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A RETROSPECTIVE STUDY TO CORRELATE PRE-OPERATIVE HIGH RESOLUTION COMPUTED TOMOGRAPHY TEMPORAL BONE FINDINGS WITH INTRA-OPERATIVE FINDINGS OF CHRONIC OTITIS MEDIA-SQUAMOUS TYPE IN A GOVERNMENT TERTIARY CARE HOSPITAL.

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ABSTRACT

Background: Chronic otitis media (COM) is an inflammatory process in the middle-ear space that results in long-term, or more often, permanent changes in the tympanic membrane.COM is classified as chronic otitis media squamosal disease and mucosal disease.

High-resolution computed tomography (HRCT) of the temporal bone is pivotal in pre-operative assessment. This study evaluates the correlation between pre-operative HRCT findings and intra-operative observations in a government tertiary care hospital.

Objective: To assess the accuracy of pre-operative HRCT in predicting intra-operative findings in patients undergoing surgery for COM-Squamous disease.

Methods: A Retrospective study of all patients diagnosed with Chronic Otitis Media-Squamous type who underwent HRCT and surgical treatment in the period of January 2021 to December 2021 was analyzed. 45 patients were included in the study with 21(46.6%) male and 24(53.3%) female patients with age ranging from 10 to 65 years.

Results: According to the present study, HRCT is highly sensitive for detecting extend of disease, ossicular erosion, tegmen and sigmoid sinus erosion, fallopian canal erosion and less sensitive for stapes superstructure erosion and lateral sinus fistula. It was specific for all these parameters. The presence cholesteatoma on HRCT has 100% sensitivity and specificity. Malleus, incus and stapes erosion were predicted with 95.5%, 95.5% and 84.4% accuracy. Bony erosion patterns (mastoid cortex and bony external auditory canal) on HRCT showed a 100% correlation with intra-operative findings. Facial canal erosion on HRCT depicted 72.5% sensitivity and specificity of 100%. Erosion of lateral semi-circular canal reported on HRCT had sensitivity of 30% and 100% specificity. Sigmoid sinus plate erosion showed 100% correlation with intra operative findings. Dural plate erosion on HRCT showed 100% sensitivity and specificity of 97.6%. Overall, HRCT demonstrated 87% concordance rate with intra-operative results.

Conclusion: HRCT Temporal bone is an important tool for the surgeon to identify the extent of disease, plan for the appropriate procedure that is required and prepare for the potential complications that can be encountered during surgery. The findings of pre-operative high resolution computed tomography findings and intra-operative findings were well comparable except for lateral semi-circular canal erosion and erosion of stapes.

Keywords: Chronic otitis media, Cholesteatoma, HRCT temporal bone.

INTRODUCTION

Chronic otitis media (COM) is one of the major causes responsible for preventable hearing loss globally. As defined by World Health Organization (WHO), COM is defined as a chronic inflammation of the middle ear and mastoid cavity, which presents with recurrent ear discharges or otorrhoea for 2 weeks or more through a tympanic membrane perforation. [1] However, most Otorhinolaryngologists consider the diagnosis of COM to be established when the discharge persists, despite treatment, for periods varying from 6 weeks to up to three months [2]. COM equates with the classic term chronic 'suppurative' otitis media (CSOM) that is no longer advocated as COM is not necessarily a result of 'the gathering of pus' [3].

COM is classified as squamous epithelial COM (atticoantral /unsafe) and mucosal COM (tubotympanic/safe). In squamous type, there is foul smelling scanty discharge, marginal perforation, associated with cholesteatoma, granulation tissue and other complications. In mucosal type, there is recurrent profuse ear discharge with central perforation of tympanic membrane.

