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IMAGING EVALUATION OF MIDDLE EAR PATHOLOGIES AND CLINICAL AND SURGICAL CORRELATION

Radiodiagnosis

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ABSTRACT

Aim: To study the radiological findings related to middle ear pathologies using X-ray mastoid schuller's view & HRCT Temporal bone and correlation with clinical and operative findings.

Method: Prospective Cohort study of fifty patients with suspected middle ear pathologies based on clinical history & examination, subjected to bilateral X-ray mastoid schuller's view and HRCT temporal bone.

Result: Twenty six (52%) cases were of CSOM (TTD), fourteen (28%) cases were of CSOM with cholesteatoma and ten (20%) cases were of trauma. Twenty five patients were operated. HRCT temporal bone showed 96% sensitivity in detecting disease extent, 99.3% sensitivity and 80% specificity in detecting ossicular erosion,100% sensitivity and 100% specificity for detecting scutum erosion, 91.7% sensitivity with specificity of 84.6% in detecting tegmen erosion,100% sensitivity and specificity in detecting sinus plate erosion,75% sensitivity and 82.4% specificity in detecting facial canal involvement and 66.7% sensitivity & 95.5% specificity in detecting the lateral semicircular canal erosion.

Conclusion: The present study showed a good agreement between HRCT and operative findings. HRCT temporal is a useful diagnostic tool for diagnosing, surgical planning and management of temporal bone pathologies.

KEYWORDS

INTRODUCTION

Middle ear disease is a common clinical entity, but has varied presentations and sequelae. Middle ear pathologies include a broad range of pathological conditions, most common include AOM (suppurative or nonsuppurative) and CSOM, with or without cholesteatoma and cholesterol granuloma. The range and complexity of the problems that can arise pose a challenge to the clinician, who sometimes has only subtle clues that lead to the discovery of extensive disease.[1,2]

Middle ear disease can present as ear pain, otorrohea, hearing impairment and other symptoms.[3]Some of the middle ear diseases (e.g., inflammation and neoplastic disease) can become serious medical problems if not identified and treated, with involvement of the inner ear, brain and systems beyond.[4]

Radiology confirms and expands upon otoscopic findings, resolves clinical doubts, and in many circumstances plays a significant role in determining surgical efficacy when surgery is necessary.[5]

The various modalities of temporal bone imaging are X-Ray mastoid schuller's view, CT scan and MRI.

The Sculler's view offers good visualization of the lateral position of the temporal bone, the mastoid process and the squama. It is good to visualize the mastoid pneumatization.

Cross-sectional imaging has evolved rapidly and has surpassed the radiography and plain film tomography.[6,7]

MSCT is highly accurate to demonstrate the presence of abnormal tissue in the middle ear, with sensitivity ranging between 70% to 96%, but one of its limitations is that it cannot define if the tissue is inflammatory, fibrotic or cholesteatoma. The differential diagnosis between such two conditions cannot be accurately done with MSCT, since the radiological findings are very similar and many times overlap to each other. In such cases, and particularly in already operated patients, MRI is essential to define the diagnosis.[8,9]

MRI increases the specificity as compared with MSCT, particularly in the postoperative follow-up. It is useful to evaluate meningoencephaloceles, to differentiate between fibrosis, inflammatory tissue and disease recurrence. The final diagnosis is usually a combination of radiological and clinical findings.[10]

This study was done with the aim to study the radiological findings related to middle ear pathologies using X-ray mastoid schuller's view & HRCT Temporal bone and correlation with clinical and operative findings.

Materials and methods

The prospective cohort study included fifty patients with suspected middle ear pathologies based on clinical history & examination and referred by Department of Otorhinolaryngology, for imaging evaluation to the Department of Radio-Diagnosis and Imaging.

Written informed consent was taken and all cases selected for study were subjected to detailed history with tabulation of clinical findings. Bilateral X-ray mastoid Schuller's view followed by HRCT temporal bone was done in all patients.

CT Scans were acquired on Philips ingenuity core 128 multislice unit with 768 × 768 and 1024 × 1024 matrix. Scanning parameters of 120KV, 250 mAs, 1mm section thickness and collimation of 0.6 mm were taken. With the patient in supine position, axial projections were obtained by serial 1mm thick sections of the temporal bone with the line joining the infra-orbital rim and external auditory meatus perpendicular to the table. The images were reconstructed with a bone algorithm. Coronal and sagittal reformatting was done. Each HRCT image were analysed for specific features relevant to the evaluation of pathologies of temporal bone and interpreted in detail.

