Journal of Population Therapeutics & Clinical Pharmacology

RESEARCH ARTICLE
DOI: 10.53555/4zbzjv20

FINDINGS OF HRCT TEMPORAL BONE VS INTRAOPERATIVE FINDINGS IN CHOLESTEATOMA - A CORRELATIVE STUDY

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ABSTRACT:

Background: Chronic suppurative otitis media with Cholesteatoma evaluated with HRCT Temporal bones is widely used for anatomical and pathological diagnosis. The Radiological findings are to be correlated with the intraoperative findings to confirm the radiological diagnosis which would help the surgeons in planning the surgeries.

Aim of the Study: To assess the use fulness of apreoperative HRCT temporal bone and establish HRCT as an efficacious tool for diagnosis of the extent and involvement of adjacent structures by Cholesteatoma.

Materials:50 patients diagnosed clinically as chronic suppurative otitis media with acquired cholesteatoma were studied with the help of HRCT temporal bones and intraoperative finding for correlation. Standard operative procedures were applied in undertaking HRCT and Surgical treatment of the Choesteatoma after thorough clinical evaluation and laboratory diagnosis. Results: Among the 50 patients included majority were 15/50 (30%) in the age group of 31-40 years followed by 12/50 (24%) who were in the age group of 21-30 years. Only few were in the extremes of age groups. Disease observed in patients aged more than 60 patients could be due to slow progression. The mean age distribution of the patients is 33.14 ± 13.70 years. The most common ossicle involved was Incus (long process) in 22/50 patients (44%) on HRCT and intraoperatively in 26/50 (52%) with a Sensitivity of 84.6 and specificity 100% (p-value= <0.001).

Conclusions: The results of this study suggest that preoperative HRCT imaging in cases of cholesteatoma, ossicular chain erosion has good correlation with intraoperative findings. However, HRCT is not able to distinguish between cholesteatoma and mucosal disease, Facial canal dehiscence, Incus and Malleuserosions in the early stages.

INTRODUCTION

Chronic otitis media attico-antral disease(cholesteatoma) remains a significant health problem in terms of prevalence, economics and sequelae. A variety of standard surgical approaches are currently used for treating it, which are categorized as canal wall up or down approaches. Historically, surgery for Chronic otitis media has been undertaken with only plain x-rays. Recently,

high resolution computed tomography (HRCT) scanning has evolved as the standard imaging technique for temporal bone, but its exact role in the preoperative assessment of patients with Chronic otitis media attico-antral disease still remains controversial. (1) Many experienced otology surgeons seldom use computed tomography scanning arguing that nature and extent of pathology become evident during surgical dissection. (2) Some otologists use it regularly aiming to evaluate the extension of disease, schedule the surgical technique to be adopted and identify potential risk of complications. Others reserve its utilization for cases in which there is suspicion of complication, recurrence or diagnostic doubt. (3) CT scan findings of acquired cholesteatoma of temporal bone consists of a homogeneous soft tissue mass with local bone erosion, middle earopacification, erosion of scutum, erosion of ossicles, Labyrinthine fistula, erosion of fallopian(facial) canal, erosion of tegmen, sigmoid sinus erosion, widening of aditus ad antrum, and auto-mastoidectomy. (4) Prior knowledge about temporal bone anatomy and the extent of disease may help surgeons plan and choose the appropriate type of surgery and avoid complications.(5) This study was done to evaluate the role of high resolution computed tomography temporal bone as a diagnostic modalityin Cholesteatoma and its use fulness in the management strategy like the approach and route and surgical intervention required. The high resolution computed tomography (HRCT) of temporal bone provides minute bony details and an excellent demonstration of the location of the soft tissue density but cannot differentiate the type of substance producing the abnormal density. Magnetic resonance is superior to CT in the identification of soft tissue pathology in the temporal bone. However bony structures like ossicles, scutum labyrinthine capsules are better delineated on CT temporal bones. Hence CT temporal bone has been considered the imaging modality of choice for assessment of the ear pathology. (6)Jackler RK et al (1984), (7) conducted a study in forty-two patients with chronic otitis media who underwent preoperative CT scanning followed by surgical exploration of the middle ear and mastoid. The CT finding of abnormal soft tissue density with bony erosion showed high correlation with the surgical finding of cholesteatoma. On the contrary, total absence of abnormals of ttissue density on CT essentially excluded cholesteatoma. They concluded that CT scan does have arole in the evaluation of selected patients with chronic otitis media, but needed to be interpreted keeping in mind its associated limitations and pitfalls. Mafee MF et al (1986), (8) conducted a study of the microdissection of 250 fresh temporal bones and review of over 1000 high resolution computed tomographyscans of the temporal bone. The anatomy was described, and the role of the tympanic diaphragm and isthmus in the determination of the degree of progression of middle ear pathology stressed. The appearance of pathological lesions as seen on CT temporal bones like otomastoiditis, tympanosclerosis, cholesterol granuloma, attic retraction pocket, and acquired cholesteatoma was illustrated. Yamasoba T et al (1991), (9) used axial scans of HRCT bones to examine the structures of the anterior epitympanicrecess and the surrounding tissues. The length and width of the recess and the cog was also imaged. The bony structure of the recess was found to be seldom influenced by inflammatory processes. Chronicotitis media was found to be associated with suppression of pneumatization of the temporal bone. The cells around the recess were also found to be less pneumatized than the mastoid cells.

