Role of High Resolution Computed Tomography Temporal Bone in Evaluation of Ear Pathologies in A Tertiary Care Hospital, Chennai.

Dr. P Manasa[1], Dr. Ashwin Kumar. A[2], Dr. Baskar. A[3]

[1]*Postgraduate Resident, Department Of Radiology, Sree Balaji Medical College and Hospital, Chromepet, Chennai, Tamil Nadu, India. Email ID: manasagupta95@gmail.com*

[2]*Associate Professor, Department of Radiodiagnosis, Sree Balaji Medical College and Hospital, Chromepet, Chennai, Tamil Nadu, India. Email ID: ashgilli@gmail.com*

[3]*Assistant Professor, Department of Radiology, Sree Balaji Medical College and hospital, Chromepet, Chennai, Tamil Nadu, India. Email ID: baskarmdrd@gmail.com*

Corresponding Author: Dr. P Manasa
Email ID: manasagupta95@gmail.com

KEYWORDS

CSOM, HRCT, temporal bone, mastoidectomy, ear pain

ABSTRACT

Introduction: Chronic Suppurative Otitis Media (CSOM) is characterized by persistent infection of middle ear cleft, which damages middle ear structures and mastoid. To maintain a higher hearing threshold, avoid treatment failure and recurrence, the surgical approach used is crucial. CSOM is treated with a range of standard surgical methods, which fall into two categories, canal wall up and down mastoidectomy. Advancement in radiological imaging like HRCT have helped in surgical approach, as well as identify anatomical variants and positions of structures during surgery.However, many surgeons keep it reserved in case of complications and not routine ear pathologies. Hence, this study was done,

Aim and Objectives: To study external, middle and inner ear pathologies and to evaluate the diagnostic accuracy of HRCT, preemptivedetection of complications in these patients and to study the normal anatomical variants and congenital anomalies of ear.

Materials and Methods: This cross sectional study was conducted in the Department of Radiodiagnosis in a tertiary care hospital. A total of 75 cases who underwent HRCT of TB were included in the study. Study participants included Patients of all age groups and both genders. HRCT-TB was done using Siemens 16 slice machine. The helical mode of acquisition was used to minimize motion artifacts in the scans.

Results: In our study, 33.3% participants belonged to 11 -20 years, followed by 29.3% that were among 21 - 30 years, male predominance was seen 53.3% males and 46.7% females. 89.3%

had otorrhoea,70.7% had hard of hearing, Based on otoscopic findings, 30.7% cases had Retraction pocket with cholesteatoma, 80% cases had CSOM and 20% cholesteatoma. HRCT has 66.7%, 95.8%, sensitivity and specificity in diagnosing erosion of outer attic wall.

Conclusion: HRCT–TB is an effective non invasive technique to identify the pathologies of ear and hence it can be used in routine practice.

Introduction:

Chronic Suppurative Otitis Media (CSOM) is one of the serious health issue observed in patients visiting the otoplasty department. This disorder is characterized by a persistent infection of middle ear cleft, which damages middle ear structures and mastoid, resulting in several complications. [1]

The temporal Bone (TB) is encircled by numerous important structures, including the brain, ICA, jugular bulb, and facial nerve.[2]Currently, CSOM is treated with a range of standard surgical methods, which fall into two categories, canal wall up and down mastoidectomy.

To maintain a higher hearing threshold, avoid treatment failure and recurrence, the surgical approach used is crucial. This is accomplished by having prior understanding of the structure of the TB and the severity of the disease, which can aid surgeons in planning, selecting the best surgical technique and preventing complications. [3] The majority of cholesteatomas in CSOM can be diagnosed otoscopically by an otologist, although the status of the ossicles and the extent and size of the lesion in m astoid antrumand epitympanum cannot be ascertained.

Knowledge of the radiographic alterations and comparison with the normal side is required to minimize the intraoperative errors of moderate bone erosions, namely in tegmen, lateral semicircular canal, and horizontal region of facial nerve canal.[4] In the past, only simple X-rays have been used to diagnose CSOM.

With development of High Resolution Computed Tomography (HRCT), radiological imaging methods have made significant progress. A revolution in the imaging of TB and ear morphology has happened with the introduction of HRCT TB. Thin section HRCT enables imaging of osseous morphology with the use of unique algorithms.[5] The site of the cholesteatoma and its extension into different subsites of the middle ear cleft and beyond can be determined using HRCT TB scan. It can also be used to plan the surgical approach, as well as identify anatomical variants in the positions of the dura, sigmoid sinus and jugular bulb.[6]

The preoperative assessment of patients with Chronic Otitis Media (COM) using HRCT is still debatable, nevertheless. Some surgeons use HRCT as part of their routine protocols for preoperative assessment of disease extension, which aids in the planning of surgical strategies to ensure complete pathology removal and

minimize postoperative risks and complications.[7] Others save the use of HRCT for high-risk cases or cases where there are chances of complications.[8,9] In this case, research is required to determine the value of preoperative HRCT TB in evaluation of ear pathologies.

