Section: Radiodiagnosis

Original Research Article

SPECTRUM OF TEMPORAL BONE PATHOLOGIES IN HRCT TEMPORAL BONE

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Received : 25/12/2025
Received in revised form : 02/02/2026
Accepted : 19/02/2026

Keywords:
Temporal bone, High resolution computed tomography, Middle ear, Cholesteatoma.

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DOI: 10.47009/jamp.2026.8.2.4

Source of Support: Nil,
Conflict of Interest: None declared

Int J Acad Med Pharm
2026; 8 (2); 13-16

ABSTRACT

Background: Owing to the complex anatomy and minute osseous and neurovascular structures of the temporal bone, high-resolution computed tomography (HRCT) has emerged as the imaging modality of choice for detailed evaluation. Its excellent spatial resolution allows accurate depiction of middle- and inner-ear structures, ossicular chain integrity, labyrinthine capsules, and skull-base foramina, thereby playing a crucial role in diagnosis, surgical planning, and postoperative assessment.. **Materials and Methods:** A Retrospective study of 50 patients with complaints of ear pain, discharge and trauma.. **Result:** Among 50 patients Young adults, between 21-30 years and Males are more commonly affected. Among middle ear infections, Cholesteatoma was most commonly seen followed by Otomastoiditis. Among HRCT findings of cholesteatoma, soft tissue density in epitympanum was most common finding and Ear osscile erosions were next common finding. **Conclusion:** HRCT is a highly valuable imaging modality for the preoperative evaluation of temporal bone pathologies, providing accurate delineation of disease extent and associated complications at a reasonable cost and with excellent spatial resolution. It plays a pivotal role in guiding surgical decision-making by clearly demonstrating middle ear disease, ossicular involvement, skull-base erosion, and intracranial extension

INTRODUCTION

Diseases of the temporal bone constitute a significant proportion of otologic morbidity encountered in tertiary care hospitals, presenting with symptoms such as hearing loss, otorrhea, vertigo, tinnitus, facial nerve palsy and intracranial complications. Owing to the complex anatomy of the temporal bone and the minute size of its osseous and neurovascular structures, high-resolution computed tomography (HRCT) has become the imaging modality of choice for detailed evaluation of temporal bone pathologies. Its excellent spatial resolution allows precise depiction of middle- and inner-ear structures, ossicular chain integrity, labyrinthine capsules and skull-base foramina, thereby playing a crucial role in diagnosis, surgical planning and postoperative assessment.[1-8]

Brief Anatomy of the Temporal Bone

The temporal bone is a paired structure forming part of the lateral skull base and houses the organs of hearing and balance. It is classically divided into the squamous, tympanic, mastoid and petrous portions. The external auditory canal is formed by the tympanic and squamous parts and leads medially to the tympanic membrane, which separates the external ear from the middle ear cavity. The middle ear contains the ossicular chain—malleus, incus and stapes—which transmits sound vibrations to the oval window of the vestibule. The epitympanum (attic), mesotympanum and hypotympanum form the three compartments of the middle ear, with the aditus ad antrum providing communication with the mastoid air-cell system.

The inner ear is located within the dense otic capsule of the petrous temporal bone and consists of the cochlea, vestibule and semicircular canals. The facial nerve traverses the temporal bone in its labyrinthine,

ISSN (O): 2687-5365; ISSN (P): 2753-6556

tympanic and mastoid segments before exiting at the stylomastoid foramen. Additional critical structures include the internal auditory canal transmitting the facial and vestibulocochlear nerves, the jugular bulb and carotid canal, and the tegmen tympani forming the roof of the middle ear and mastoid cavity.

Common Temporal Bone Pathologies

Temporal bone diseases may be broadly categorized into inflammatory, congenital, traumatic, neoplastic and otic capsule disorders. Chronic suppurative otitis media and its complications remain highly prevalent in developing countries, often leading to ossicular erosion, mastoiditis, labyrinthine fistula and intracranial spread. Cholesteatoma represents a particularly aggressive middle-ear pathology characterized by keratinizing epithelium causing bone destruction and is a frequent indication for imaging.

Congenital anomalies include external auditory canal atresia, ossicular malformations and inner-ear dysplasias such as Mondini deformity. Traumatic injuries may result in temporal bone fractures—classified as longitudinal, transverse or mixed—with possible involvement of the otic capsule, facial nerve canal or ossicles. Neoplastic conditions range from glomus tumors and vestibular schwannomas to primary temporal bone malignancies, while otosclerosis and labyrinthitis ossificans affect the otic capsule and cause conductive or sensorineural hearing loss.

Role of HRCT in Temporal Bone Evaluation

HRCT has emerged as the cornerstone imaging technique for temporal bone assessment because of its ability to provide sub-millimeter section thickness, high spatial resolution and multiplanar reformations. It accurately demonstrates bony erosion, sclerosis, ossicular chain disruption, scutum blunting, tegmen defects, semicircular canal dehiscence and facial nerve canal integrity. In cases of cholesteatoma, HRCT delineates the extent of disease and identifies complications such as labyrinthine fistula or tegmen erosion, thereby aiding surgical planning.

In traumatic settings, HRCT rapidly detects fracture lines, pneumolabyrinth, ossicular dislocation and vascular canal involvement. For congenital hearing loss, it maps middle- and inner-ear malformations prior to reconstructive surgery or cochlear implantation. HRCT is also invaluable in evaluating otosclerosis, superior semicircular canal dehiscence and postoperative temporal bone status.

Although magnetic resonance imaging complements HRCT in assessing soft-tissue components, intracranial extension and residual or recurrent cholesteatoma, HRCT remains the first-line modality for detailed osseous anatomy and preoperative road-mapping.