Cholesteatomas have characteristics pattern of growth, migration, osseous erosion and are locally destructive. The only treatment to avoid its complications and to restore the middle ear is its full surgical removal since there is no effective clinical treatment for eradication of the disease so far. [3]

A major advance in imaging of the ear structures has occurred with the development of high-resolution computed tomography (HRCT) [4]. HRCT findings suggesting cholesteatoma include outer attic wall (scutum) erosion, aditus and antrum widening, dislocation of ossicular chain, erosion of ossicles, semicircular canal fistula, facial nerve canal (fallopian canal) erosion, tegmen plate dehiscence, auto mastoidectomy, sigmoid plate dehiscence, and external auditory canal roof erosion and sagging. HRCT is useful for planning the surgical approach, determining the extension and site of cholesteatoma and its sac, assessing the ossicles, evaluating the facial nerve, tegmen and sinus plate, and determining dural plate, sigmoid sinus, and jugular bulb positions [5].

Primary management of cholesteatoma is surgical. The prior knowledge of the extent of disease and anatomical landmarks of the mastoid air system can be helpful in deciding the technique used for mastoid surgery. [1]

The present study is a retrospective study to correlate the pre-operative HRCT findings with the intra operative findings of squamous type of chronic otitis media.

MATERIAL AND METHODS

The study was a retrospective record-based study in Department of Otorhinolaryngology at Mandya Institute of Medical Science, Mandya from January 2021 to December 2021. Records of 45 patients with active squamous COM, who underwent HRCT Temporal bone and subsequently modified radical mastoidectomy (MRM) in our institution were included in study and analyzed after obtaining clearance and approval from institutional ethics committee.

Records of Pre-operative HRCT Temporal bone of patients with COM Squamous disease and intraoperative findings with the following parameters: extent of disease, ossicular chain status, facial nerve canal status, sinus tympani, sinus plate, dural plate and lateral semicircular canal status were correlated.

Data obtained were entered into Statistical Package for Social Science (SPSS) version 3.0. Statistical analysis to calculate specificity, sensitivity, false positive, false negative, true positive, true negative, positive predictive value as well as negative predicative value was done by using 2x2 contingency table. The correlation between preoperative and intraoperative findings was performed using sensitivity, specificity, NPV, and PPV. Results obtained from the study were then discussed with reference to current world literature. Comparison between findings of our study and similar studies in past were done. Conclusion was drawn based on these results.

RESULTS

45 patients were included in the study with 21(46.6%) male and 24 (53.3%) female patients with age ranging from 10 to 65 years.

Table 1: Age and sex distribution of study group

Age group(years)	Male	Female	Total
10-20	6	6	12(26%)
21-30	3	3	6(13%)
31-40	6	6	12(26%)
41-50	0	9	9(20%)
51-60	3	0	3(6%)
61-70	3	0	3(6%)
Total	21	24	45

Table 2: Evidence of Squamous COM

Evidence of Squamous COM	No. of cases &Percentage (%)
Pre op HRCT	45(100%)
Intra op	45(100%)

Sensitivity=100%, Positive predictive value=100%

Evidence of cholesteatoma was detected in 45(100%) patients in preoperative HRCT and intraoperatively.

Table 3: Ossicular erosion

Ossicle	HRCT	INTRA OPERATIVE
Malleus	18(40%)	20(44.4%)
Incus	29(64.4%)	31(68.8%)
Stapes superstructure	6(13.3%)	13(28.8%)

HRCT showed erosion of **malleus** in 18 (40%) patients, whereas 20(44.4%) patients had erosion of malleus per operatively. On HRCT, sensitivity = 90%, specificity = 100%, positive predictive value = 100%, and negative predictive value = 92.5%.

Incus appeared eroded on HRCT scan in 29(64.4%) cases, whereas intra operatively it was seen in 31(68.8%) patients. HRCT was found to be 93.5% sensitive with positive predictive value of 100%.

Stapes superstructure erosion was reported by HRCT in 6 (13.3%), and during surgery 13(28.8%) patients had stapes erosion.