Correlation of the imaging findings was done with clinical and operative findings with statistical analysis done using online available software (SSSP ver. 22).

Result

The present study included fifty patients with 29 (58%) males and 21 (42%) females. In this study most common age group affected was 11 to 20 years (32%, n=16), followed by 21-30 years age group (n=9, 18%). The mean age of 32.32 years was calculated. [Table 1]

Table 1. Age Wise Distribution of Studied Patients

AGE GROUP	NO. OF PATIENTS (n=50)	PERCENTAGE
0-10	04	8
11-20	16	32
21-30	09	18
31-40	05	10
41-50	04	8
51-60	07	14
61-70	03	6
71-90	02	4
TOTAL	50	100

The most common presenting symptom was impaired hearing (72%, n=42). [Table 2]

Table no – 2 Clinical Symptoms in Studied Patients

CLINICAL SYMPTOMS	NO. OF PATIENTS	PERCENTAGE
IMPAIRED HEARING	42	84
EAR DISCHARGE	36	72
FEVER	19	38
EARACHE	18	36
HEADACHE	14	28
TINNITUS	13	26
EARBLEED	12	24
VII NERVE INVOLVEMENT	08	16
VERTIGO	06	12
POST AURAL SWELLING	02	4

Radiography in majority of cases showed loss of pneumatization of mastoid and sclerosed mastoid (46%, n=23).

On HRCT temporal bone majority 52% (n=26) patients were diagnosed as CSOM (TTD) followed by 28% (n=14) patients were diagnosed as CSOM with cholesteatoma and 20% (n=10) patients were diagnosed as trauma.

Table no. 3 HRCT & Surgical Concordance

	Anatomical Findings	HRCT & Surgical Concordance	Non Concordance	Sensitivity	Specificity
Disease Extent		**24**	**1**	**96.0%**	**-**
Bony Destruction	**Ossicular Erosion**	**14**	**3**	**99.3%**	**80.0%**
	Scutum Erosion	**8**	**-**	**100%**	**100%**
	Tegmen Erosion	**11**	**3**	**91.7%**	**84.6%**
	Sinus Plate Erosion	**7**	**-**	**100%**	**100%**
Inner Ear Involvement	**Facial Nerve Canal Involvement**	**6**	**5**	**75.0%**	**82.4%**
	LSCC Erosion	**2**	**2**	**66.7%**	**95.5%**

HRCT findings in cases of CSOM (TTD) showed soft tissue opacification of epitympanum in 23(88.4%) patients, of mesotympanum in 19(73%) patients, of hypotympanum in 06 (23%) patients, of mastoid air cells in 25 (96.1%) patients, of aditus in 11 (42.3%) patients and of the antrum in 13 (50%) patients. 14 (53.8%) patients had sclerosed mastoid, 05 (19.2%) patients had ossicular erosion and 11 (42.3%) patients had bony wall erosion.

HRCT findings in cases of CSOM with Cholesteatoma showed that 14 (100%) patients had soft tissue opacification of epitympanum, 10 (71.4%) patients had of mesotympanum, 07 (50%) patients were having of hypotympanum, 10 (71.4%) patients had of mastoid air cells, 09 (64.2%) patients had of aditus and 06 (42.8%) patients had of antrum.10 (71.4%) patients had sclerosed mastoid, 13 (92.8%) patients had ossicular erosion, 06 (42.8%) patients had scutum erosion, 08 (57.1%) patients had tegmen erosion and 05 (35.7%) patients had sinus plate erosion. In inner ear, 09 (64.2%) patients had facial nerve dehiscence and 03 (21.4%) patients had lateral semicircular canal erosion. HRCT findings in cases of Trauma showed that 90% (n=9) patients had longitudinal fractures, 70% (n=7) patients had soft tissue opacification, 10% (n=1) patient had mixed fractures & and none had otic capsule involvement.

