Original Article

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Evaluation of Temporal Bone Cholesteatoma with High Resolution Computed Tomography (HRCT)

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Abstract

Background: Cholesteatoma is a potentially dangerous condition affecting middle ear cavity. As high-resolution computed tomography (HRCT) of temporal bone clearly depicts the inner anatomy, it can serve as an important imaging tool in evaluating cholesteatoma for preoperative planning. Hence, this study evaluates the efficacy of pre-operative HRCT in the evaluation of patients with middle ear cholesteatoma. **Subjects and Methods:** This was a prospective pilot study of 40 patients with chronic suppurative otitis media and unsafe type cholesteatoma. Each patient was subjected to full clinical evaluation, and HRCT examination prior to operative intervention. Preoperative radiological data were correlated with data related to surgical findings. **Results:** The study showed that a high incidence of cholesteatoma in the 2nd to 4th decade of life. The scutum and lateral attic wall were the most common bony erosions in the middle ear bony wall in nearly two-third patients. The malleus was the most eroded ossicle in the middle ear in nearly 80% cases. Facial canal erosion was found in nearly one-fifth patients. Temporal bone complications were commoner than intracranial complications. When compared with operative features, HRCT findings had an accuracy of more than 90% in detecting, localizing and determining the extent of cholesteatoma and nearly 100% accuracy in demonstrating ossicular chain erosion, labyrinthine fistula and intracranial complications. **Conclusion:** HRCT scan is an excellent preoperative imaging modality for the otologist to predict ossicular status and determining patient prognosis.

Keywords: Cholesteatoma, Computed Tomography, Temporal Bone.

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Introduction

Cholesteatoma refers to an abnormal, benign growth or migration of skin from ear canal into the middle ear cavity usually secondary to chronic suppurative otitis media (CSOM). It is potentially a dangerous condition as it can extend into and erode adjacent structures causing a variety of serious complications. The choice of surgery for cholesteatoma is very important in order to preserve hearing and to prevent further complications.[1-2] As High-Resolution Computed Tomography (HRCT) of temporal bone clearly depicts the anatomy of various small important structures in middle and inner ear cavities, it can serve as an excellent modality and investigation of choice in diagnosing and defining the extent of cholesteatoma thus helping in preoperative planning for operating surgeon. However, routine preoperative HRCT temporal bone scan prior to surgery in every patient of CSOM can be justified only if proven to influence the clinical management.

Aims and Objectives of Study

To understand the role of preoperative HRCT temporal bone in CSOM patients in evaluation of following:

- Detection of middle ear cholesteatoma
- Defining extent and severity of ossicular pathology
- Detecting complications

Subjects and Methods

This was a multicentric, prospective pilot study of 40 patients with CSOM and unsafe type cholesteatoma. Each patient was subjected to full clinical evaluation, and HRCT examination prior to operative intervention. Axial images of 0.6-0.7 mm thickness were acquired in spiral & high-resolution mode parallel to the orbitomeatal plane with subsequent reconstruction in coronal plane parallel to vertical ramus of the mandible. Intravenous, non-ionic, iodinated, contrast media was used whenever indicated.

Patients with recurrent CSOM, revision surgery, temporal bone fracture, history of head & neck radiotherapy and

patients unsuitable for surgery or scanning were excluded from study.

The images were analysed by the radiologists and findings were recorded in standardised format. All patients underwent mastoid exploration following HRCT temporal bone within one week and surgical findings were recorded. Finally, preoperative radiological data was correlated with data obtained by surgical exploration.

Observations – (Figures 1-6)

In our study, male (23/40) outnumbered female patients (17/40).

Table 1 shows distribution of patients according to age, where we can see that majority of patients 24 out of 40 were in 2nd to 4th decade of life.

In our study, there was no significant difference in the involvement of pars flaccida& pars tensa region of tympanic membrane [Table 2].

Table 3 shows distribution of patients with destruction of bony middle ear walls where scutum& lateral attic wall erosions were the commonest, contributing to 45% in our study followed by Korner's septum. Additional findings noted in our study were sclerosis of mastoid air cells in 40% (16/40), facial canal erosion in 20% (8/40) and lateral semicircular canal involvement in 10% (2 out of 40).

Majority of patients in our study revealed complete erosion of ossicular chain with malleus being most commonly involved isolated as well as with other ossicles [Table 4].

Results

Our study revealed a high incidence of cholesteatoma in the third decade of life. The scutum and lateral attic wall were most commonly eroded in middle ear cavity accounting to nearly two-third patients. The malleus was the most commonly eroded ossicle of middle ear in 80% cases. Sclerosis of mastoid air cells were encountered in less than two-third patients while lateral semicircular canal was affected in less than 10%. Temporal bone complications were far more common than intracranial complications in CSOM. Facial canal erosion was found in nearly one-fifth patients.

When compared with operative findings, HRCT findings had an accuracy of more than 90% in detecting, localizing and determining the extent of cholesteatoma and nearly 100% accuracy in demonstrating ossicular chain erosion, labyrinthine fistula and intracranial complications.

