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ORIGINAL ARTICLE RESEARCH

Role of HRCT Temporal Bones as a Predictor of Intra-Operative Findings in Cases of CSOM: A Prospective Study

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ABSTRACT

Introduction: The temporal bone, a part of the skull, is the most complex single bone in the human body and carries various nerves, muscles, tendons and bones which help in hearing and balance. Diseases of the temporal bone are a common entity in daily practice. Chronic Suppurative Otitis Media (CSOM) and complications of CSOM account for a large section of diseases which need surgery in the Department of Otorhinolaryngology. Computed Tomography is an important tool in drawing the surgical plan.

Material and Methods: 100 patients presenting to the ENT OPD with hard of hearing, ear discharge, headache and/or vertigo and tinnitus were taken to be part of study. Special attention was given to otoscopic/endoscopic examination and radiological assessment by means of High Resolution Computed Tomography. A strict inclusion and exclusion criteria was used. All patients taken up for Mastoid Exploration under General Anaesthesia. All surgeries were performed by the same surgeon using the same instruments to avoid bias.

Results: The average age of presentation was 42.3. The most common finding on the CT was erosion of the Incus which was seen in 43 cases and the least common finding was fistula of LSCC which was seen in 1 case. 48 patients underwent surgery in Right ear and 52 in Left ear. 100% of cases showed the same status of the Incus on table which was the most and only 62% of the cases showed positive association for disease in the attic.

Conclusions: HRCT is a very easy tool in today's age and generation. It helps to see the extent of disease, predict complications and also help understand anatomy better. It should be performed on the patient 48 hours before surgery (whenever available) to make sure that the findings do not change grossly because of the issued medical management.

Keywords: Chronic Suppurative Otitis Media, High Resolution Computed Tomography; Mastoidectomy

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INTRODUCTION

The temporal bone, a part of the skull, is the most complex single bone in the human body and carries various nerves, muscles, tendons and bones which help in hearing and balance.[1]

Diseases of the temporal bone are a common entity in daily practice. Clinical examination alone is not sufficient in present days, owing to prevalence, complications and recurrence of various pathologies of the temporal bone, imaging plays a major role in the management and influences the treatment.[2]

High Resolution Computed Tomography of the Temporal Bone gives us a better understanding of the various anatomical differences and location of major structures. It is absolutely essential in today's age that we visualise all important areas before taking up for surgical intervention. Hidden areas of the middle ear such as sinus tympani and facial recess are well appreciated in HRCT[3] along with tegmen tympani, sigmoid sinus plate, sinodural angle, carotid canal, jugular fossa, infra and supralabrynthine air cells allowing better understanding of the aetiology, pathology, disease course with early detection of complications which alters treatment modality and has considerably reduced the morbidity and mortality pertaining to lesions of the temporal bone.[4]

HRCT has the additional advantage of excellent topographic visualization, without superimposition of temporal bone, soft tissue details and thus mostly devoid of artifacts.

HRCT improves the depiction of newly occurring progressive bone erosive changes, and detection sensitivity and reading time in postoperative recurrence of middle ear. Thus, CT is a very important prognostic tool in the pre planning of surgical techniques.[5]

By means of special algorithms, thin section HRCT allows imaging of osseous structures up to a spatial resolution of 0.45–0.65 mm. This is very critical to prevent the misdiagnosis in all areas especially the blind spots of temporal bone.

Surgical approaches to the temporal bone can be categorized didactically into tympanoplasty and ossicular reconstruction, mastoidectomy, and approaches to the cerebellopontine angle and internal auditory canal (IAC). CT is the preferred modality for assessing the continuity of the reconstructed conductive mechanism, from the tympanic membrane to the oval window, with use of grafts or prostheses.

The aim of this study is to correlate the Radiological Findings to the Intra-operative findings in all patients undergoing Mastoid Exploration.