Hence, this study was done, to determine external, middle and inner ear pathologies. To evaluate the diagnostic accuracy of HRCT, preemptive detection of complications in these patients and to study the normal anatomical variants and congenitalanomalies of ear.

Materials and Methods:

This cross sectional study was conducted in the Department of Radiodiagnosis at a Tertiary Care Hospital in Chennai after approval from the institutional ethics committee, in the period, October 2022 to May 2024. A total of 75 cases who underwent HRCT of TB were included in the study.

Study participants included Patients of all age groups and both genders who were referred from ENT department to Radiodiagnosis department with ear pathologies, for HRCT TB with symptoms such as ear pain, ear discharge, tinnitus and vertigo.

Patients with radio- opaque prosthesis which may obscure thearea of interest on the same side of presentation, those with prior history of surgery for treatment of middleear disease or previous history of trauma to TB and those who were not willing to participate were excluded from the study.

Each participant received a thorough explanation of the study and a written informed consent was obtained. A pre-structured proforma to evaluate each participant's clinical presentation and demographics was used. After that, the participants' complete medical histories were evaluated, HRCT was performed on them.

HRCT-TB was done using Siemens 16 slice machine. The helical mode of acquisition was used to minimize motion artifacts in the scans. The following scanning settings were recorded: 130kV,150 mAs, 1-2 mm section thickness, and 0.5 mm collimation. The patient was placed in a supine position while the TB was serially thinned out by 1-2 mm intervals. The line connecting the external auditory meatus and infra-orbital rim was placed perpendicular to the table to acquire axial projections.

Results:

In our study, 33.3% participants belonged to 11 -20 years, followed by 29.3% that were among 21 - 30 years, then 22.7% in 31 - 40 years,10.7% of cases belonged to age > 40 years and 4% in1-10 years category.

Also male predominance was noted with 53.3% (n=40) males and 46.7% (n=35) females.

On assessing the presenting complaints, 89.3%(n=67) had otorrhoea,70.7% (n=53) had hard of hearing, 30.7% (n=23) had earache, 13.3% (n=10) had headache and 4% (n=3) had tinnitus.

Based on otoscopic findings, 30.7% (n=23) cases had Retraction pocket with cholesteatoma, 26.7%(n=20), 20% (n=15), 9.3% (n=7) and 6. 7% (n=5) of cases with Cholesteatoma with granulation tissue, granulation tissue, polyp and migrating perforation respectively.

In this study, 80% (n=60) of cases had CSOM and 20% (n=15) had cholesteatoma. 56% (n=42) and 44% (n=33) of cases had pathology on theirleft and right side respectively.

Notably, 6.7% (n=5), 81.3% (n=61) and 12% (n=9) of cases underwent Tympanomastoidectomy, Canal wall up and Canal wall down procedure respectively.Similarly, 53.3% (n=40), 36% (n=27) and 10.7% (n=8) cases had pathology inepitympanum, mesotympanum and hypotympanum respectively.

On assessing the Erosion of outer attic wall:,CT vs surgical findings, there were 2 (2.7) true positive and 69 (92) true negatives with 3 (4) false positive and 1 (1.3) false negative case as shown in the following table 1,

Erosion of outer attic wall	**Surgical finding**		**Total**
CT	**Yes**	**No**	
Yes	2 (2.7)	3 (4.0)	5 (6.7)
No	1 (1.3)	69 (92)	70 (93.3)
Total	3 (4.0)	72 (96.0)	75 (100.0)

Table 1: Erosion of outer attic wall: CT vs surgical findings

HRCT showed 66.7 %, 95.8%, 40%, 98.6% and 94.7% Sensitivity (Sn), Specificity (Sp), Positive Predictive Value (PPV), Negative Predictive Value (NPV) and Diagnostic Accuracy (DA), respectively in diagnosing Erosion of outer attic wall.