Table 1: Age distribution of Patients

Age (Years)	Total
10-19	8
20-29	10
30-39	6
40-49	4
50-59	4
60-69	4
70-79	4
Total	40

Table 2: Distribution of Patients with Tympanic Membrane Involvement

Cholestestoma	No. of Patients	% age
Pars FlaccidaCholestestoma	14	35.0
Pars tensaCholestestoma	12	30.0
Combined Cholestestoma	14	35.0

Table 3: Distribution of Patients with Middle Ear Wall Erosion

Bony wall erosion	No. of Patients	%
Blunted scutum	6	15
Eroded scutum& lateral attic wall	12	30
Eroded tegmen	4	10
Thinning of the tegmen	4	10
Eroded sigmoid sinus plate	4	10
Eroded superior and posterior meatal wall	4	10
Eroded Korner`s septum	6	15

Table 4: Distribution of Patients with Ossicular Chain Erosion

Integrity of the Ossicles	No. of Patients	%
Completely eroded (no ossicles)	18	45.0
Eroded malleous only	14	35.0
Eroded incus only	6	15.0
Intact ossicles	2	5.0
Total	40	100.0

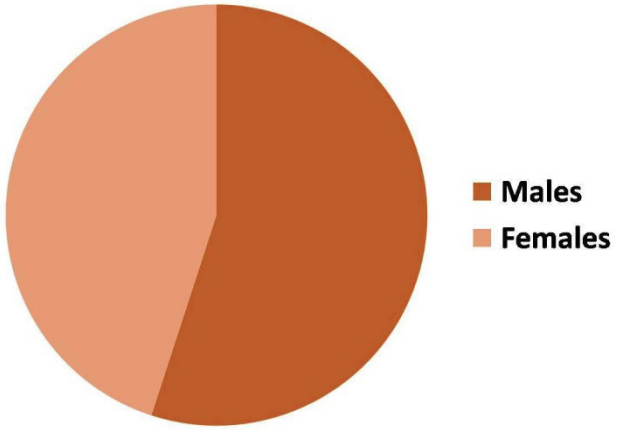

Figure 1: Pie chart showing distribution of patients according to sex

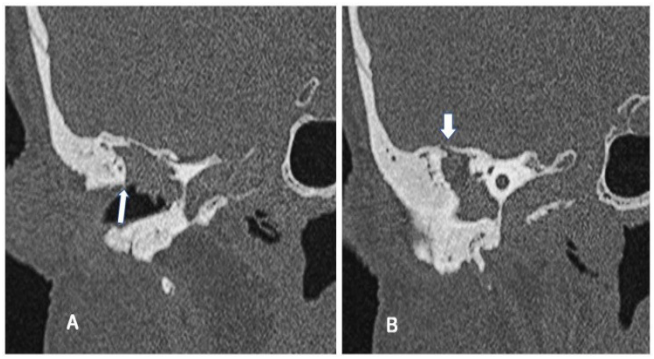

Figure 2: Coronal MPR HRCT images of temporal bone in CSOM with cholesteatoma in two different patients showing complete ossicular chain disruption along with destruction of scutum (A) &tegmen tympani (B)

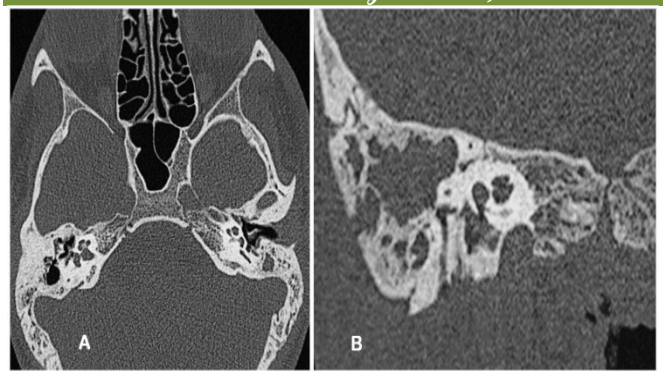

Figure 3: HRCT images of temporal bone in CSOM in 2 different patients showing sclerosis of mastoid (bilateral, R>L) in axial (A) while mastoid sclerosis with wall destruction in coronal (B) images

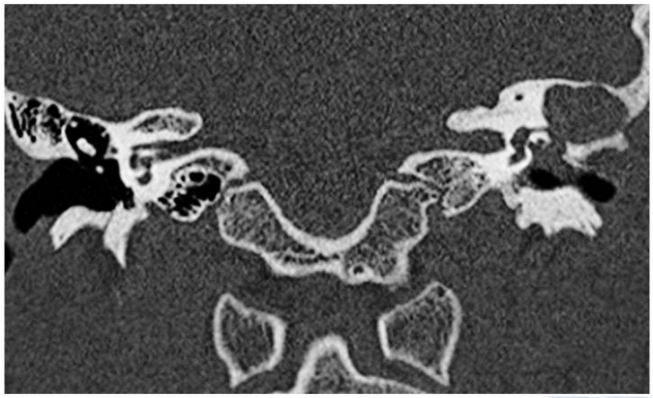

Figure 4: HRCT images of temporal bone in CSOM with cholesteatoma on left side showing complete ossicular destruction, labyrinthine fistula & facial canal dehiscence