Table 4: Extent of disease

Extend of disease	HRCT	INTRA OPERATIVE
Middle ear	45(100%)	45(100%)
Mastoid air cells and aditus	45(100%)	45(100%)
Mastoid cortex erosion	4(8.8%)	4(8.8%)
Bony EAC erosion	6(13.3%)	6(13.3%)
Scutum erosion	26(57.7%)	28(62.2%)

Mastoid cortex erosion was detected in 4(8.8%) patients in HRCT and intra operatively. Bony external auditory canal erosion was detected in 6(13.3%) patients in HRCT which co- related with intra operative findings. Scutum erosion was noticed in 28 (62.2%) patients intra operatively, in contrary HRCT detected only 26 patients. HRCT is highly sensitive and specific for detecting extend of disease.

Table 5: Facial canal dehiscence

	HRCT	INTRA OPERATIVE
Facial canal dehiscence	8(17.7%)	11(24.4%)

Sensitivity=72.75%, Specificity=100%, Positive predictive value=100%, Negative predictive value=89.65%

Facial canal dehiscence was depicted by HRCT in 8(17.7%) cases, whereas intra operatively it was seen in 11 (24.4%) patients.

Table 6: Erosion of Dural and Sinus plate

Erosion	HRCT	INTRA OPERATIVE
Dural plate	3(6.6%)	2(4.4%)
Sinus plate	2(4.4%)	2(4.4%)

Sigmoid sinus plate erosion was seen both on HRCT and during surgery in 2(4.4%) cases.

Therefore, the statistical analysis showed at par results with no difference, the sensitivity, specificity, positive and negative predictive value of HRCT = 100%

Dural plate erosion was detected for 3 (6.6%) patients in HRCT whereas intraoperatively it was found only in 2 (4.4%) patients. HRCT sensitivity = 100%, specificity = 97.6%, positive predictive value = 66.6 %, and negative predictive value = 100%

Table 7: Lateral Semicircular canal erosion

	HRCT	INTRA OPERATIVE
Lateral SCC erosion	3(6.6%)	10(22.2%)

Sensitivity=30%, Specificity=100%, Positive predictive value=100%, Negative predictive value=83.3%

Erosion of lateral semi-circular canal was reported only in 3(6.6%) patients in HRCT. In contrast, surgical findings confirmed it to be positive in 10(22%) cases.

DISCUSSION

COM is a significant health burden in developing countries and accounts for preventable deafness in community [4]. Though otoscopic recognition of cholesteatoma is often reliable, imaging modalities should be used in all patients suspected of harbouring a cholesteatoma to determine the gross or subtle changes and the presence of complications which are mostly due to bone erosion. [6]

HRCT temporal bone plays an important role in the assessment of patients with squamous type of COM by giving preoperative information of the closed spaces of the middle ear.[7]

The results of this study are consistent and are comparable with other studies.

In our study, we analyzed the correlation between pre-operative high-resolution computed tomography (HRCT) findings and intra-operative findings for chronic otitis media-squamous type. Our data focused on presence of cholesteatoma, extend of disease and the erosive patterns observed in the lateral semicircular canal (SCC), dural plate, sinus plate, ossicles and facial canal.

Extend of disease

HRCT showed 100% sensitivity for detecting cholesteatoma and soft tissue density in middle ear, aditus and attic which is well comparable with study by Mandal et al. [8]

Scutum erosion

Mandal et al [8] demonstrated that HRCT is 94.1% sensitive and 80% specific in detecting scutum erosion which is comparable to our study with sensitivity of 92.8% and specificity of 100%.

Lateral Semicircular canal Erosion

Our study found a discrepancy between HRCT and intra-operative findings for lateral SCC erosion. Erosion of lateral semi-circular canal was reported only in 3(6.6%) patients in HRCT. In contrast, surgical findings confirmed it to be positive in 10(22%) cases.

Our study showed that HRCT temporal bone had sensitivity of 30%, specificity 95.74%, PPV 100%, and NPV 97.77%.

Kanotra et al. [4] showed that HRCT temporal bone had sensitivity of 66.66%, specificity 95.74%, PPV 100%, and NPV 97.77%.