On assessing the Erosion of lateral Semi Circular Canal (SCC), CT vs surgical findings, there were 3 true positive and 70 true negatives with 2 false positive cases as shown in the following table 2,

Erosion of lateral SCC	**Surgical finding**		**Total**
CT	**Yes**	**No**	
Yes	3 (4.0)	2 (2.7)	5 (6.7)
No	0 (0.0)	70 (93.3)	70 (93.3)
Total	3 (4.0)	72 (96.0)	75 (100.0)

Table 2: Erosion of lateral SCC: CT vs surgical findings

HRCT showed 100%, 97.2%, 60%, 100% and 97.3%, Sn, Sp, PPV,NPV and DA, respectively in diagnosing Erosion of lateral SCC.

On assessing the Erosion of middle ear ossicles: CT vs surgical findings, there were 26(34.7) true positive and 40(53.3) true negatives with 6(8) false positive and 3(4) true negative cases.

HRCT had 89.7%, 86.9%, 81.3%, 93% and 88%, Sn, Sp, PPV, NPV and DA, respectively in diagnosing Erosion of middle earossicles.

On assessing the Erosion of sigmoid sinus: CT vs surgical findings, there were 2 (2.7) true positive and 63(84) true negatives with 3(4) false positive and 7 (9.3) true negative cases.

HRCT had 33.3%, 96.5%, 50%, 92.9% and 90% Sn, Sp, PPV, NPV and DA, respectively in diagnosing Erosion of sigmoid sinus.

On assessing the pathology of jugular bulb: CT vs surgical findings, there were 2 (2.7) true positives and 71 (94.7) true negatives with 2 (2.7) false positive cases.

HRCT showed 100 %, 97.3%, 50%,100% and 97.3% Sn, Sp, PPV, NPV and DA, respectively in diagnosing jugular bulb.

On assessing the pathology of hypotympanum: CT vs surgical findings, there were 5(6.7) true positive and 66(88) true negatives with 2(2.7) false positive and 2(2.7) true negative cases.

HRCT has 71.4%, 97.1%, 71.4%, 97.1% and 94.7% Sn, Sp, PPV, NPV and DA, respectively in diagnosing of pathology in hypotympanum.

On assessing the Dehiscence of facial nerve: CT vs surgical findings, there were 3(4) true positive and 64(85.3) true negatives with 3(4) false positive and 5(6.7) true negative cases.

HRCT has 37.5 %, 95.5%, 50%, 92.8% and 89.3% Sn, Sp, PPV, NPV and DA, respectively in diagnosing of pathology in Dehiscenceof facial nerve.
On assessing the Cholesteatoma: CT vs surgical findings, there were 13(17.3) true positive and 44(58.7) true negatives with 15(20) false positive and3(4) true negative case.

HRCT has 81.3 %, 74.6%, 46.4%, 93.6% and 76% Sn, Sp, PPV,NPV and DA, respectively indiagnosing of pathology with cholesteatoma.

Among the cases with stage II, stage III and stage IV CSOM there were 6.7 %, 81 .3 % and 12% of cases who underwent Tympanomastoidectomy, canal wall down mastoidectomy and canal wall up mastoidectomy respectively.

Notably, there were 2.7% (n=2) of cases with congenital anomalies of the auditory cavity.

Among the cases with congenital anomalies, 50% cases had Congenital aural atresia and 50% Enlarged vestibular aqueduct.

Following are few case illustrations from our study,

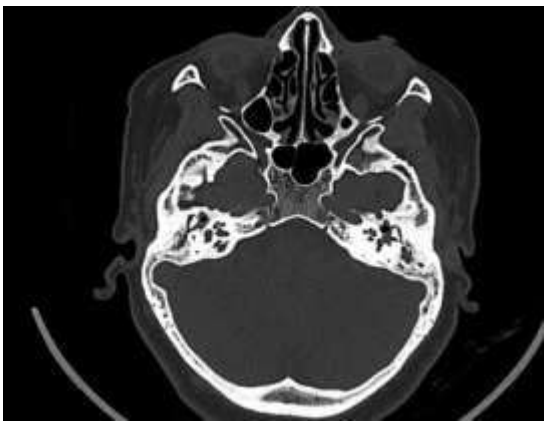

Figure 1: HRCT temporal bone demonstrates extensive soft tissue densities in left mastoid antrum, middle ear cavity and prussak space-bilateral CSOM

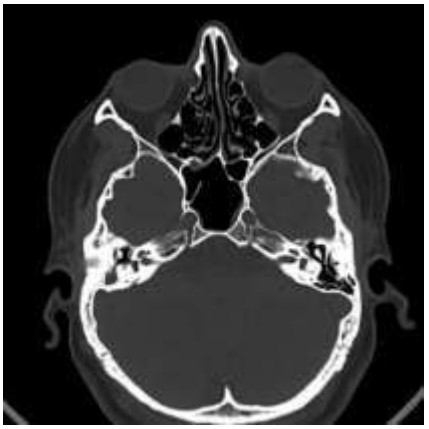

Figure 2: HRCT temporal bone shows soft tissue density in right middle ear cavity-right CSOM

