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HRCT TEMPORAL BONE FINDINGS IN ATTICOANTRAL TYPE OF CHRONIC SUPPURATIVE OTITIS MEDIA – FACT OR FICTION

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ABSTRACT The study was conducted in the Department of Otorhinolaryngology, Dr Shankarrao Chavan Government Medical College, Nanded. It was a Prospective type of Descriptive study, carried out from 1st January 2020 to 21st June 2021. 60 Patients who attended the ENT OPD with signs and symptoms of Atticoantral type of chronic suppurative otitis media were included in the study. The main aims of the study were to study the Radiological findings of Temporal Bone in Atticoantral type of chronic suppurative otitits media; and to correlate the findings of HRCT temporal bone showing Atticoantral type of chronic suppurative otitits media; with intra-operative findings in Tympanomastoid surgeries.

KEYWORDS : Atticoantral, HRCT, Temporal bone, intra-operative

INTRODUCTION:

According to World Health Organisation, Chronic Suppurative Otitis Media is defined as a chronic inflammation of middle ear and mastoid cavity, which presents with recurrent ear discharge or otorrhoea through a tympanic membrane perforation. Chronic Suppurative Otitis Media [CSOM] is an inflammation of the middle ear cleft of long duration. It involves inflammation of the mastoid air cell system also due to its anatomical connection to the middle ear. CSOM has been classified into tubo–tympanic and attico-antral disease. Tubo tympanic type of CSOM is characterized by a perforation of pars tensa, while marginal & attic perforations are pathognomic of attico - antral variety. The latter category is usually associated with the presence of cholesteatoma[1]. The prevalence of CSOM is more than 4% in India.

Middle ear cholesteatoma, most often acquired than congenital, occurs from the ingrowth of keratinising squamous epithelium from external auditory canal skin to middle ear, through the tympanic membrane.[2] Due to the location of the tympanomastoid compartment, separated from the middle and posterior cranial fossae by thin bony partitions, otitis media has the potential for intracranial extension. So it is very important to know the location and extent of the disease before planning surgical management. Radiological examination of the temporal bone helps us to achieve this objective. The various modalities of temporal bone imaging are X-ray Mastoid (Schuller's view), CT scan and MRI. Out of these, the most widely used and appreciated radiological modality is High Resolution Computed Tomography (HRCT) of Temporal Bone.

The petrous temporal bone is a complex structure containing the middle and inner ear and various contained structures like the ossicles. This challenges the limits of resolution by imaging techniques. Good spatial resolution by imaging to allow adequate demonstration of these bony structures in the middle and inner ears has made management of otitis media much simpler these days. Otitis media can be diagnosed clinically to a certain extent. Radiology acts as an adjuvant diagnostic modality. It is useful in identifying bony erosion in acute and chronic mastoiditis, extent of pneumatization of temporal bone and relationship of the pathology to adjacent critical anatomical structures like dura, internal carotid artery, lateral sinus and facial nerve.

Diagnosis of a pathology like acquired cholesteatoma with attic perforation is considered largely clinical. Radiology was rarely thought to be required to establish the diagnosis. But nowadays it is being claimed that a cholesteatoma as small as 3mm in size can be diagnosed much earlier by the use of CT. Atticoantral type of chronic suppurative otitis media has a propensity to develop several complications, which can be extremely deterious to the health of the patient. So it is essential to eradicate the disease completely by operating the patient. Pre-operative HRCT temporal bone imaging can help the operating surgeon to have a clear idea of what lies ahead, and what to look out for in tympanomastoid surgeries. HRCT temporal bone gives an idea of the extent of the disease, and thereby helps in removing the disease completely. This study focuses on the importance of HRCT temporal bone in Atticoantral type of chronic suppurative otitis media.

MATERIALS AND METHODS:

This is a Descriptive type of Prospective study conducted in department of ENT at a tertiary care centre from 1st January 2020 to 21st June 2021. All Patients diagnosed with Atticoantral type of chronic suppurative otitis media during the study period were included in the study. The study excluded the following patients:

- Acute suppurative otitis media
- Tubotympanic/mucosal chronic suppurative otitis media
- Tuberculous otitis media and other granulomatous diseases affecting ear
- Patients with ear and temporal bone malignancies
- Keratosis Obturans
- Drop out cases during study period

Procedure

A detailed History was taken initially with emphasis on the socioeconomic status of the patient. Thorough general and systemic examinations were performed. Otolaryngological examination findings were noted down.

- Examination under Operating Microscope was done
  -to confirm otoscopic findings, assess the extent of the disease,
  -to assess the status of middle ear mucosa,
  -to assess ossicular mobility,
  -to see for retraction pockets,
  -to clean debris.

Pure Tone Audiometry was done to see for the nature and severity of hearing loss.