Datta et al [6] reported 100% sensitivity, specificity, positive and negative predictive value much higher than our study.

Dural Plate Erosion

Dural plate erosion was detected for 3 (6.6%) patients in HRCT whereas intraoperatively it was found only in 2 (4.4%) patients. On comparing the HRCT findings with Intra-operative findings in the present study, the sensitivity = 100%, specificity = 97.6%, positive predictive value = 66%, and negative predictive value = 100%. In a prospective, analytical study on 65 patients by Karki et al [9] HRCT had a sensitivity of 100% and specificity of 100% with regards to detection of erosion of tegmen plate.

Sinus Plate Erosion

Sigmoid sinus plate erosion was seen both in HRCT and during surgery in 2(4.4%) cases.

Therefore, the statistical analysis showed sensitivity, specificity, positive and negative predictive value of HRCT as 100% which is well compared with study by Datta et al. [6]

Ossicular Erosion

HRCT showed erosion of malleus in 18 (40%) patients, whereas 20 (44.4%) patients had erosion of malleus per operatively making the HRCT, sensitivity = 90%, specificity = 100%, positive predictive value = 100%, and negative predictive value = 92.5%.

The sensitivity, specificity, and positive predictive value of the present study were comparable to the study conducted by Datta et al [6] and Kanotra et al [4] whereas the negative predictive value of the present study was higher 92.5% as compared to 66.66% reported by Datta et al. [6]

Incus appeared eroded on HRCT scan in 29(64.4%) cases, whereas intra operatively it was seen in 31(68.8%) patients. HRCT was found to be 93.5% sensitive with positive predictive value of 100%. Datta et al. also observed a positive predictive value of 100%, but the sensitivity was slightly low (87%) as compared to the present study.

Stapes superstructure erosion was reported by HRCT in 6 (13.3), and during surgery 13(28.8%) patients had stapes erosion making HRCT sensitivity= 46.1%, specificity=100% positive predictive value=100%, negative predictive value= 65%.

A study by Khan et al [10] HRCT was able to diagnose ossicular erosion with 76% specificity and 68% sensitivity for stapes. Our study showed that HRCT had better predictive value for erosion of malleus and incus than for stapes.

Facial canal dehiscence

Facial nerve palsy secondary to canal erosion is present in nearly 1% of cholesteatoma cases [11]. Facial canal dehiscence was depicted by HRCT in 8(17.7%) cases, whereas intra operatively it was seen in 11 (24.4%) patients. Therefore, HRCT sensitivity=72.75%, specificity=100%, positive predictive value=100%, negative predictive value=89.65%. This might be due to error in interpreting CT scan. Our study is comparable with the findings by Kanotra et al [4] with HRCT, sensitivity = 33.33%, specificity = 100%, positive predictive value = 100%, and negative predictive value = 91.11% in identifying facial canal dehiscence.

Our study's findings are consistent with the broader literature, which indicates that while HRCT is a valuable diagnostic tool for assessing chronic otitis media, its accuracy in predicting intra-operative findings can be variable.

Enhanced imaging modalities or adjunctive diagnostic methods may be required to better correlate pre-operative assessments with intra-operative findings, ultimately leading to improved surgical outcomes and patient management.

CONCLUSION

High resolution computed tomography temporal bone can provide detailed information about anatomy of middle ear cleft, the extension and complications of cholesteatoma but mis interpretations are possible.

It acts as a road map for the surgeon to identify the extent of disease, plan for the appropriate procedure that is required and prepare for the potential complications that can be encountered during surgery.

The findings of pre-operative high resolution computed tomography findings and intra-operative findings were well comparable except for lateral semi-circular canal erosion and erosion of stapes. Enhanced imaging modalities or adjunctive diagnostic methods may be required to better correlate pre-operative assessments with intra-operative findings, ultimately leading to improved surgical outcomes and patient management.

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Conflicts of interest

There are no conflicts of interest

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