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CORRELATION BETWEEN RADIOLOGICAL AND OPERATIVE FINDINGS IN UNSAFE CHRONIC SUPPURATIVE OTITIS MEDIA: A CLINICAL STUDY

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ABSTRACT

Background: Unsafe Chronic Suppurative Otitis Media (CSOM), primarily of the attico-antral type, is a persistent middle ear infection often associated with cholesteatoma, ossicular erosion, and potentially life-threatening complications. Accurate preoperative evaluation is crucial for effective surgical planning and optimal patient outcomes. High-Resolution Computed Tomography (HRCT) has emerged as a vital diagnostic tool in assessing disease extent, but its correlation with intraoperative findings remains a subject of clinical interest. **Objective:** To evaluate the correlation between preoperative radiological findings on HRCT and intraoperative observations in patients with unsafe CSOM, focusing on the detection of cholesteatoma, ossicular chain erosion, scutum erosion, and other key pathological features. **Materials And Methods:** This prospective study was conducted at the Department of ENT, Government Medical College, Amritsar, involving 50 patients clinically diagnosed with unsafe CSOM. All patients underwent HRCT temporal bone imaging followed by surgical intervention. Intraoperative findings were documented and compared with radiological reports. Data were analyzed using appropriate statistical tests. **Results:** Soft tissue in the middle ear cleft was identified in 82% of cases on HRCT and 90% intraoperatively (sensitivity 88.88%, specificity 80%). Incus necrosis was the most frequent ossicular erosion (76% HRCT, 84% intraoperative) with 83.33% sensitivity and 92.10% positive predictive value. Malleus and stapes necrosis showed lower sensitivity (80% and 47.82%, respectively). Scutum erosion was reliably detected (68% HRCT, 72% intraoperative) with 88.88% sensitivity and 85.71% specificity. HRCT also showed high specificity for lateral semicircular canal (97.82%), facial nerve canal (97.72%), tegmen tympani (97.56%), and sinus plate (100%) erosions. **Conclusion:** HRCT is a valuable preoperative tool in the evaluation of unsafe CSOM, providing detailed insights into the extent of middle ear pathology. While not infallible, it closely correlates with intraoperative findings and significantly aids in surgical planning.

KEYWORDS

Chronic suppurative otitis media, HRCT Temporal bone, Atticoantral, Cholesteatoma, Unsafe CSOM

INTRODUCTION

Chronic otitis media (COM) is a common and often debilitating condition characterized by long-term inflammation of the middle ear and mastoid cavity. This condition is classified into two categories: Tubo-tympanic disease (safe type) and Attico-antral disease (unsafe type). Safe COM typically involves a perforated tympanic membrane with limited risk of complications, while unsafe COM is associated with more severe pathological changes, including cholesteatoma, ossicular erosion, and possible invasion of the inner ear structures. Destruction may be limited to long process of incus or it may involve stapes suprastructure and entire ossicular system also. Unsafe COM can lead to significant hearing loss, recurrent infections, and, if left untreated, potentially life-threatening complications such as intracranial or intratemporal spread of infection[1]. On examination, unsafe disease has signs like attic perforation, retraction pockets, cholesteatoma sacs and scutum erosion. However, clinical findings alone often lack the accuracy needed to assess the extent of the disease or predict potential complications.

Traditionally, surgical decision-making in COM was largely based on clinical examination and intraoperative findings. However, with advancements in imaging technology, High-Resolution Computed Tomography (HRCT) has become a valuable diagnostic tool in evaluating the extent of middle ear disease[2]. HRCT provides detailed cross-sectional images that can visualize subtle anatomical changes, including ossicular chain involvement, cholesteatoma, and erosion of the bony structures of the temporal bone[3].

Despite the advantages of HRCT in preoperative evaluation, the correlation between HRCT findings and intraoperative observations in unsafe COM remains an area of ongoing investigation[4]. Intraoperative findings, such as the presence and extent of cholesteatoma, ossicular destruction, and the involvement of critical structures like the facial nerve or inner ear, are crucial for determining the appropriate surgical approach[5]. Therefore, understanding the degree of agreement between preoperative HRCT imaging and intraoperative findings is essential for assessing the role of HRCT in surgical decision-making.