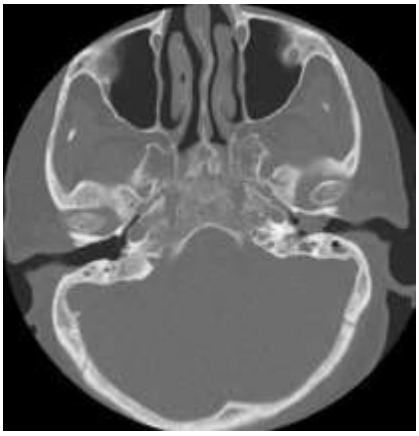

Figure 3: Soft tissue density material occupying partially left middle ear cavity without ossicular chain destruction-left CSOM

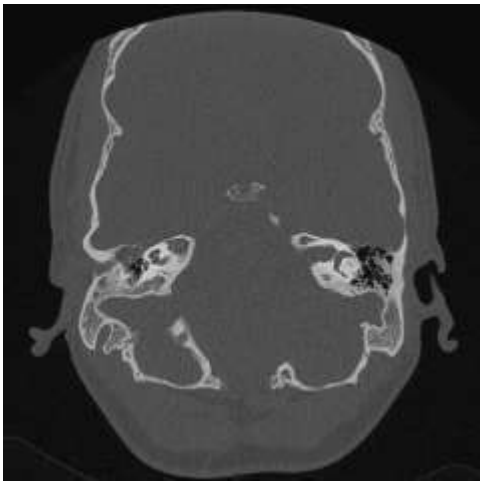

Figure 4: HRCT temporal bone demonstrates soft tissue occupying right middle ear, involving prussak spaces and the attic.Erosion of malleus, incus and scutum-Cholesteatoma

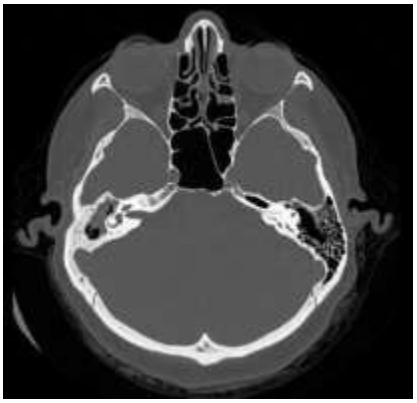

Figure 5: Loss of right middle ear ossicular chain, as well as bony septae of mastoid air cells with subsequent formation of one cavity, shows internal soft tissue densities.Focal erosion of bony wall of right lateral SCC-Cholesteatoma

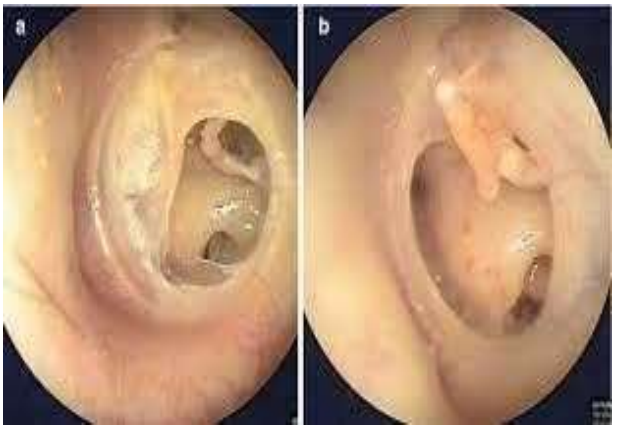

Figure 6: Safe and unsafe CSOM-Otoscopic view

Discussion:

In our study, 33.3% participants belonged to 11 -20 years, followed by 29.3% that were among 21 - 30 years, then 22.7% in 31 - 40 years,10.7% of cases belonged to age > 40 years and 4% in1-10 years category. Also male predominance was noted with 53.3% (n=40) males and 46.7% (n=35) females. On assessing the presenting complaints, 89.3% had otorrhoea, 70.7% had hard of hearing, 30. 7% had earache, 13.3% had headache and 4% had tinnitus.

Based on otoscopic findings, there were 30.7%, 26.7%, 20%, 9.3% and 6. 7% of cases with Retraction pocket with cholesteatoma, Cholesteatoma with granulation tissue, granulation tissue, polyp and migrating perforation, respectively. In this study, 80% of cases had CSOM and 20 % of cases had cholesteatoma. In this study, 56. 0% and 44.0 % of cases had pathology on their left and right side, respectively.