MATERIAL AND METHODS

This was carried out in our Institute for a duration of 18 months in 2020-22.

Source: Patients presenting to the ENT OPD with hard of hearing, ear discharge, headache and/or vertigo and tinnitus.

Sample Size: One Hundred.

Type of Study: Prospective Study.

Statistical Analysis: All statistical analyses were performed using SPSS Statistics 19 for Windows (IBM Corp., Armonk, NY, USA). Samples were compared and evaluated by means of a Paired Student T-test. A P-value of <0.05 was considered statistically significant. The confidence interval was set at 95%.

All the patients were put thorough a detailed and complete clinical examination of Ear, Nose and Throat. Special attention was given to otoscopic/endoscopic examination and radiological assessment by means of High Resolution Computed Tomography.

Inclusion Criteria

- Perforation of either pars tensa non responsive to medical management or pars flaccida with or without cholesteatoma.
- Patients who consent for Mastoid Exploration for disease clearance.
- Complications of Chronic Suppurative Otitis Media requiring surgery.

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- Temporal Bone Fractures causing vestibular/cochlear symptoms and/or Facial Nerve Palsy.

Exclusion Criteria

- Patients unwilling to be part of study.

Method of Assessment

All patients taken up for Mastoid Exploration (Canal Wall Up/Down) for any of the aforementioned diagnoses were first evaluated with a HRCT of the Temporal Bones. Topogram Position: Supine; kV: 120; mA: 80. Helical section temporal bone: Matrix: 512 x 512; FOV:14-24 cm; Slice thickness:0.625 mm; 120 kv,200 mA; Pitch - 0.531, Gantry rotation speed: 0.8 seconds. Images were reconstructed in the ultra-sharp bone algorithm for image reconstruction, analysed for reporting, as the bone algorithm is superior to the standard algorithm in the assessment of tiny bony structures with increased spatial resolution without degrading the image quality.

The following parts were noted clearly to understand the nature of disease/disorder and which would also be rechecked on table during surgery:

- Fistula of Lateral Semi-Circular Canal (LSCC).
- Breach of Sigmoid Sinus plate.
- Breach of Tegmen plate.
- Erosion of Scutum.
- Erosion of Malleus.
- Erosion of Incus.
- Erosion of Stapes.
- Cholesteaoma/soft tissue/pus in aditus.
- Sclerosis of Mastoid Bone.
- Erosion of Fallopian Canal.

Surgical Intervention

All surgeries were performed by the same surgeon using the same instruments to avoid bias. Each of the mentioned signs were noted on the scan and checked on the surgical table. Mastoidectomy was performed as decided before surgery.

RESULTS

Out of the 100 patients taken up for study, 73 were female and 27 were male.

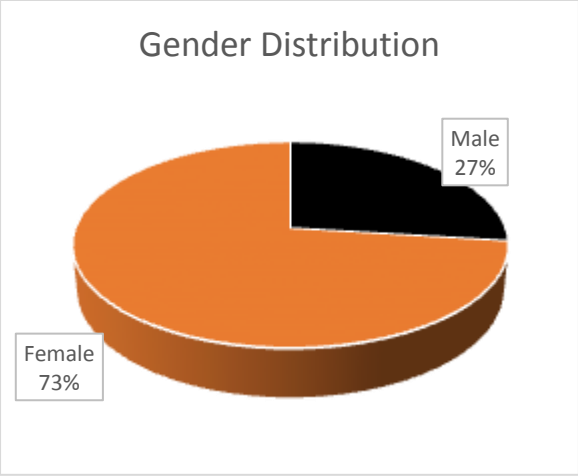

Image 1: Gender Distribution

The average age of presentation was 42.3.