This study aims to evaluate the correlation of radiological imaging and intraoperative findings in patients with unsafe COM, focusing on the accuracy of HRCT in predicting cholesteatoma presence, ossicular erosion, and the extent of disease. By investigating the accuracy and utility of HRCT in predicting intraoperative findings, we hope to enhance the diagnostic process, improve preoperative planning, and optimize patient outcomes in the management of this challenging condition.

MATERIAL AND METHODS

The present study of "Correlation Between Radiological and Operative Findings in Unsafe Chronic Suppurative Otitis Media: A Clinical Study" was conducted in the Department of E.N.T, Govt. Medical College, Amritsar. All patients attending the E.N.T outpatient department were screened thoroughly and those in whom attico-antral type of COM was suspected, were taken for the study with a sample size of fifty patients. The patients were enrolled in the study after obtaining written informed consent and approval of Institutional Ethics Committee, Government Medical College, Amritsar.

Inclusion Criteria

1. Patients with foul smelling ear discharge, having attico-antral type of chronic suppurative otitis media.
2.Patients with aural polyps.
3. Patients with retraction pockets.
4. Patients with history of ear surgery but presenting with unsafe pathology on clinical examination.

Exclusion Criteria

1.Patients with tubo-tympanic type of chronic suppurative otitis media.

2.Cases of acute suppurative otitis media.
3. Suspicion of ear pathology to be malignant.
4.Patients unfit for surgery.
5.Patients with a history of prior temporal bone trauma.

After selection, a detailed history and general physical and systemic examination was carried out. A thorough ENT examination with focus on otological examination, along with examination under microscope was done. Radiological investigation i.e. high resolution computed tomography of temporal bone was done.

All selected cases were subjected to routine pre- anesthetic check- up and requisite clearance was obtained. The patients were operated under general anaesthesia/local anaesthesia. Intraoperative findings were recorded.

Statistical Analysis:
Data obtained from the present study was systematically collected, compiled, and subjected to statistical analysis. Appropriate statistical tests were employed to compare various parameters and patient characteristics. The p-value was calculated to assess the level of statistical significance. A p-value of < 0.05 was considered statistically significant.

RESULTS

Age wise distribution of patients is given in Table no.1 Maximum number of patients, that is, 16 (32%) were from the age group of 21-30 years, followed by 13 (26%) in 31-40 years.

Table No.1: Age Wise Distribution Of Patients

AGE IN YEARS	NUMBER OF PATIENTS	PERCENTAGE
0-10	2	4
11-20	8	16
21-30	16	32
31-40	13	26
41-50	9	18
>50	2	4
TOTAL	50	100

In present study, females were affected more commomly than males. Distribution of patients by gender is shown in figure1. 54% of our patients were females and 46% were males.

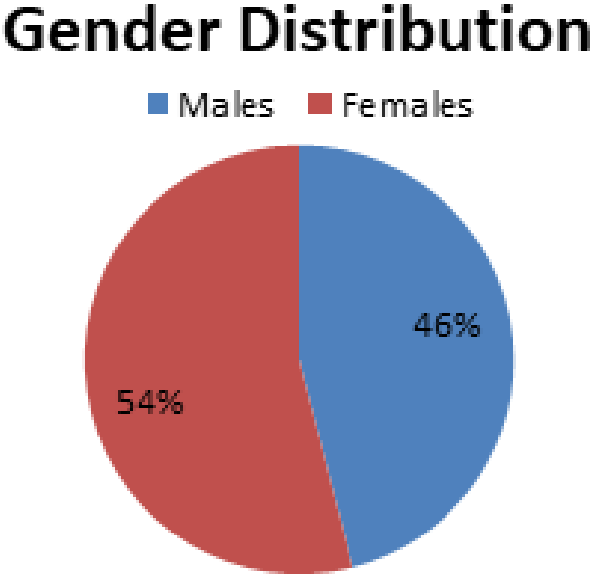

Figure 1- Pie chart showing distribution of study subjects by gender

Ear discharge was the most common presenting symptom found in 92% patients followed by hearing loss (found in 88% patients). Otalgia (38%) and tinnitus (18%) were found in patients as the next common presenting symptoms. Vertigo (10%), postauricular swelling (10%), facial paresis/ paralysis (4%), headache (2%) and nasal obstruction (2%) were other less frequent symptoms (Table no.2).