In our study twenty five patients out of the fifty patients were operated and the operative findings were compared with HRCT findings. HRCT over-diagnosed two cases of ossicular erosion & tegmen erosion, three cases of facial nerve involvement and one case of lateral semicircular canal erosion whereas HRCT missed one case each of disease extent, ossicular erosion, tegmen erosion & lateral semicircular canal erosion and two cases of facial nerve canal involvement.

[Table 3] shows HRCT findings & surgical concordance among the twenty five operated patients.

Discussion

HRCT imaging is necessary for anatomic determination of chronic otitis media and cholesteatoma to detect any loss of surgical landmarks caused by prior operation. HRCT provides useful information about extent and severity of middle ear pathology and,thus preoperative imaging is essential and very helpful.

In present study, the commonest age group was 11 to 20 years followed by 21-30 years which is in agreement to the study done by **Nayak G etal**[11] who also reported the commonest age group to be 11-20 years followed by 21-30 years.

In the present study, majority of cases were males (n=29; 58%) and male to female ratio of our study population was 1.38:1 which is in exact agreement to the study done by **Thukral CL etal**[12] who reported males (n=29; 58%) and male to female ratio of study population was 1.38:1. **Gerami H etal** [13] had a highly skewed male to female ratio of 2.48:1.

In the present study, majority of patients had hearing loss (84%), followed by ear discharge (72%), fever (38%), pain in ear (36%), tinnitus (26%), facial nerve involvement (16%) and vertigo (12%). In a retrospective study by **Parisier SC et al**[14]who also showed the most common presenting symptom was hearing loss (85%), followed by ear discharge (73%), pain in ear (32%), tinnitus (8%) and vertigo (8%).In the series of **Gomaa M et al**[15], they reported hearing loss to be the most common clinical symptom (60.7%) followed by ear discharge (17.9%).

In present study on x-ray Schuller's view, 46% patients had sclerosed mastoids, 46% patients were having loss of pneumatisation of mastoid air cells, 18% patients had low lying dural plate, 12% patients had forward lying sinus plate and 8% patients were diagnosed having lytic lesions.

In present study on HRCT temporal bone out of total fifty patients, 52% (n=26) patients were diagnosed as CSOM (TTD), 28% (n=14) patients were diagnosed as CSOM with cholesteatoma, 20% (n=10) patients were diagnosed as trauma.

In this study among the twenty five patients who were operated, HRCT temporal bone showed 96% sensitivity in detecting disease extent, which is in agreement with the study by **Garg P etal**[16] showing HRCT to be 96.3% sensitive in detecting disease extent. **Sarin V etal** [17] in their study found HRCT to be 94.6% sensitive and 100% specific in detecting disease extent where as **Sirigiri R etal**[18] showed HRCT to be 92% sensitive. Whereas **Gomma M et al**[15] **& O'Reilly BJ et al**[19] showed HRCT to be 100% sensitive.

In the present study, HRCT was 99.3% sensitive and 80% specific in detecting ossicular erosion. In contrast to our study **Thukral CL etal**[12] reported sensitivity of HRCT to be 80.65% and specificity to be 46.67%. Similar observations were concluded by **Keskin S etal**[20] who in their study reported 80% sensitivity & 46.1% specificity for detecting ossicular erosion.

In the present study, HRCT was 100% sensitive and 100% specific for detecting scutum erosion. This is in agreement to studies by **Rai T**[21], **Rocher P etal**[22] and **Sunita M etal** [23] who also stated HRCT to be 100% sensitive and specific in detecting scutum erosion. In contrast to our findings **Keskin S etal** [20] in their study found HRCT to 80% sensitive and 90.4% specific in detecting scutum erosion. Scutum

erosion in our study was seen in 42.8% patients with cholesteatoma which is less than that of **Rai T**[21]who found in 46% patients whereas in a study by **Gaurano J etal**[6] they found it in 86% patients.

In the present study HRCT showed 91.7% sensitivity with specificity of 84.6% in detecting tegmen erosion. In moderate agreement to our study, **Gomma M et al**[15] reported 100% sensitivity and 94.4% specificity. Another study done by **Chee NWC etal** [24] showed HRCT to be 100% sensitive and specific. In contrast **Chintale SG etal** [25] have reported 71.4% sensitivity and 100% specificity of HRCT where as **Garg P etal** [16] reported HRCT to 54.5% sensitive and 73.7% specific in detecting tegmen erosion.