MATERIALS: Source of Data: The present work was undertaken to study the radiological findings of HRCT temporal bone in patients with cholesteatoma at ENT Department, Mahatma Gandhi Memorial Hospital, Kakatiya Medical College between July 2022 and June 2024.
Sample size:50

Type of study: Prospective Observational Study

Duration of study: 23 Months.

OBJECTIVES OF STUDY:- To evaluate HRCT Efficacy by identifying the extension and site of cholesteatoma and its sac, to assess Anatomical Structures, to assess the status of the ossicles, facial nerve canal, tegmenandsinus plate; to evaluate the positions of the dura, sigmoids inus, in relation to

the cholesteatoma; to compare HRCT findings with the intra-operative Findings which would guide surgical procedures and minimize intraoperative complications to evaluate the surgical outcomes based on the preoperative HRCT findings; to compare the study results with those of similarly published studies to validate the findings and improve Surgical Outcomes; which would enhance surgical planning and outcomes, and aims for better patient prognosis and reduced complication rates. An Institution ethics Institute approved the clinical study and prescribed the proforma and limitations. Patients with cholesteatoma presenting to the ENT department at Mahatma Gandhi Memorial Hospital, Kakatiya Medical College were taken up for study. Detailed clinical history and examination were carried out as per the proforma prepared. Laboratory investigations were done. All patients were subjected to HRCT temporal bones, 1mm axial and coronal slices. Once the radiological findings were noted and extent of disease established, management was done accordingly.

Inclusion criteria: All patients diagnosed clinically as chronic suppurative otitis media with acquired cholesteatoma were included. All patients who underwent surgery within 10 days of obtaining HRCT temporal bones can were included.

Exclusion criteria: Patients with previous ear surgery, recurrent Cholesteatoma, history of previous head trauma were excluded. Patients with known history of sensorineural hearing losswere excluded. Patients with systemic disease which could have affected the ear (e.g. collagen vascular or granulomatous diseases), Malignancies of the temporal bone and skull base, and those with a history of head and neck radiotherapy were excluded. All patients included in the study were subjected to certain investigations. Hematological investigations such as complete hemogram, bleeding time, clotting time, were done. Urine analysis, Random blood sugar, renal function tests were done, Specific investigations included were HRCT of temporal bones. Instrumentation: - Canon aquilion computed tomography scan16 slice. Sequences used: -Axial, coronal views obtained using 16 slice CT scan. Operating Microscope: - Op to fine Delight Data Analysis: The collected data were numerically coded and then data were entered using Microsoft Excel version 2022. The data was then exported to Statistical Package for Social Sciences software version 22 for analysis. Descriptive statistics like frequencies and percentages were done to study the baseline demographic characteristics. Categorical data were expressed as percentage. The Chi-Square test was used as the test of significance. Sensitivity, specificity, positive predictive value and negative predictive value were calculated to compare the findings between CT scan and intraoperative findings. Statistical significance was fixed at P value of <0.05. Microsoft Excel and Microsoft Word were used to obtain various types of graphs.