Notably, 6.7%, 81.3%and 12% of cases underwent Tympanomastoidectomy, Canal wall up and Canal wall down procedure, respectively. Similarly, 53.3%, 36% and 10.7% of cases had pathology in epitympanum, mesotympanum and hypotympanum, respectively.

On assessing the Erosion of outer attic wall: CT vs surgical findings, there were 2 true positive and 69 true negatives with 3 false positive and 1 false negative case. HRCT has 66.7%, 95.8%, 40%, 98.6 % and 94.7 % Sn, Sp, PPV, NPV and DA, respectively in diagnosing Erosion of outer attic wall. On assessing the Erosion of lateral SCC: CT vs surgical findings, there were 3 true positive and70 true negatives with 2 false positive cases. HRCT has 100%, 97.2%, 60%, 100 % and 97.3 %, Sn, Sp, PPV, NPV and DA, respectively in diagnosing Erosion of lateral SCC.

On assessing the Erosion of middle ear ossicles: CT vs surgical findings, there were 26 true positive and 40 true negatives with 6 false positive and 3 true negative cases. HRCT has 89.7%, 86.9%, 81.3 %, 93 % and 88%, Sn, Sp, PPV, NPV and DA, respectively indiagnosing Erosion of middle ear ossicles. On assessing the Erosion of sigmoid sinus: CT vs surgical findings, there were 2 true positive and 63 true negatives with 3 false positive and 7 true negative cases. HRCT has 33. 3%, 96.5 %, 50%, 92.9% and 90% Sn, Sp, PPV, NPV and DA, respectively in diagnosing Erosion of sigmoid sinus.

On assessing the pathology of jugular bulb: CT vs surgical findings, there were 2 true positive and 71 true negatives with 2 false positive cases. HRCT has 100%, 97.3%, 50%, 100% and 97. 3% Sn, Sp, PPV, NPV and DA, respectively in diagnosing jugular bulb. On assessing the pathology of hypotympanum: CT vs surgical findings, there were 5 true positive and 66 true negatives with 2 false positive and 2 true negative cases. HRCT has 71.4%, 97. 1%, 71.4%, 97.1% and 94 .7 % Sn, Sp, PPV, NPV and DA, respectively in diagnosing of pathology in hypotympanum.

On assessing the Dehiscence of facial nerve: CT vs surgical findings, there were 3 true positive and 64 true negatives with 3 false positive and 5 true negative cases. HRCT has 37.5%, 95.5%, 50%, 92.8 % and 89.3 % Sn, Sp, PPV, NPV and DA, respectively in diagnosing of pathology in Dehiscence of facial nerve.

On assessing the Cholesteatoma: CT vs surgical findings, there were 13 true positive and 44 true negatives with 15 false positive and 3 true negative case. HRCT has 81. 3%, 74. 6%, 46.4%, 93.6% and 76% Sn, Sp, PPV, NPV and DA, respectively in diagnosing of pathology with cholesteatoma.

Among the cases with stage II, stage III and stage IV CSOM there were 6.7%, 81 .3 % and 12% of cases who underwent Tympanomastoidectomy, canal wall down mastoidectomy and canal wall up mastoidectomy, respectively. Notably,there were 2.7% of cases with congenital anomalies of the auditory cavity. Among the cases with congenital anomalies, Congenital aural atresia and enlarged vestibular aqueduct contributes equal proportion.

Findings of the present study were comparable with the findings of Yorgancilar E et al[10] who examined the temporal deterioration areas in CSOM patients. Patients with complex CSOM were shown to have a higher frequency of all forms of TB erosion. Significantly increased erosion was seen in the labyrinth, posterior fossa dural plate, scutum, and mastoid tegmen in patients with complex CSOM who also had a cholesteatoma. Sigmoid sinus and facial canal were invaded by granulation/polyp tissue at a pace akin to cholesteatoma. They proved that patients with complex CSO experience bone erosion more frequently. Patients with cholesteatomatous and non- cholesteatomatous CSOM both have TB degradation. Granulation/polyp tissue played a similar role in the erosion of the sigmoid sinus plate and facial canal as cholesteatoma. Rai T et al[11] reported that all of the following parameters: cholesteatoma expansion in the middle ear and mastoid; scutum destruction, ossicular destruction, mastoid pneumatization; low lying dura; anterior lying sigmoid; Korner's septum; presence of complications: mastoiditis and mastoid abscess; mastoid cortex dehiscence; sigmoid sinus plate erosion; facial canal dehiscence; tegmen mastoideum destruction and labyrinthine fistula; intracranial complications; however, tegmen tympani destruction and posterior fossa dural plate destruction are not considered reliable.