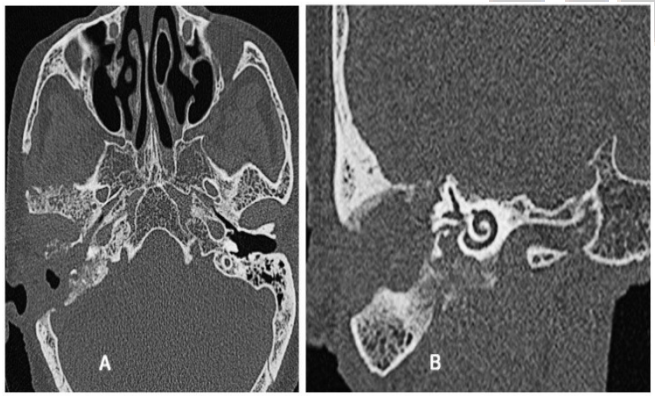

Figure 5: Axial (A) & Coronal (B) HRCT images of temporal bone showing gross destruction of mastoid & middle ear with scutum, mastoid, ossicular chain, facial nerve canal &tegmen tympani erosions on right side

Discussion

Acquired cholesteatoma may be associated with multiple pathologies viz. infection, tumor, etc. The commonest association in our study was infection of the middle ear cavity which is similar to that described by Sethom et al &Gaurano et al in their studies.[3-4]

Common complications encountered in severe late cases of CSOM are extradural abscess, cerebral or cerebellar abscess and otitic hydrocephalus. Incidence of intracranial complications in our study was approximately 20%. Crandal et al also showed that brain abscess is the most common intracranial complication and mostly affects the temporal lobe and cerebellum.[5]

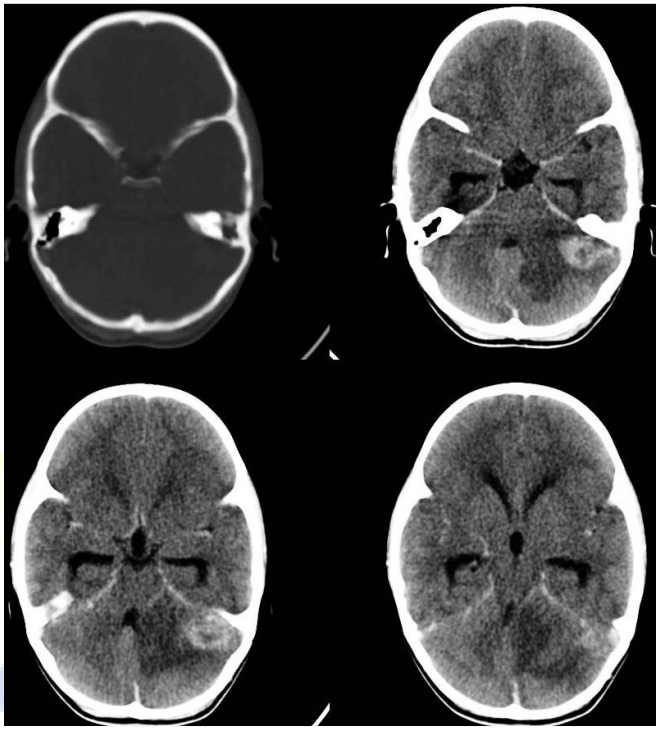

Figure 6: Axial CECT images, A in bone window settings demonstrates opacification of left middle ear cavity; B-D in brain window settings shows a thick walled ring enhancing lesion in left cerebellar hemisphere adjacent to left tympanic cavity producing edema, tentorial enhancement & mass effect on 4th ventricle with dilatation of proximal ventricular system in a case of CSOM with intracranial complications

Results of our study suggest that preoperative HRCT scan in CSOM have high concurrence with intraoperative findings. Our study results are similar to those reported in multiple other studies in the world literature.[1, 6-10]

Thus, early recognition of disease by HRCT temporal bone can help prevent hearing loss and grave intracranial complications. HRCT scan can serve as a guide to nature of disease (destructive / non-destructive), potential dangers (such as labyrinthine fistula) and possible complications thus assisting the choice of surgical procedure (simple or radical mastoidectomy with or without tympanoplasty / atticotomy). Thus, a routine preoperative HRCT scan can be justified as it can predict outcome of surgery and significantly lowers morbidity.

Conclusion

HRCT temporal bone scan is an excellent & justifiable

preoperative imaging modality for the otologist to detect cholesteatoma, predicting ossicular status and other complications in patients with CSOM not only determining patient prognosis but also serving as a roadmap to surgeon.

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