RESULTS

The present study was aprospective observation alone with 50 (N) patients. Among them the majority were15/50 (30%) in the age group of 31-40 years followed by 12/50 (24%)who were in the age group of 21-30 years. Only few were in the extremes of age groups. Disease observed in patients aged more than 60 patients could be due to slow progression. The mean age distribution of the patients is 33.14 ± 13.70 years. The minimum age of the patient ranged from 6years to a maximum age of 62 years. Among the 50 patients, majoritywerefemalesaccountingfor36/50 (72%) and the remaining14/50 (28%)were males with a Male to Female ratio of 1:2.57 (Table 1).

Observation	Number	Percentage	P value
Age in Years			
<10	02	04	
11–20	08	16	
21 – 30	12	24	0.218
31 – 40	15	30	
41 – 50	07	14	

51 – 60 >61 years	04 02	08 04	
Gender Male Female	 14 36	 28 72	 0.341

Table-1: Age and Gender distribution of study participants (N=50)

In this study all the patients were subjected to High resolution computed tomography of temporal bone scans with 1 mm thickness axial and coronal slices with Cannon Aquilion computed tomography 16 slices in bone algorithm. Soft tissue opacity noted in all patients (100%) confirmed by intra operative observation under microscopy using OptofineDelightF-200objectivelenswith12.5x eyepiece with appropriate magnification. Scutum erosion was noted in 19 patients (38%) in preoperative computedtomographybutobservedinsurgeryin23 patients (46%)with sensitivity of 78.3% and specificity of 96.3% (p-value= <0.001).Most common ossicle involved was Incus (long process) in 22 patients (44%) which was identified in computed tomography and intraoperatively it was found that Incus erosion was seen in 26/50 patients (52%) with a Sensitivity of 84.6 and specificity 100% (p-value= <0.001). The second most common ossicle involved was Malleus and found in 14/50 patients (28%) in computed tomography and intraoperatively it was detectedin17/50 patients (34%)with Malleus erosion out of which Malleus handle erosion was observed in 12/50 patients (24%) intraoperatively and computed tomography detected 10/50 patients (20%) with sensitivity of 83.3% and specificity of 100% (p-value -<0.001). Overall ossicularerosion noted in 25 patients (50%) in preoperative computed tomography and intraoperatively detected in 27 patients (54%). Malleus head erosion was observedin 09/50 patients (18%) in preoperative computed tomography and intraoperatively detected in 12/50 patients (24%) with sensitivity of 75% and specificity of 100% (p-value=<0.001),**(Table 2).** Stapes was the least commonly involved ossicleand most commonly affected part was Stapessupra structure. Stapeserosion was detected accurately in both computed tomography and intraoperatively in 03/50 patients (06%) with both sensitivity and specificity of 100% (p-value= <0.001), **(Table 2).** The positive predictive value was 89.5% and the Negative predictive value=93.5% P value = <0.001*. Facial canal dehiscence was observed in only onepatient in preoperative computed tomography but facial canal dehiscence found in 02/50 (04%) patients during surgery with sensitivity of 50% and specificity of 100% (p-value=0.04). The Positive predictive value was 100% and the Negativepredictivevaluewas98% with p value = 0.04* The lateral semicircular dehiscence was observed in one patient (02%) in preoperative computed tomography but observed in 03 patients (06%)during the surgery with sensitivity of 33.3% and specificity of 100% (p-value=0.06). The positive predictive value=100%; Negative predictive value = 95.9% P value = 0.06***(Table 2).** Tegmenerosionnotedin 3 patients (06%) in preoperative computed tomography and the same was found during surgery with sensitivity of 66.7 and specificity of 97.9%. The positive predictive value=66.7%; Negative predictive value=97.9% p value was 0.007*. Sinus plate erosion observed in 04 patients (08%)in both preoperative computed tomography and during surgery with both sensitivity and specificity of 100% (p-value= <0.001). positive predictive value=100%; Negative predictive value=100% P value < 0.001***(Table 2).**

CT scan findings	CT finding		Surgical finding		P value
	Frequency	Percentage	Frequency	Percentage	
Scutum erosion Present Absent	 19 31	 38 62	 23 27	 46 54	 <0.001
Incuserosion Present Absent	 22 28	 44 56	 26 24	 52 48	<0.001 <0.001