High Resolution Computed Tomography scan of temporal bone was done in every patient with attic disease irrespective of indications; for study purpose. All the HRCT scans were performed at our institute on high speed Multidetector CT machines. Patients were scanned in axial (supine) axis. After all routine investigations and Pre-Anesthetic fitness, the patients were taken up for elective surgery, and the intra-operative findings were noted down, and correlated with the pre-operative HRCT Temporal bone findings.

OBSERVATIONS AND RESULTS:

Out of 60 patients selected for the study, the maximum age of patients

was 73 years whereas minimum was 7 years. The mean age of patients was 30.23 years with standard deviation ± 15. The maximum patients i.e., 26.67% belonged to 21-30 age group followed by 11-20 age group (21.67%). The least common age group was 61-70 (3.33%). 51.67 % patients were males and 48.33 % patients were females. Male to female ratio was 1.07:1.

Most of the patients belonged to lower class and lower middle class of socioeconomic status, classified by BG Prasad scale.

The most common symptoms of Atticoantral Chronic Suppurative Otitis Media were foul smelling ear discharge (100%) and hearing loss (100%), followed by Otalgia (25%) and least common presentation was Facial Weakness (8.33%).

Posterosuperior retraction pocket was the most common tympanic membrane finding (45%) followed by attic retraction pocket (31%), and attic perforation (23%).Out of 60 patients, 49 patients had sclerotic mastoid, 8 patients had well pneumatised mastoid, and diploic mastoid was found in 3 patients in HRCT Temporal Bone as well as intraoperatively. This has been depicted in Figure 1.

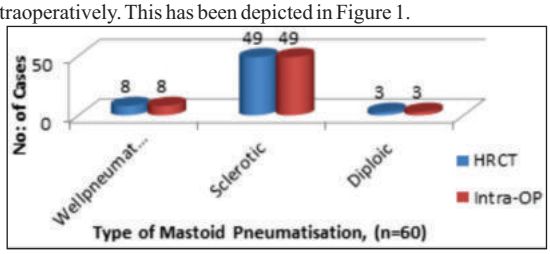

Figure 1: Type of Mastoid Pneumatisation

Low lying dura was present in 3 cases according to HRCT as well as intra-operatively. Hence, sensitivity as well as specificity was 100%. Forward lying sigmoid sinus was present in 1 case according to HRCT. Intra-operatively, there were 2 cases with forward lying sigmoid sinus. Hence, sensitivity was 50% and specificity was 100%. In this study, high riding jugular bulb was seen in 1 case in HRCT as well as intra-operatively. Hence, sensitivity as well as specificity was 100%. This has been depicted in figure 2

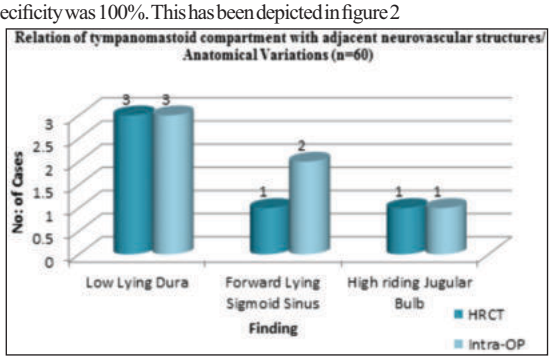

Figure 2:Relation of tympanomastoid compartment with adjacent neurovascular structures/ Anatomical Variations

HRCT detected scutum erosion accurately in all the cases. So HRCT is 100% sensitive and specific to detect scutum erosion as per this study. In this study, Malleus, Incus and Stapes were found to be eroded in 26%, 46% and 26% respectively in HRCT and 30%, 53% and 33% respectively intraoperatively. In case of Malleus Erosion, there were 2 false negative cases, and hence sensitivity was 88.88%, specificity was 100%. In case of Incus Erosion, there were 4 false negative cases giving a sensitivity of 87.5%, specificity of 100%. In case of Stapes Erosion, 4 cases were false negative, making sensitivity 80%, specificity 100%. This has been depicted in figure 3.