Otoscopic and microscopic examinations were key to clinical diagnosis. On otoscopic examination 64% cases had attic retraction, 48% cases had posterosuperior retraction pocket, 16% presented with ear polyps, 12% cases had scutum erosion and 6% had marginal perforation (Table no.3).

Table No.2: Presenting Symptoms Of Patients

S. No.	CLINICAL FEATURES	NO OF PATIENTS	PERCENTAGE
1	EAR DISCHARGE	46	92
2	HEARING LOSS	44	88
3	OTALGIA	19	38
4	TINNITUS	9	18
5	VERTIGO	5	10
6	POSTAURICULAR SWELLING	5	10
7	FACIAL PARESIS/PARALYSIS	2	4
8	FEVER	1	2
9	HEADACHE	1	2
10	NASAL OBSTRUCTION	1	2

Table No.3: Otoscopic Findings

S. No.	Otoscopic findings	No of patients	Percentage
1	Attic retraction	32	64
2	Posterosuperior retraction pocket	24	48
3	Polyp	8	16
4	Scutum erosion	6	12
5	Marginal perforation	3	6

HRCT reported soft tissue density in the middle ear cleft in 41 patients. Soft tissue in the middle ear cleft was found in 45patients intra-operatively.

Among the other bony anatomical landmarks involved, erosion of the scutum was the most common lesion found in 34 patients (68%) on HRCT scan and in 36 patients (72%) intraoperatively. Tegmen tympani was found eroded in 5 cases (10%) on HRCT scan and in 9 cases (18%)intraoperatively. Bony facial canal was found eroded in 5 cases (10%) on HRCT scan and in 6 cases (12%) intraoperatively. Lateral semicircular canal erosion was found in 4 cases (8%) on HRCT scan and in 4 cases (8%) intraoperatively. Sinus plate erosion was found in 2 cases (4%) on HRCT and in 3 cases (6%) intraoperatively(Table no.4).

Table No.4: Comparison Of HRCT And Surgical Findings

S. No.	Finding	On HRCT Temporal Bone	Intraoperative
1	Soft tissue in ME cleft	41(82%)	45(90%)
2	Scutum erosion	34(68%)	36(72%)
3	Lateral SCC erosion	4(8%)	4(8%)
4	Facial nerve canal erosion	5(10%)	6(12%)
5	Tegmen tympani erosion	5(10%)	9(18%)
6	Sinus plate erosion	2(4%)	3(6%)

This study found that Incus was the most commonly eroded ossicle on HRCT Temporal bone (76%) as well as intraoperatively (84%), followed by erosion of malleus (46% on HRCT and 50% intraoperatively) and stapes (34% on HRCT and 46% intraoperatively)(Table no.5).

Table no.5: HRCT Findings And Operative Findings Of Ossicular Status

S. No.	Ossicular erosions	On HRCT Temporal Bone	Intraoperative
1	Incus necrosis	38(76%)	42(84%)
2	Malleus necrosis	23(46%)	25(50%)
3	Stapes necrosis	17(34%)	23(46%)

HRCT and intra-operative findings were correlated and sensitivity, specificity and accuracy were calculated (Table no.6).

Table No.6: Comparision Of Preoperative HRCT Temporal Bone With Intraoperative Findings.