Erosion of Malleus Handle					
Present	10	20	12	24	
Absent	40	80	38	76	
Erosion of Malleus Head					<0.001
Present	09	18	12	24	
Absent	41	82	38	76	
Erosion of Stapes					
Present	03	06	03		<0.001
Absent	47	94	94		
Facial canal dehiscence					
Present	01	02	01	02	0.040
Absent	49	98	49	98	
Lateral semicircular Canal erosion					
Present	01	02	01	02	0.060
Absent	49	98	49	98	
Tegmen erosion					
Present	03	06	03	06	0.007
Absent	47	94	47	94	
Erosion sinus plate					
Present	04	08	04	08	<0.001
Absent	46	92	46	92	

Table-12: Comparison between pre-operative HRCT findings and intraoperative observations in terms of different radiologic signs (N=50).

DISCUSSION

High Resolution Computed Tomography of the temporal bone is the imaging modality of choice for pre-surgical anatomical and pathological evaluation, though it has limitations in differentiating cholesteatoma from other soft tissue densities such as fluid, granulation tissue, and discharge, and in identifying early cholesteatom as. In this study, Incus (long process) was most commonly affected ossicle followed by Malleus (handle)and Stapes (supra structure). The sensitivity of HRCT for detecting Malleus erosion was 83.3 %; Incus was also 84.6%. Similarly, the specificity of HRCT scan for detecting Malleus erosion was 100%; Incus erosion was also 100%. These findings are consistentwiththefindingsofCheeetal.andincontrasttostudybyTatlipinar etal. Who observed sensitivity of 62.8% and specificity of 85.7% for the same. In our series, HRCT had a sensitivity of 66.7% and specificity of 97.9% with regards to detection of erosion of Tegmen plate, which is comparable to study by Jackler et al. (7) Sreedhar S, Pujary K.(10) Jackler et al. (7) were able to diagnose dehiscence in the Facial canal with a sensitivity of 62.5% and specificity 100%. In the present study, erosion of the horizontal part of the facial canal was correctly diagnosed with asensitivityof50%andspecificityof100%. It was foundthat100%sensitivity and 100% specificity of CT scan was possible in detecting sigmoid plate erosion. This finding was similar to a study by Roghaetal. (11) Conversely, Tatlipinaretal. (12) Used 1.5mm cuts HRCT 2011) reported a relatively low sensitivity of 33% and specificity of 100%. Variable results have been reported in literature with regard to the ability of CT scan in detection of Lateral semicircular canal. Rogha (11) and colleagues reported sensitivity of 75% and specificity of 87.5%. On the other hand, Sreedhar et al. (10) reported a sensitivity of 100% and specificity of 94%.We found that the sensitivity of CT in detecting lateral semicircular canal erosion was 33.3% and specificity was also 100%. The variability in impression about lateral semicircular canal fistula formation could be due to volume averaging of these structures with adjacent soft tissues. These findings highlighted the fact that,

although HRCT temporal bone is helpful for diagnosing chronic otitis media, the findings must be interpreted cautiously in view of its limitations. The results of our study show that high resolution computed tomography of temporal bone gives precise information about the location and extent of disease. Information regarding the status of ossicular chain erosion, erosion of Lateral semicircular canal and Fallopian canal canal so be well appreciated by the HRCT scan. The delineation of pathology prior to surgical exploration allows the operating surgeon to plan the most appropriate surgical approach that is required. The information about the possible anatomic variations helps in preparingforthedifficultiesthatmightnothavebeencontemplatedotherwise. Pre-surgical knowledge about the status of ossicular chain also allows the surgeon to be ready for ossicular chain reconstruction and to advise the patient regarding the degree of hearing attainable after surgery.

CONCLUSIONS

The results of this study suggest that preoperative HRCT imaging in cases of cholesteatoma, ossicular chain erosion has good correlation with intraoperative findings. However, HRCT is not able to distinguish between cholesteatoma and mucosal disease, Facial canal dehiscence, Incus and Malleuserosions in the early stages. HRCT can act as a guide to the nature of disease, potential dangers and possible complications, and this information can assist the surge on inplan of surgery to be performed and better advise the patient on the degree of hearing attainable after surgery.

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