In another study, Chatterjee P et al[12] stated that the routine use of HRCT mastoids to characterize all middle ear structures and consequences of the disease before cholesteatoma surgery, with enhanced resolution, would serve as a road map for safe CSOM mastoid investigations. Early cholesteatoma diagnosis is crucial for HRCT, as it allows for the use of more conservative surgical techniques to completely eliminate the condition.Chavadi C V et al[13] reported that the most frequent ossicle engaged in erosion was the incus long process; tumours and TB trauma ranked first and second, respectively, as the causes of TB lesions, with infection coming in third. The two most typical initial symptoms were otalgia and otorrhea. For the most part, patients had persistent ear drainage. Thukral CL et al[14] stated that 83.33% of the 50 cases had cholesteatoma.

A significant percent of Sn (89.3%) was found in the surgical and radiographic findings, indicating the presence of cholesteatoma. Despite the existence of surrounding soft tissue, HRCT offers a good Sn of 80.7% in determining the presence of alterations to the ossicular chain. The diagnosis of LSCC erosion was greatly aided by HRCT. A low Sn of 33.3% was seen in HRCT when facial canal dehiscence was diagnosed. HRCT has proven useful in evaluating any congenital abnormalities of the ear by providing anatomical details.

However, Sreedhar et al[15] stated that an HRCT scan serves as an effective preoperative imaging method for the otologist to forecast disease during the procedure and to inform the patient of the potential consequences. Menon P et al[16] stated that the Sn for cholesteatoma detection by HRCT was 80%. However, in 18% of the patients, it was unable to distinguish cholesteatoma from other types of soft tissue densities. Ossicular erosion was detected by HRCT with a Sn and Sp of 83.8 % and 100%, respectively. For LSCC, tegmen tympani, and facial canal degradation, the observed Sn and Sp values were 50% and 100%, 75 % and 100%, and 60% and 100%, respectively.

Karki S et al[17] discovered that for the purpose of visualizing sigmoid and tegmen plate erosion, HRCT- TB provided Sn and Sp of 100%. HRCT showed good efficacy in detecting erosion of the malleus (100%/95. 2%), incus (100%/80.5%) and stapes (96.6%/71.4%). Itprovided detailed information on the extent of the disease to the sinus tympani and facial recess (83.3%/100%), as well as the erosion of the scutum (100%/ 96. 9%) and facial canal (100%/ 75%). HRCT revealed low Sn (53.8 %) but 100% Sp for lateral semicircular canal degradation. They stated that, with the exception of lateral semicircular canal erosion, the results of the HRCT and the intraoperative observations were quite similar. The HRCT-TB serves as a guide for surgeons to determine the severity of the disease, schedule necessary procedures, and get ready for any difficulties that can arise during the procedure.

In consistent with this study, Sagar NJ et al [18] claimed that, with the exception of the integrity of the facial canal, a good radiosurgical correlation is observed for the status of most middle and inner ear structures in CSOM with cholesteatoma. In CSOM instances, there was insufficient radiosurgical correlation to distinguish cholesteatoma from persistent mucosal hypertrophy as the underlying pathology. The results showed that HRCT was less sensitive in identifying erosions of the malleus (68.8%), tegmen (32.6%), semicircular canal (71.4%), and facial canal (53.3%) than it was in detecting erosions of the incus (85%), stapes (82.3%), scutum (91.7%), sigmoid plate (100%), and mastoid cortex (100%). For erosions of the mastoid cortex, sinus plate, incus, malleus and scutum, 100% Sp was obtained; however, it is somewhat less specific for erosions of the facial canal (84%) and tegmen (81%).

Sharma VK et al[19] stated that the age range of 21 to 30 years old included the greatest number of patients. The most frequent observation (90%) was ossicular erosion, which was followed by scutum degradation (84%). There was only one instance (2%), when the sigmoid sinus plate was eroded. None of the CT showed evidence of a cochlear promontory fistula. The most often necrosed ossicle in the ossicular chain was the incus (92%) followed by the malleus (66%). They asserted that HRCT-TB offers information on anatomical changes and consequences as well as defining the site and degree of the disease.

Similarly, Bathla M et al[20] examined the regular application of HRCT-TB in disorders of the ears. HRCT revealed extremely high Sn and Sp for the mesotympanum (98, 98%) and epitympanum (100, 94%) areas in relation to the disease's extent. It provided important details about the degree of the disease in obscure locations including the sinus tympani and the mesotympanum facial recess. HRCT identified degradation of the malleus and

incus adequately, but only had 75% Sn to identify erosion of the stapes suprastructure, even though Sp was 97%. HRCT revealed extremely high Sn and Sp for lateral semicircular canal, tegmen tympani, and sinus plate erosion for bone anatomical markers.