In our study HRCT showed 100% sensitivity and specificity in detecting sinus plate erosion and this exactly correlates to the study done by **Gomma M et al.**[15]In close agreement is another study done by **Rawat V etal**[26] who reported HRCT to be 100% sensitive and 94.7% specific in detecting sinus plate erosion. In contrast to our study **Garg P etal**[16] found HRCT to be 66.67 sensitive and 92.6% specific in detecting sinus plate erosion.

In present study HRCT showed 75% sensitivity and 82.4% specificity in detecting facial canal involvement. In contrast to our findings **Gomaa M et al**[15] found HRCT to be 83.3 sensitive and 94.4% specific where as **Chintale SG et al** [25] found HRCT to be 66% sensitive and 100% specific in detecting facial nerve involvement. **Chee NWC etal**[24] in their study found HRCT to be 33.33% sensitive & 100% specific in detecting facial nerve involvement.

In our study HRCT was 66.7% sensitive & 95.5% specific in detecting the lateral semicircular canal erosion. These findings are in agreement to the study by **Keskin S etal**[20] who found HRCT to be 45.4% sensitive and 95.5% specific. Our findings were also in agreement to other studies done by **Rawat V etal** [26] who found HRCT to be 66.7% sensitive and 100% specific and **Garg P etal** [16] who found 66.7% sensitivity and 83.3% specificity.

Overall, the results of the present study showed a good agreement between HRCT and operative findings. HRCT temporal bone is an efficacious modality for accurate delineation of the anatomy and pathological involvement of temporal bone. Hence HRCT is a useful diagnostic tool for diagnosing, surgical planning and management of temporal bone pathologies.

Figures



FIG 1: X-rayschuller's view image showing loss of pneumatisation of mastoid air cells and sclerosis of temporal bone in a case of CSOM.

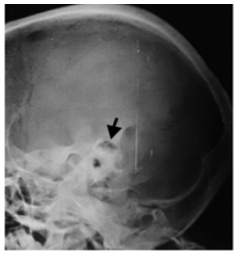


FIG 2: X-rayschuller's view image showing presence of a lytic lesion in a case of cholesteatoma.

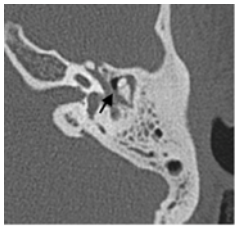


FIG 3: HRCT temporal bone axial image in a case of CSOM showing soft tissue opacification of middle ear along with facial

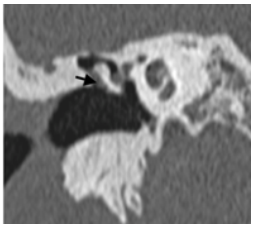


FIG 4: HRCT temporal bone coronal image in a case of CSOM demonstrating soft tissue opacification around ossicles without their erosion.

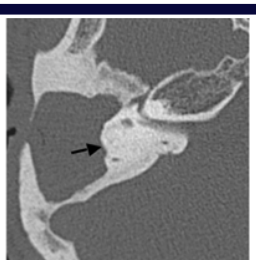


FIG 5:HRCT temporal bone axial image in a case of cholesteatoma showing LSCC erosion.

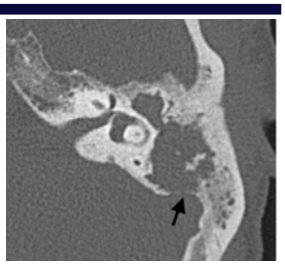


FIG 6: HRCT temporal bone axial image in a case of cholesteatoma demonstrating soft tissue

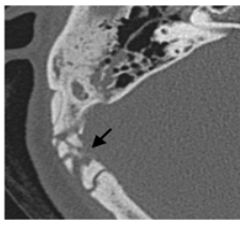


FIG 7: HRCT temporal bone axial image in a case of trauma demonstrating mixed fracture

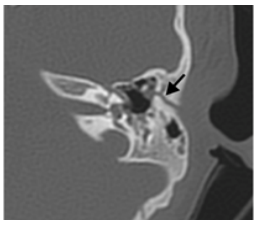


FIG8: HRCT temporal bone axial image in a case of trauma demonstrating longitudinal fracture extending upto middle ear.

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