesteatoma are soft tissue mass-like opacity in the middle ear cavity and mastoid antrum associated with smooth bony erosion of the ossicles and expansion of adjacent structures (5,6)

HRCT scan of temporal bone correlates well for the detection of disease presence and shows good radiosurgical agreement for sinus plate erosion, LSCC erosion but fair agreement for dural plate erosion and malleus erosion. (7,8)

This study is to document CT findings in temporal bone of patients referred for middle ear pathologies to the Department of Radiodiagnosis, Government Medical College, Thrissur, Kerala and simplify them by categorizing into "radiological diagnosis".

II. MATERIALS AND METHODS

- Study setting-Dept of Radiodiagnosis, Govt medical college Thrissur.
- Study design- Cross sectional Descriptive study
- Study population-Patients with signs and symptoms of middle ear pathology such as ear discharge, hearing loss,

vertigo, headache, cerebellar signs and tinnitus, where CT is indicated.

- Inclusion criteria-Patients who came for HRCT temporal bone with signs and symptoms of temporal bone (middle ear) pathologies.
- Exclusion criteria: Any radical surgery (like radical /modified radical mastoidectomy) done to temporal bone.
- Study period- March 2023 to September 2023 - 6 months
- Study procedure-Patients selected on the basis of inclusion criteria were scanned using Seimens 16 slice MDCT in axial plane with thin 0.6mm sections of formatted axial, coronal and sagittal non-enhanced images. Intravenous Iohexol was used as contrast in indicated cases. CT scans were evaluated for the presence of findings in temporal

bone. Results were entered in Excel sheets and tabulated using percentages.

Few definitions were used in the study

For the purpose of convenience, to aid a radiological diagnosis.

- Cholesteatoma –Non enhancing soft tissue density with ossicular erosion.
- CSOM/Otomastoiditis- Middle ear soft tissue/fluid density without bony erosion with or without mastoid involvement.
- Mastoiditis –Soft tissue /fluid density with or without bony erosion and isolated involvement of mastoid.

III. RESULTS

Forty cases of temporal bone CT were included in the study.

- Sex distribution: The study sample included 21 females (52.5) and 19 males (47.5%)

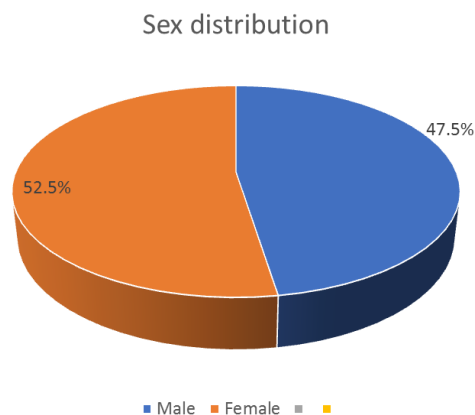


Fig 1: Sex distribution of cases

- Age distribution: The age ranged from 5 years to 72 years mean of 36.6 years. Most number of patients were in 20 to 29 age group.

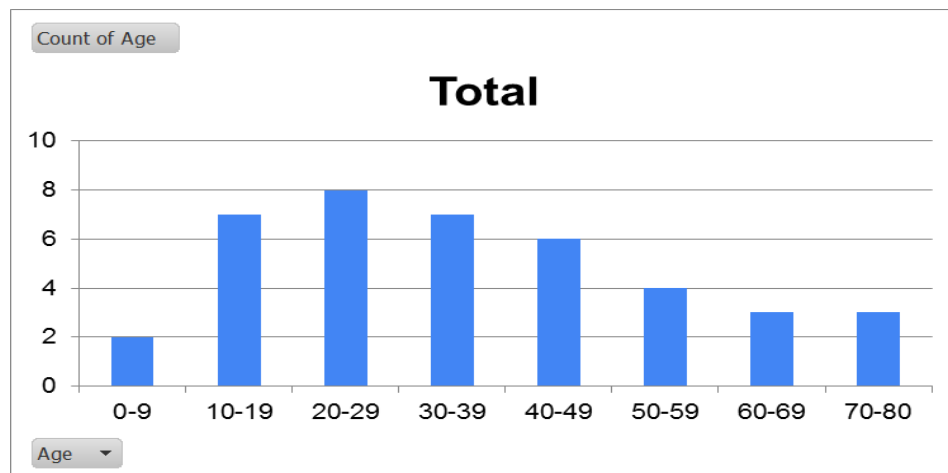


Fig 2: Age distribution of cases

- Side affected: In our study, of the 29 cases with CT findings in ear, it was found that the left ear was involved in 14 cases, Right ear in 11 cases and both ears in 4 cases.
- Symptoms: The main symptom is each patient was noted. Most common symptom was decreased hearing/hard on hearing, in 15 cases(37.5%) , followed by discharge from ear in 14 cases (35%) . Other symptoms documented, included pain, tinnitus and vertigo.Radiological diagnosis:

With the CT findings, a radiological diagnosis was assigned to each case. The "radiological diagnosis" were Otomastoiditis , Cholesteatoma, Mastoiditis, Tumors and radiological normal.