Facial canal erosion was detected on HRCT with a moderate Sn of 75%. They came to the conclusion that regular HRCT use is warranted as a dependable preoperative technique for individuals with atticoantral CSOM who do not have intracranial problems, and it aids in the planning of the surgical procedure type. HRCT plays a limited function in defining the stapes suprastructure and facial nerve canal, as well as in differentiating between granulations and cholesteatoma.

Dhulipalla S et al[21] examined the value of a preop HRCT scan in CSOM of attico antral illness to represent the ossicles' condition. For the diagnosis of malleus erosion, the preoperative HRCT's Sn and Sp values were 100% and 98%, respectively, whereas for incus erosion, they were 91% and 100%, respectively. Stapes erosion was identified by HRCT using 100 % Sp and 67% Sn. The results show that the HRCT scan isa useful preoperative imaging tool for the otologist to forecast the patient's ossicular status throughout the procedure and to inform them of the potential consequences for their hearing.

Additionally, Chitnis A et al[22] examined the extent and complications of long-term middle ear and mastoid infection using the HRCT-TB findings. According to their report, the most typical symptom was otorrhea. The most frequent side effect was chronic mastoiditis, which was followed by ossicle erosion. Among the ossicles, incus erodes most frequently. The case of Bezold's abscess was singular. According to their claims, HRCT - TB is helpful in detecting a variety of facts about the location and severity of illness that are clinically occult and is crucial in helping the surgeon plan the surgical procedure. Singh J et al[23] evaluated the effectiveness of HRCT-TB in identifying ossicular erosion in CSOM cases by conducting a study with 60 patients.

The gold standard in this diagnostic observational trial was the surgical discovery of ossicular erosion. For malleus erosion, Sn and Sp were 78.5% and 78.1%, respectively. For incus erosion, Sn and Sp were 73.1% and 57.8%, respectively. For stapes erosion, Sn and Sp were 52% and 57.1%, respectively. They came to the conclusion that HRCT is a useful supplementary tool for identifying ossicular erosion and that otologists ought to promote its use.

Khan MI et al[24] observed that the Sn of HRCT-TB was 91.8% for cholesteatoma detection. The hallmark of cholesteatoma was thought to be soft tissue attenuation content with bone erosion, but it was unable to distinguish it from other soft tissue densities such as granulation, hypertrophic mucosa, or discharge. For identifying malleus, incus, and stapes erosion, the Sn and Sp of HRCT were, respectively, 71.5 and 88.5%, 86.3 and 95%, and 53.1 and 64.7%. For identifying LSCC erosion, the Sn and Sp values were 77.78 and 98.2%, respectively. For the facial canal, the Sn and Sp values were 80 and 100 %. In competent hands, HRCT provides great details about the amount of cholesteatoma with a reasonable degree of precision. Mandal S et al[25] provided evidence of the diagnostic use of HRCT - TB in atticoantral illness. The middle ear, aditus, and attic all have 100% Sn of soft tissue density, according to HRCT

results. Sp was more for the sinus tympani and Eustachian tube region. There were found to be osseous erosions in the malleus (90.9%, 75%), incus (93.2 %, 80 %), and stapes (78. 8%, 68.8%). The following erosions were assessed: 75%, 100% of the facial nerve canal; 80%, 97.7% of the semicircular canal fistula; tegmen (66.7%, 100%); 80%, 80% ofthe scutum; 100% of the sinus plate; 50%, 97.9% of the cochlear promontory fistula. Evaluation of the disease's severity and adjacent structures' involvement is aided by HRCT-TB.

In another study, Matta S et al[26] discovered that 34% and 10%, respectively, of the HRCT scans revealed degradation of the malleus head and handle. On an HRCT scan, it was discovered that the incus body and the long process were eroded in 26% and 62% of cases, respectively, while the stapes suprastructure was eroded in 36% of cases. This study backs the use of HRCT scans to determine the optimal treatment plan for each case of CSOM by determining the state of the ossicular chain. Lyngwa GY et al[27] reported a strong association between the intraoperative results and the preoperative HRCT. In 35 cases, cholesteatoma was observed. Ossicle erosion was observed in 40 cases; the most often eroded ossicle was the incus, which was followed in frequency by the scutum, mastoid cortex, sinus plate, tegmen, lateral semicircular canal, and facial canal.