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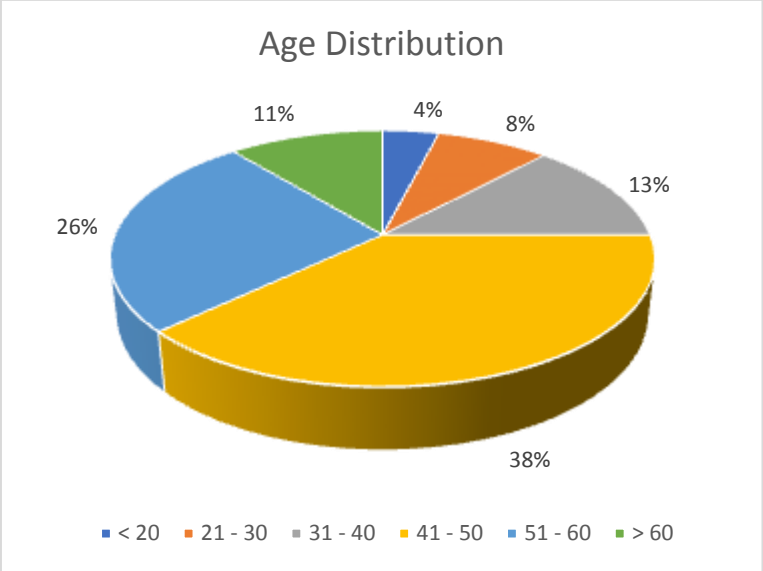

Image 2: Age Distribution

The most common finding on the CT was erosion of the Incus which was seen in 43 cases and the least common finding was fistula of LSCC which was seen in 1 case. 48 patients underwent surgery in Right ear and 52 in Left ear.

Table 1: Comparison between Radiological and Clinical Findings

Name of finding	Number seen on CT	Number seen Intra-operative	Accuracy
Fistula of LSCC	1	1	100%
Breach of Sigmoid Sinus plate	2	2	100%
Breach of Tegmen plate	6	6	100%
Erosion of Scutum	11	9	82%
Erosion of Malleus	21	19	90%
Erosion of Incus	43	43	100%
Erosion of Stapes	12	10	83%
Cholesteaoma/soft tissue/pus in aditus	39	24	62%
Sclerosis of Mastoid Bone	38	35	92%
Erosion of Fallopian Canal	2	2	100%

In our study, 100% of cases showed the same status of the Incus on table which was the most and only 62% of the cases showed positive association for disease in the attic.

DISCUSSION

Erosion of long process of incus is commonly encountered intraoperative finding during mastoid surgeries due to it's precarious blood supply. Previous studies have shown that the sensitivity and specificity of this finding is around 85%[6-7] which is similar to our study.

Malleus head and incus body are better seen on axial section, while handle of malleus and long process of incus are better seen in coronal section. The sensitivity is around 90% and it has been proved in various studies before.[7-8]

The role of a HRCT to identify cholesteatoma and disease in the aditus/attic is very high and it helps in understanding the approach for the surgery. As shown in one particular study, it is close to 97% correct in predicting what to expect on table.[9]

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Fistula of lateral semicircular canal is the commonest intratemporal complication of COM.[10] It is advisable to be more cautious during dissecting the disease from semicircular canal.

Sclerosis of the Mastoid bone was also very specific when seen in association between the two forms of assessment. This is also in accordance with other studies previously published.[11-12]

The presence of a fistula in the LSCC was also seen clearly in a lot of cases in some previous studies and was correlated in the patient on table during surgery. The loss of the whole or part of stapes was not clear and was a poor predictor as understood in one study performed.[13]

In our study, the poorest predictor was disease in the attic which was was found to be low because of the medical management administered to the patient before surgery. We feel that in case of pus, it might get resolved with the antibiotics and anti-inflammatory agents and thus not be seen on table.

CONCLUSIONS

HRCT of the Temporal Bone is a very easy tool in today's age and generation. It helps to see the extent of disease, predict complications and also help understand anatomy better. It should be performed on the patient 48 hours before surgery (whenever available) to make sure that the findings do not change grossly because of the issued medical management.

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