Objectives:

- To determine the infective pathologies of the temporal bone along with their complications on HRCT.
- To assess the temporal bone trauma and its associated complications on HRCT.

MATERIALS AND METHODS

This is the Systemic review conducted in the PESIMSR Hospital, Kuppam in the time period of Jan 2024 and June 2025. Study included the total of 50 patients.

Inclusion Criteria

Patients with Otological symptoms like ear discharge, tinnitus, hearing loss and ear pain. Cases of trauma also included.

Exclusion Criteria

1. Patients with congenital anomalies.
2. Patients with cochlear implants.
3. Patients not cooperating for the study.
4. Pregnant women.

RESULTS

Incidence of temporal bone lesions

Table 1: showing distribution of disease

Etiology	Number of cases(n=54)	percentage
Infective	45	83 %
Trauma	4	7 %
Normal	5	9 %

Table 2: Showing Sex Distribution

Gender distribution	Number of cases(n=54)	percentage
Male	30	55.5%
Female	24	44.4%

Table 3: Showing Age Distribution

Age distribution (yrs)	number of cases(n=54)	percentage
0 -10	2	3.7%
11_20	10	18.5%
21-30	18	33%
31-40	8	14%
41-50	7	13%
51-60	5	9%
61-70	4	7%

ISSN (O): 2687-5365; ISSN (P): 2753-6556

Table 4 showing distribution of Infection.

Infective	number of cases(n=45)	percentage
Middle ear	41	91%
External ear	4	8%

Table 5: showing distribution of Infection in middle ear.

Infective	Number of cases(n=41)	percentage
Cholesteatoma	12	29%
Otomastoiditis	24	58%
Mastoidits	35	85%

Table 6: showing distribution of involvement of cholesteatoma -uni/ bilateral

Involvement	Number of cases with cholesteatoma n=12	percentage
Bilateral	1	8.3%
Unilateral	11	91.6%

Table 7: showing cholesteatoma with associated pathologies

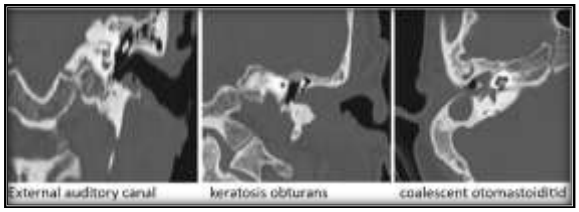
Associations	No of cases (n=12)	Percentage
Chol + automastoidectomy	4	33%
Chol+ Mastoid sclerosis	5	41%

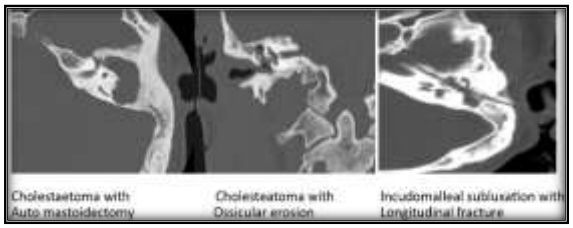
Table 8: showing involvement of otomastoiditis-Uni/bilateral

Involvement	Number of cases with Otomastoiditis	percentage
Bilateral	5	20.8%
Unilateral	19	79%

Table 9: showing HRCT findings in cholesteatoma

HRCT Findings in Cholesteatoma	No. of Cases (n=12)	Percentage
Epitympanum	11	91%
Mesotympanum	9	75%
Hypotympanum	10	83%
Aditus	10	83%
Entire middle ear cavity	9	75%
Ossicles erosions	9	75%
Facial nerve involvement	6	50%
Semicircular canal involvement	3	25%
Tegmen erosions	9	75%
Antrum	9	75%
External ear	1	8.3%





DISCUSSION

In our study, we found that Most common temporal bone pathology was infections of middle ear. Young adults, between 21-30 years were most commonly affected in our study. In our study, Males are more commonly affected than females. Among middle ear infections, Cholesteatoma was most commonly seen followed by Otomastoiditis. Unilateral involvement was most commonly seen than bilateral ear involvement in cholesteatomas.[9,10]

Among HRCT findings of cholesteatoma, soft tissue density in epitympanum was most common finding (Prussak's space) seen in cholesteatoma cases in our study.[11]

Ear osscile erosions were next common finding in cholesteatoma cases (75%) followed by tegmen erosions (74%) and facial canal involvement (50%) of cholesteatoma cases in our study.SCC involvement were least frequent findings seen in cholesteatomas.Complications like coalescent mastoiditis.[12]

External ear infections like keratosis obturans, external auditory canal cholesteatoma, chronic myringitis and external auditory canal polyp/granulation tissue. Among 4 cases of trauma assessed in our study, 3 cases were found to have fractures of various parts of temporal bone like mastoid, squamous and tympanic parts.

Associated complications of temporal trauma like hemomastoid & hemotympanum and ear ossicle involvement were seen in 2 cases each.

Normal variants like High jugular bulb, greater emissary veins and aberrant petrous internal carotid artery.

ISSN (O): 2687-5365; ISSN (P): 2753-6556

CONCLUSION

The results of the present study indicate that HRCT is a valuable imaging modality through which pre-operative assessment of temporal bone pathologies can be done efficiently with reasonable accuracy, cost, and precision for making surgical decisions. HRCT helps in defining the disease, extent, and complications of almost all middle ear pathologies. Hence it helps the surgeon to decide the course of action in a particular clinical problem.

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ISSN (O): 2687-5365; ISSN (P): 2753-6556