The most frequent intracranial complication was an epidural abscess, while the most common extracranial complication was mastoiditis. Shaik A et al[28] sought to identify the atticoantral kind of CSOM's radiological and clinical characteristics. Males predominate in the age bracket of 21 to 30 years old, while atticoantral CSOM is more prevalent. In 94.8 % of cases, ear discharge is observed, and in 89.7% of cases, hearing loss is noted. 85. 8% and 79. 4% of patients had ear discharge and scutum erosion on otoscopic examination of the ear, respectively. On HRCT, TB, ossicular erosion (92.3%) and scutum erosion (88.4%) are observed. The most often afflicted ossicle, the incus, affects 70.5 % of patients.

However, Kumar et al[29] reported that of the patients, 40% had involvement of the left ear. The primary complaint of the majority of patients (80%) was otorrhea. The majority of patients (82%) had normal EAC both radiologically and during surgery. It was discovered that the HRCT scan is 100% sensitive in detecting cholesteatomas. CT scans revealed that the incus had 100% Sp and 91% Sn erosion, and the malleus had 100% Sn and Sp erosion. For the diagnosis of scutum erosion, ossicles erosion and disruption, mastoid pneumatization, anterior lying sigmoid, middle ear cholesteatoma extent, and MAC, HRCT has a very high degree of reliability. According to the study's findings, HRCT is advised for all suspected instances in order to determine the disease's degree and lower morbidity.

Singh R et al[30] stated that of the fifty patients, 42%, 38%, and 20% of them had involvement in one or both of their ears.The most prevalent symptom (100%) was ear discharge, which was followed by tinnitus (14%), vertigo (16%) and earache (66%). 82% of ears on HRCT showed evidence of cholesteatoma, and 40 out of 49 ears had intraoperative and histological confirmation of the diagnosis.

In 18% of ears, the HRCT scan did not identify the cholesteatoma; nevertheless,

intraoperative and histological evaluations identified six patients with cholesteatoma and the remaining patients with granulation tissue. HRCT showed high Sn (86.4%–100%) and Sp (93.3%–100%) for the detection of ossicular damages, tegmen damages, facial nerve canal erosions, sigmoid sinus plate erosions, and lateral/posterior semicircular canal erosions.

Also, Mitra M et al [31] examined the function of HRCT as a means of diagnosis in the assessment and management planning of COM patients. HRCT was 100% sensitive and specific for the existence of soft tissue mass in cases of soft tissue attenuation. The HRCT test was reported to be 100% accurate in predicting the existence of cholesteatomas, with a sensitivity range of 83.3% –100% and a specificity range of 87. 04%–100%. HRCT was found to be reasonably accurate for bone erosion. It was discovered that these comparisons were quite important. They asserted that HRCT -TB in COM patients can serve as the gold standard diagnostic, surgical, and follow-up tool.

Sherwani MA et al [32] compared the intraoperative results of patients with CSOM with the results of HRCT -TB. 47% of the reported population was male, and 53% was female. Of those witha diagnosis, 18% had a cholesteatoma, whereas 82% did not. When it came to scutum erosion (100%), semicircular canal erosion (100%), and ossicles erosion (94%), HRCT- TB had very high Sn values. However, it only provided poor Sn values (33%), when it came to predicting facial nerve canal dehiscence. Nevertheless, even if images in an HRCT indicate an intact facial canal, the prognosis of the canal' s dehiscence should not be ruled out. For the sigmoid sinus wall, semicircular canal, facial canal dehiscence, and scutum erosion, about 100% Sp was attained. On the other hand, it is comparatively less specific for ossiculation erosion and granulation tissue distinction from cholesteatoma.

However, Agarwal R et al[33] compared the intraoperative findings in COM—Squamous type with the preoperative HRCT findings of the TB. On an HRCT scan, cholesteatoma/granulation was detected with 100% Sn. The malleus had an ossicular status of 81.3%, whereas the stapes and incus had ossicular statuses of 68.3% and 70.2%, respectively. The sinus plate status revealed 100% Sn and Sp agreement, indicating excellent radiosurgical agreement. Sn was found in the bony facial canal at 45.8%. The Sn of 38.9% was in fair accord with the Dural Plate status. Sn of 90.9% was recorded for LSCC erosion. Radiosurgical consensus for sinus plate degradation and LSCC erosion is good, but consensus for dural plate degradation and malleus erosion is only medium. The TB of the preoperative HRCT scan correlates well for the diagnosis of disease presence.

Conclusion:

We infer that HRCT–TB is an effective non invasive technique to identify the pathologies of ear and hence it can be used in routine practice.

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