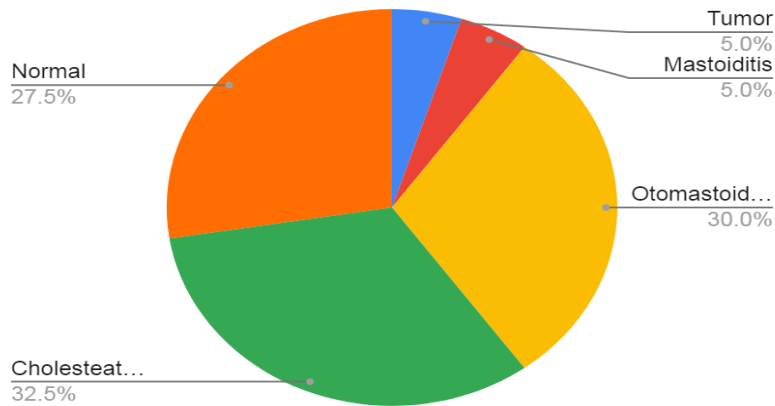


Fig 3: Pie diagram showing distribution of final radiological diagnosis



Fig 4: Radiology of isolated mastoid soft tissue opacification in the right mastoid.

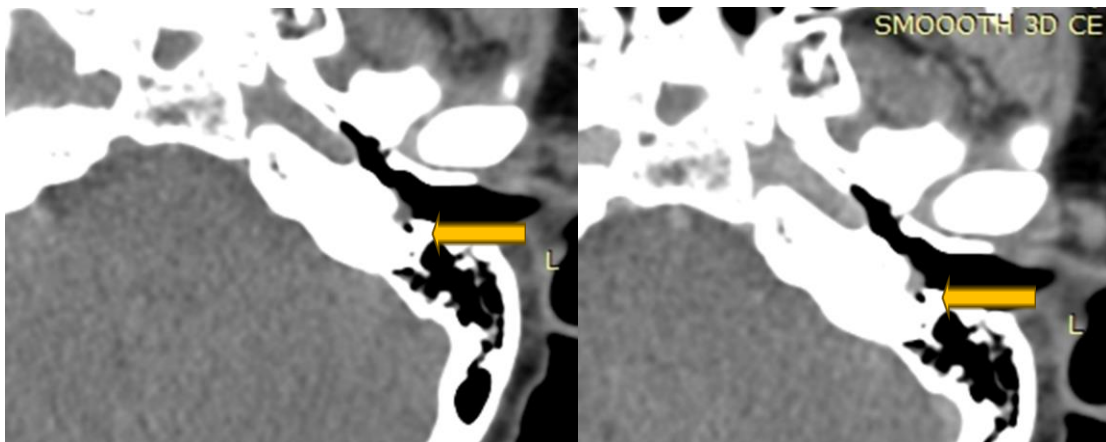


Fig 5, 6: Soft tissue density in middle ear which is Intensely enhancing on contrast (Fig 6)



Fig 7, 8: Soft tissue density in left middle ear with ossicular disruption

IV. DISCUSSION

High Resolution Computed Tomography is one of the easiest available non invasive modality for evaluation of temporal bone. Its importance in studying pre operative anatomy of the middle ear is well documented. Although, MRI is better in discriminating soft tissue masses, yet another importance of CT is in establishing the complications of middle ear pathology like ossicular discontinuity and bony defects.

Our study included 40 patients in the age range of 5 to 72 years with almost equal male female distribution. Of the most important symptom documented, the highest complaints were decreased hearing (37.5 %), followed by ear discharge (35 %, n=14)

External ear abnormality was not documented in any case. Tympanic membrane was not well visualized in most cases and hence, perforation was not separately commented upon.

Soft tissue masses in the middle ear was noted in 27 cases amounting to 67.5 percentage.

Of these, two were identified as neoplasms and 13 had bone erosions, hence categorized as Cholesteatoma.

The term Otomastoiditis was used for soft tissue filling the middle ear and mastoid without bony erosion, and so, 12 cases were radiologically diagnosed as Otomastoiditis.

Scutum showed erosion in 13 cases with all of them showing soft tissue in Prussacs space.

Those cases with soft tissue mass and bony erosion of middle ear was categorized as Cholesteatoma.

Ossicular erosion, particularly involving incus (8 cases) and malleus(6 cases) was noted.

Tegmen erosion was noted in one case. Other bony discontinuity like bony facial canal defect was not seen. Including all these cases, a final radiological diagnosis of Cholesteatoma was given in 13 cases (32.5%).

No obvious defects/ erosion or sclerosis of inner ear structures were noted in any of the cases in the present study.