S. No.	Feature	On HRCT	Intra Operative	Sensitivity	Specificity	Positive Predictive Value	Negative Predictive Value

1	Soft tissue in ME cleft	41 (82%)	45 (90%)	88.88%	80%	97.56%	44.44%
2	Malleus necrosis	23 (46%)	25 (50%)	80%	88%	86.95%	81.48%
3	Incus necrosis	38 (76%)	42 (84%)	83.33%	62.5%	92.10%	41.66%
4	Stapes necrosis	17 (34%)	23 (46%)	47.82%	77.77 %	64.70%	63.63%
5	Scutum erosion	34 (68%)	36 (72%)	88.88%	85.71 %	94.11%	75%
6	Lateral SCC erosion	4(8%)	4(8%)	75%	97.82 %	75%	97.82%
7	Facial nerve canal erosion	5(10%)	6(12%)	66.66%	97.72 %	80%	95.55%
8	Tegmen tympani erosion	5(10%)	9(18%)	44.44%	97.56 %	80%	88.88%
9	Sinus plate erosion	2(4%)	3(6%)	66.66%	100%	100%	97.91%

DISCUSSION

Squamous type Chronic Otitis Media (COM) has been a significant cause of middle ear pathology since prehistoric times, often associated with challenging complications that demand careful evaluation by both otologists and radiologists. Historically, mastoid surgeries were performed with limited preoperative assessments, relying primarily on otoscopy, audiometry, and plain radiographs.

The introduction of High-Resolution Computed Tomography (HRCT) in the 1980s marked a pivotal advancement in the preoperative assessment of temporal bone anatomy. HRCT provides detailed visualization of disease extent and serves as a critical tool in identifying potential complications. Despite its diagnostic value, many otologic surgeons continue to reserve its use for select indications, such as squamous COM with suspected complications, congenital anomalies, or cases with distorted anatomy due to prior surgeries.

However, the routine use of HRCT prior to surgical intervention in squamous COM could be substantiated if it demonstrably alters clinical decision-making. By enabling precise anatomical mapping and identification of pathology, HRCT has the potential to transform an exploratory surgery into a well-planned, targeted procedure, thereby improving surgical outcomes and minimizing intraoperative risks.

In the present study, the age of patients varied from 9 - 65 years with maximum number of cases presenting between 21-30 years age group (32%). In a study by Stefanescu E.H [6], the group predominantly affected by this disease entity 31-40 years. In present study, females were affected more commomly than males. 54% of our patients were females. In the prospective study by Datta et al[7] in 2014 of 50 cases in which affected females were 56% and males 44%.(33]

The most common symptom was the foul smelling ear discharge in 92 % cases followed by hearing loss in 88 % cases. Tinnitus, vertigo and facial nerve palsy were less common in the present series. This probably indicates that the patients come to hospital relatively early before any temporal and intracranial complication. In the study by Glascocketal[8] he noted majority of symptoms are ear discharge and hearing loss. Thukral CL Singh et al[9] in their study noted majority of the symptoms are hearing loss and ear discharge; our study correlated well with their studies.

In the present study HRCT was 88.88% sensitive and 80% specific in identifying soft tissue mass. Mafee et al.[10] and O'Reilly et al. [11] have similar results, whereas Jackler et al. [12] and Garber and Dort [13] found it to be less sensitive and specific. On the whole, although HRCT can identify soft tissue mass accurately, it is less sensitive in differentiating cholesteatoma from granulations. Mafee et, al [10] suggested CT scans were able to detect soft tissue masses in the mastoid and middle ear in almost all cases, although he believed it was possible to identify cholesteatoma by its characteristically low attenuation values.

The inherent property of cholesteatoma in unsafe COM to elicit bone erosion results in ossicular erosion. Knowledge about the ossicular integrity preoperatively may enable the surgeon to plan for ossicular reconstruction according to the individual case and be in a better position to explain the patient about the hearing outcome of the surgery. In our study, incus was the most common ossicles found to be eroded on HRCT scan (n = 38, 76%) as well as intraoperatively (n = 42, 84%). The findings of present study are comparable to a study by Datta et al[7] in 2014 who also quoted a sensitivity of 87%. Payal G et al[14] in their study quoted that most of the false negatives involved the lentiform process which is the most common site of ossicular erosion and is a subtle finding.