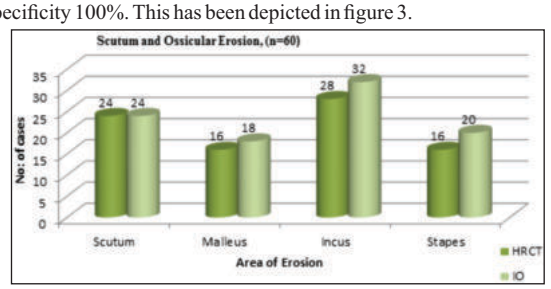

Figure 3: Scutum and Ossicular Erosion

HRCT identified disease in **Epitympanum** in 37 cases, whereas 39 cases had disease intra-operatively. In case of anterior epitympanum, sensitivity was 95% and specificity was 100%. In case of posterior epitympanum, sensitivity was 94.7% and specificity was 100%.Regarding Involvement of **Mesotympanum,** sensitivity was 84.61% and specificity was 95.74%. HRCT identified disease in **Protympanum**, sensitivity was 100% and specificity was 98.18%. HRCT identified disease in **Hypotympanum** with sensitivity of 100% and specificity of 98.03%.In case of **Posterior Tympanum**, sensitivity was 100% and specificity was 96.07%.In **Aditus, s**ensitivity was 86.95% and specificity was 94.59%. In case of Mastoid **Antrum, s**ensitivity was 93.10% and specificity was 96.77%. Sensitivity of disease in **Mastoid Air Cells** was 90.90% and specificity was 100%. Depiction of extent of disease has been given in table 1.

Table 1: Extent of disease – comparison between HRCT and Intra-operative findings

EXTENT		HRCT	IO	FP	FN	SENSITIVITY (%)	SPECIFICITY (%)
Epitympanum	Anterior	19	20	0	1	95	100
	Posterior	18	19	0	1	94.7	100
Mesotmpanum		13	13	2	2	84.61	95.74
Protympanum		6	5	1	0	100	98.18
Hypotympanum		10	9	1	0	100	98.03
Posterior Tympanum		11	9	2	0	100	96.07
Aditus		22	23	2	3	86.95	94.59
Antrum		28	29	1	2	93.10	96.77
Mastoid Air Cells		30	33	0	3	90.90	100

In case of **Facial canal dehiscence**, sensitivity was 80% and specificity was 100%. For **Tegmen tympani erosion**, sensitivity as well as specificity was 100%. Regarding **Mastoid cortex erosion**, HRCT was 100% sensitive and specific. In case of **Sinus plate erosion**, sensitivity was 75% and specificity 100%. **Dural plate erosion** was detected with a sensitivity as well as specificity of 100%. Sensitivity was 66.67% and specificity 100% for **Lateral semicircular canal dehiscence**. HRCT correctly detected complications like **mastoiditis and mastoid abscess** in 10 patients with 100% sensitivity and specificity. **Intracranial complications (epidural abscess)** were detected with sensitivity of 50% and specificity of 100%. Table 2 shows the above-mentioned findings.

Table 2: Complications - Comparison between HRCT and Intra-operative findings

Complications	HRCT	IO	FP	FN	Sensitivity (%)	Specificity (%)
Facial canal dehiscence	4	5	0	1	80	100
Tegmen tympani erosion	2	2	0	0	100	100
Mastoid cortex erosion	6	6	0	0	100	100
Sinus plate erosion	3	4	0	1	75	100
Dural plate erosion	3	3	0	0	100	100
LSCC erosion	2	3	0	1	66.67	100
Mastoiditis and Mastoid Abscess	10	10	0	0	100	100
Intracranial Extension	1	2	0	1	50	100

DISCUSSION

The sensitivity as well as specificity of HRCT was 100% in predicting the pneumatization of mastoid when compared with the intra-operative results. This is in accordance with studies by **Jackler et al.**[3]**, Vlastarakos et al.**[4]**,** and **Rai.**[5]

In this study, low lying dura was correctly detected in 3 patients by HRCT giving it 100% sensitivity and specificity. This correlates with studies by **Zhang X et al**.[6] (2004) and **Chee NW et al**.[7] (2001). In our study, HRCT Temporal Bone detected forward lying sigmoid sinus with sensitivity of 50% and specificity of 100%, which is in accordance with study by **Rai.**

HRCT detected scutum erosion accurately in all the cases. So HRCT is 100% sensitive and specific to detect scutum erosion as per this study. This is in accordance with studies by **Rocher P et al.**[8] (1995) and **Kanotra S et al.**[9] In case of Malleus Erosion, sensitivity was 88.88%, specificity was 100%. This is in accordance with study done by **Kanotra S et al.,** where sensitivity was 90%, and specificity was 100%. In case of Incus Erosion, sensitivity was 87.5%, and specificity was100%. This is similar to the study by **Jamal S et al.**[10], where sensitivity was 86.1% and specificity was 100%. In case of Stapes

Erosion, sensitivity was 80%, and specificity was100%, this is similar to the study by **Jamal S et al.**, where sensitivity was 82.7% and specificity was 100%.