Mastoid sclerosis was noted in 4 cases, and soft tissue exclusively filling mastoid air cells were noted in 2 cases. These cases with soft tissue filling only in mastoid was given a radiological diagnosis of isolated mastoiditis, 5%

These above radiological diagnoses were included in the heading of "infection", which accounted for 67.5 % of cases.

11 cases were "radiologically normal" without any obvious soft tissue/ bone erosion. A normal CT does not mean there is no pathology as some like mild otitis externa, facial palsy, etc may not be detected in CT. HRCT images may not well delineate tympanic membrane and its perforations, hence ASOM or a quiescent CSOM may not be well diagnosed. (These are clinical diagnosis which may not be diagnosed in CT).

The other major radiologically detected pathology was neoplasms. In this study, two cases of soft tissue masses with intense enhancement, hence diagnosed as glomus tympanicum, the most common middle ear tumor according to literature. (9)

These findings are comparable with similar studies from elsewhere in literature. A study by Santhosh Patil et al, in 2021 from Raichur, India, notes infection to be the most common pathology, of which Cholesteatoma was around 39% being the most common. Although they have reported more number of neoplasms (6 cases), majority was acoustic neuroma(60%) (9)

In yet another 2017 study from Ahmednagar, India with 100 patients, infection was the most common pathology (78%) followed by trauma (12%) and 6% cases of neoplasms (2)

A 2019 study from Udaipur, India (10) also reports the most common pathology to be Infections (61%), but they have included more trauma cases as HRCT has high accuracy in detecting fracture lines.

Most authors suggest HRCT as a tool for detailing middle ear anatomy in preoperative work up for middle ear pathology (3,4,8,11)

V. CONCLUSION

HRCT of temporal bone can be used to detect soft tissue density and bony erosions in middle ear diseases and a broad radiological diagnosis can be suggested in individual cases. These can be interpreted in adequate clinical context. However, HRCT is best indicated as a preoperative work up for middle ear diseases.

REFERENCES

- [1]. Juliano, A.F. Cross Sectional Imaging of the Ear and Temporal Bone. *Head and Neck Pathol* 12, 302–320 (2018).
- [2]. Sneha Ankush More, Dilip L. Lakhkar, Sushil Kachewar, Pramod Kumar S, Rekha Panpati, High-resolution Computed Tomographic Evaluation of Pathologies of Temporal Bone, *Sch. J. App. Med. Sci.*, Mar 2017; 5(3B):770-779
- [3]. August S. Tuan, James Y. Chen, Mahmood F. Mafee, Glomus tympanica and other intratympanic masses: Role of imaging Operative Techniques in Otolaryngology, Vol 25, No 1, March 2014
- [4]. Mandal, S., Muneer, K. & Roy, M. High Resolution Computed Tomography of Temporal Bone: The Predictive Value in Atticoantral Disease. *Indian J Otolaryngol Head Neck Surg* 71 (Suppl 2), 1391–1395 (2019).
- [5]. Joselito L. Gaurano, Ismail A. Joharjy, Middle ear cholesteatoma: characteristic CT findings in 64 patients, *Journal Article*, 2004, *Annals of Saudi Medicine*, 24, 442-447.
- [6]. Mafee MF, Levin BC, Applebaum EL, Campos CF. Cholesteatoma of the middle ear and mastoid. *Otolaryngol Clin North Am.* 1988;21:265–268.
- [7]. Agarwal R, Pradhananga R, Das Dutta H, Poudel S. Correlation of Pre-operative Temporal Bone CT Scan Findings with Intraoperative Findings in Chronic Otitis Media: Squamous Type. *Indian J Otolaryngol Head Neck Surg.* 2022 Aug;74(Suppl 1):33-42. doi: 10.1007/s12070-020-01805-0. Epub 2020 Feb 1. PMID: 36032878; PMCID: PMC9411409.)
- [8]. Khan MI, Patel S, Dasgupta K. Is HRCT Temporal Bone Necessary in All Cases of Active Squamous Chronic Otitis Media? *Indian J Otolaryngol Head Neck Surg.* 2019 Nov;71(Suppl 2):1212-1216. doi: 10.1007/s12070-018-1272-0. Epub 2018 Feb 15. PMID: 31750153;
- [9]. Santosh Reddy Patil, Chetan M. Role of CT in Evaluation of Diagnosis and Pathologies of Temporal Bone. *International Journal of Contemporary Medicine Surgery and Radiology.* 2021;6(4):D48-D52.

- [10]. Abhijit Kishorkumar Sankhla, Neha Dubey. Assessment of temporal bone diseases by high resolution computed tomography – institution based study. *International Journal of Contemporary Medicine Surgery and Radiology.* 2019;4(2):B87-B90.
- [11]. Watts S, Flood LM, Clifford K. A systematic approach to interpretation of computed tomography scans prior to surgery of middle ear cholesteatoma. *The Journal of Laryngology & Otology.* 2000;114(4):248-253.