International Journal of Otorhinolaryngology and Head and Neck Surgery
Murugesan G et al. Int J Otorhinolaryngol Head Neck Surg. 2022 Aug;8(8):647-651
http://www.ijorl.com
pISSN 2454-5929 | eISSN 2454-5937

DOI: https://dx.doi.org/10.18203/issn.2454-5929.ijohns20221881

Original Research Article

A study of radiological assessment of chronic otitis media in both mucosal and squamosal disease

Gowrishankar Murugesan*, Suresh Vadivel, Sujatha Balu

Department of ENT and Head and Neck Surgery, Government Stanley Medical College, Chennai, Tamil Nadu, India

Received: 08 June 2022
Revised: 06 July 2022
Accepted: 07 July 2022

***Correspondence:**
Dr. Gowrishankar Murugesan,
E-mail: gowrishankarhodent2022@gmail.com

ABSTRACT

Background: Chronic otitis media (COM) is common disease prevalent in India. Patients coming to OPD who were clinically diagnosed as chronic otitis media (COM) were evaluated using High resolution computerised tomography (HRCT) temporal bone. HRCT temporal bone is highly useful in knowing the disease involving middle ear cleft and adjacent structures. Previous studies have indicated the importance of HRCT temporal bone in mapping anatomy and middle ear disease status in COM patients. The aim of the study was to assess radiological findings of chronic otitis media in both types, and to choose management plan based on the involvement of structures.
Methods: A prospective study was done in 100 COM patients with both mucosal and squamosal disease, using HRCT temporal bone scan and features analyzed.
Results: Among 100 COM patients, 75 had mucosal disease, 25 had squamosal disease. In our study the most common age group was between 16 to 25 years (26%) and 46 to 55 years (24%). The male: female ratio was 2:3. In 100 clinically diagnosed COM participants, 10% of them were found to be radiologically negative. In 90% radiologically positive participants, findings showed radiolucent shadow in the mastoid and middle ear cavity(67%), ossicular involvement(35%) and adjacent structures like epitympanum (22%), hypotympanum (2%), tegmen tympani (3%), Prussak's space (20%), scutum involvement (18%), sinus tympani (3%), were noted by HRCT.
Conclusions: HRCT temporal bone is a highly reliable diagnostic tool used for preoperative assessment of all COM patients planned for surgery.

Keywords: High resolution computerised tomography, Temporal bone, Chronic otitis media, Pre-operative assessment

INTRODUCTION

Chronic otitis media (COM) is a disease that is highly prevalent in India. Most of the patients affected by COM belong to the low socio-economic status suggesting that lack of hygiene; poor nutritional status and reduced resistance to infection are major factors in their pathogenesis. COM most likely arises as a result of inadequately treated acute otitis media, persistent negative middle ear pressure or otitis media with effusion and resulting in a permanent damage to the pars tensa or flaccida. Former studies indicated the importance of HRCT temporal bone in mapping anatomy and middle ear disease status in COM patients.[1] It can be classified into squamous (active and inactive), mucosal (active and inactive) and healed COM.[2]

Healed COM (Tympanosclerosis,healed perforation), shows thinning and/or local or generalized opacification of the pars tensa without perforation or retraction on otoscopic examination. Inactive mucosal COM (Perforation), on otoscopy shows permanent perforation

of the pars tensa but the middle ear mucosa is not inflamed. Active mucosal COM, shows permanent defect of the pars tensa with an inflamed middle ear mucosa which produces mucopus that may discharge.

Inactive squamous COM (retraction), shows retraction of the pars flaccida or pars tensa (usually posterosuperior) which has the potential to become active with retained debris. Active squamous COM (cholesteatoma), shows retraction of the pars flaccida or tensa that has retained squamous epithelial debris and is associated with inflammation and the production of pus, often from the adjacent mucosa.

The most common presenting symptom in COM is otorrhoea followed by hard of hearing. The organism causing COM are streptococcus pneumoniae, hemophilus influenzae, pseudomonas aeruginosa and staphylococcus aureus. COM can cause both intratemporal and intracranial complications. Intratemporal complications include acute mastoiditis, subperiosteal abscess, petrositis, facial paralysis and labyrinthitis. Intracranial complications include meningitis, brain abscess, otitic hydrocephalus, extradural and subdural abscess. Biofilms have been implicated in cholesteatoma formation. Both gram-positive and gram-negative bacteria have been identified in a biofilm of extracellular matrix within keratin debris. Radiological imaging is a universal investigation in cases of COM. Studies have shown usefulness of high-resolution computed tomography (HRCT) of the temporal bone in COM cases.

HRCT imaging in COM is reliable for all the parameters like scutum erosion, ossicular erosion, mastoid pneumatisation, low lying dura, anterior lying sigmoid, Korner's septum, cholesteatoma extension in to the middle ear and mastoid, and presence of complications such as mastoiditis and mastoid abscess, mastoid cortex dehiscence, sigmoid sinus plate erosion, facial canal dehiscence, tegmen mastoideum erosion and labyrinthine fistula and intracranial complications, tegmen tympani erosion and posterior fossa dural plate erosion. Advent of HRCT and improvements in radiological technique has definitely improved study of the temporal bone in patients with COM, which includes evaluation of the extent of disease and involvement of adjacent neurovascular structures.