HRCT Temporal Bone detected disease in Anterior Epitympanum with a sensitivity of 95% and specificity of 100%. In a study by **Mandal S et al**[11], sensitivity as well as specificity was 82.4%. In our study, HRCT Temporal Bone detected disease in Posterior Epitympanum with a sensitivity of 94.7% and a specificity of 100%. %. In a study by **Kanotra S et al.**, sensitivity was 90% and specificity was 100%. In our study, HRCT Temporal Bone detected disease in Mesotympanum with a sensitivity of 84.61% and a specificity of 95.74%. In a study by **Varsha Rathi et al.**[12] sensitivity was 90.90%, specificity was 89.89%. In our study, HRCT Temporal Bone detected disease in Protympanum with a sensitivity of 100% and a specificity of 98.18%. In a study by **Mandal S et al**. sensitivity as well as specificity was 100%. In our study, HRCT Temporal Bone detected disease in Hypotympanum with a sensitivity of 100% and a specificity of 98.03%. In a study by **Varsha Rathi et al.** sensitivity was 100%, specificity was 84.9%. In our study, HRCT Temporal Bone detected disease in Posterior Tympanum with a sensitivity of 100% and a specificity of 96.07%. In a study by **Varsha Rathi et al.** sensitivity was 100%, specificity was 89.58%.

In our study, HRCT Temporal Bone detected disease in Aditus with a sensitivity of 86.95% and a specificity of 94.59%. In a study by **Rai.,** sensitivity was 92.3%, specificity was 91.6%. In our study, HRCT Temporal Bone detected disease in Antrum with a sensitivity of 93.10% and a specificity of 96.77%. In a study by **Mandal S et al.** sensitivity as well as specificity was 97.6%. In our study, HRCT Temporal Bone detected disease in Mastoid Air Cells with a sensitivity of 90.90% and a specificity of 100%. In a study by **Varsha Rathi et al.** sensitivity was 89.66%, specificity was 100%.

HRCT Temporal Bone had 80% sensitivity and 100% specificity in detecting facial canal dehiscence. Sensitivity was 33.33%, and specificity was 100% in a study **by Kanotra S et al.** HRCT Temporal Bone had 100% sensitivity as well as specificity in detecting Tegmen Erosion. In a study by **Kanotra S et al**., sensitivity was 100%, and specificity was 95.45%. HRCT Temporal Bone had 75% sensitivity and 100% specificity in detecting Sigmoid Sinus Plate Erosion.

In a study by **Kanotra S et al**., sensitivity as well as specificity was 100%. In a study by **Jamal S et al.** sensitivity as well as specificity was 100%. A study by **Singh R et al**.[13] also had 100% sensitivity as well as specificity.

Our study showed that HRCT Temporal Bone had 100% sensitivity as well as specificity in detecting Dural Plate Erosion; which is in accordance with study by **Aljehani M et al.**[14] HRCT Temporal Bone had 66.67% sensitivity and 100% specificity in detecting Lateral Semicircular Canal Erosion. Study by **Kanotra S et al.,** showed 66.66% sensitivity and 95.74% specificity; which is in accordance with our study. HRCT Temporal Bone had 100% sensitivity as well as specificity in detecting Mastoid Cortex Erosion; which is in accordance with studies by **Bathla M et al.**[15], **Rai.**, and **Varsha Rathi et al.**, all of which showed 100% sensitivity as well as specificity.

CONCLUSION

Chronic Suppurative Otitis Media is a major health problem in the current scenario, especially in developing countries. There hasn't been a drastic improvement in mortality and morbidity rates due to CSOM in developing countries. Atticoantral type of CSOM is more prone to develop complications, and hence warrants surgical intervention at the earliest. A proper guidance to the operating surgeon can be vital during the surgery and here comes the need for imaging technology. Out of various imaging modalities, HRCT Temporal Bone has become the prime tool.

Advent of HRCT and improvements in radiological technique has definitely improved study of temporal bone in patients with chronic otitis media which includes evaluation of the extent and sites of involvement and inter-relationships of the tympanomastoid compartment with adjacent neurovascular structures. According to this study, HRCT Temporal Bone was highly sensitive in detecting: Type of Pneumatisation, scutum erosion, low lying dura, high riding jugular bulb, disease in anterior epitympanum, posterior epitympanum, mastoid antrum, mastoid air cells, protympanum, hypotympanum, posterior tympanum, tegmen erosion, mastoid cortex erosion, dural plate erosion, mastoiditis, and mastoid abscess. HRCT Temporal Bone had high specificity in detecting Type of Pneumatisation, scutum erosion, erosion of malleus, low lying dura, high riding jugular bulb, forward lying sigmoid sinus, disease in anterior epitympanum, posterior epitympanum, mesotympanum, aditus, mastoid antrum, mastoid air cells, protympanum, hypotympanum, posterior tympanum, facial canal dehiscence, tegmen erosion, mastoid cortex erosion, dural plate erosion, lateral semicircular canal erosion, mastoiditis, mastoid abscess, and intracranial extension.

Therefore, this study concludes that HRCT can be recommended not only in cases suspected with potential complications but also in all cases of COM to know the extent of disease, varied pneumatization and presence of anatomical variations which should alert the clinician and guide in surgical approach and treatment plan.

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