In this study of 50 cases, HRCT detected malleus erosion in 46% (23 patients) while intra-operative findings showed malleus erosion in 50% (25 patients) cases. There were 3 false positive and 5 false negative cases, thus indicating that the sensitivity of HRCT for malleus erosion was 80% and specificity was 88%. Similar results were seen in a study conducted by Rogha et al[15] in 2014, who also reported HRCT sensitivity of 82.4% for detecting malleus erosion. Similarly, Shah et al[16] in 2014 have also reported a sensitivity of 81.3% and a specificity of 91.1% which is comparable with our results.

The calculated p value for malleus and incus necrosis was not significant making HRCT a good diagnostic modality for diagnosing malleus and incus necrosis pre-operatively.

In studies on efficiency of HRCT in diagnosing pre-operative stapes erosion, Rogha et al[15] in 2014 and Garg et al[17] in 2011 have found sensitivity of 61.9%, specificity of 66.7% and sensitivity of 40% and specificity of 26.67% respectively. According to the literature, the reason for its low sensitivity and specificity is that stapes is not consistently visualized on HRCT and when seen, it appears as a structure of soft tissue density in the oval window niche. This evidence supports low HRCT sensitivity and specificity of 47.82% and 77.77% respectively in diagnosing stapes necrosis in present study. The p value so calculated for stapes necrosis was significant (< 0.05), therefore, HRCT could not diagnose stapes necrosis well.

Pre-operative knowledge of the status of the ossicular chain would allow the surgeon to be ready for the ossicular chain reconstruction and to better advise the patient on the degree of hearing attainable after surgery.

In our study, we observed that HRCT showed high sensitivity (88.88%) in detecting scutum erosion. This is in accordance with other studies [18, 19]. This is one of the important signs of cholesteatoma in epitympanum. Osseous erosion involving the scutum or ossicles is key to distinguishing a cholesteatoma from debris or tubotympanic otitis media on CT, although absence of erosion does not exclude cholesteatoma.

In the present study 5 out of 6 cases of facial canal dehiscence were detected on HRCT with less sensitivity 66.66% and good specificity 97.72%. Similar results were seen in studies by Khavasi P et al[20] and Zhang X et al[21]. In our study, most of the false negatives involved vertical segment of facial canal. Studies quoted that tympanic segment of facial nerve canal and part of vertical segment was most commonly missed due to the thin underlying bony floor. But mesotympanum soft tissue density usually makes it difficult to identify facial canal dehiscence due to the oblique orientation of scan and it is frequently difficult to locate the pathology[9].

There were 10% cases (5 patients) reported of tegmen erosion on HRCT while intra-operatively, 18% cases (9 patients) showed tegmen erosion. HRCT sensitivity for tegmen erosion was 44.44% while its specificity for the same was 97.56%. According to review of the articles, HRCT was found to be poorly sensitive to detect tegmen tympani erosion which agrees with results by Jackler et al[12] in 1984, O' Reilly et al[11] in 1991. In present study, p value was not significant (> 0.05). We could thus conclude that HRCT could adequately diagnose tegmen erosion pre-operatively, possibly due to availability of machine with improved resolution.

CONCLUSION

HRCT is useful for the anatomy and variations in the temporal bone. It helps to know the changes induced by the disease in the temporal bone. HRCT helps us to assess the extent of pathology before surgery. It is a useful preoperative investigation for cholesteatoma surgery for successful identification and documentation of ossicular status, location and extent of disease, erosion of tegmen or sinus or

labyrinthine dehiscence. However, its not so useful for detecting facial canal dehiscence, stapes erosion and differentiating between presence of granulation tissue or cholesteatoma. Although it serves as roadmap for surgery, presence of false positives and false negatives prevent wholesome reliability on HRCT.

In conclusion, HRCT remains an indispensable modality in the preoperative evaluation and management planning of unsafe CSOM, aiding in early detection of complications and surgical preparedness. Nevertheless, operative findings remain the gold standard for dictating the surgical plan. A multidisciplinary approach combining clinical, audiological, radiological, and intraoperative perspectives offers the best outcomes in the management of unsafe CSOM.

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