METHODS

Study design

The study design was prospective study.

Study settings

The study setting was department of ENT and head and neck surgery and department of radio diagnosis, of a tertiary care centre in India.

Study duration

The study duration was March 2021 to February 2022.

Sampling technique

All patients attending to OPD with complaints of com within a period of March 2021 to February 2022 were recruited using convenience sampling technique aged between 16-65 years of both sexes as inclusion criteria. Patients with previous history of mastoid surgery and congenital ear anomalies were excluded from the study.

Study methodology

In our study 100 COM patients attending OPD aged between 16- 65 years of both sexes, were investigated using HRCT Temporal bone and the radiologist was asked to comment on the following points: dural plate position, sinus plate position, dural plate integrity, sinus plate integrity, radiolucent shadow in the mastoid, middle ear cavity, mesotympanum, epitympanum, hypotympanum, ossicles, tegmen tympani, sinus tympani, facial recess, Prussack's space and scutum.

Patients with previous history of mastoid surgery and congenital ear anomalies were excluded from the study. HRCT temporal bones are scanned in axial and coronal (supine and prone) planes. Scout films are taken in all patients before starting the scan. Scanning is commenced from the lower margin of the external auditory meatus and extended upward to the arcuate eminence of the superior semicircular canal as seen on lateral tomogram. Slight extension of the head is given to avoid gantry tilt and thereby protect the lens from radiation. Coronal images are obtained perpendicular to the axial plane from the cochlea to the posterior semicircular canal.

The relevant data from HRCT Temporal bone was collected and analysed with IBM SPSS Statistics for Windows, Version 23.0. (Armonk, NY: IBM Corp).

To describe about the data frequency analysis and percentage analysis were used for categorical variables. To find the significance in categorical data Chi-Square test was used. In the above statistical tool, the probability value 0 .05 is considered as significant level.

RESULTS

In our study, majority of the patients were in the second decade of life, mean age was 39.91 years. Age distribution 26% of patients were between 16-25 years age group followed by 24% of patients between 46-55 years of age (Table 1).

Female (60%) were affected more than males (40%) and male to female ratio of 2:3 was present as shown below (Table 2).

Table 1: Age distribution of patients.

Age groups (years)	%
16-25	26.0
26-35	11.0
35-45	23.0
46-55	24.0
56-65	16.0
Total	100

Table 2: Gender distribution of patients.

Gender	%
Female	60.0
Male	40.0
Total	100

Unilateral disease (62%) was noted predominantly more than bilateral (38%) involvement. Among 62% of unilateral disease, right side (33%) was more common than left side (29%) as shown below (Table 3).

Table 3: Side and laterality distribution.

Side	%
Right	33.0
Left	29.0
Bilateral	38.0
Total	100

Out of the 100-study population, 75% had mucosal disease and 25% had squamous type COM. Among them positive radiologic findings observed in 90% and negative radiologic findings in 10% as below (Table 4) which was statistically insignificant (p=0.3). Other findings included mastoiditis with subperiosteal abscess in one patient. In ossicular erosion, long process of incus was most commonly involved followed by malleus. Most of the mastoids in this study were sclerotic. In general, HRCT used to enhance the knowledge of surgical anatomy of middle ear.

Table 4: Comparison of clinical findings and imaging association.

Comparison	Mucosal disease	Squamosal disease	Total
Radiologic imaging with positive findings	68	22	90
Radiologic imaging with negative findings	7	3	10
Clinical findings	75	25	100

Based on radiological analysis in our study, radiolucent shadow in the mastoid and middle ear cavity was present in 67% of total patients studied. Ossicular involvement was found in 35% of study population. Involvement of adjacent structures like epitympanum (22%), hypotympanum (2%), tegmen tympani (3%), Prussak's space (20%), scutum (18%), sinus tympani (3%) were noted by using HRCT temporal bone imaging. Among our study participants, 67% of them had features of otomastoiditis (mastoid and middle ear involved) and 23% of them had features of adjacent structural erosion along with mastoid and middle ear involvement by radiological investigation as shown below (Table 5).

Table 5: Imaging distribution.

Structure involvement	%
Mastoid and middle ear	67
Ossicle erosion	35
Epitympanum involvement	22
Hypotympanum involvement	2
Tegmen tympani involvement	3
Prussak's space involvement	20
Scutum erosion	18
Sinus tympani involvement	3

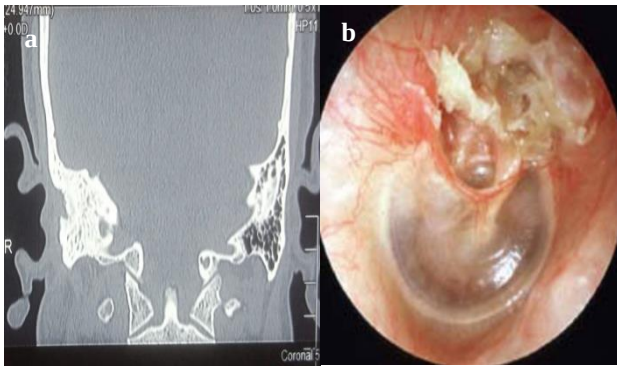

Figure 1: Right squamosal disease (a) coronal section showing right tympanomastoid disease with sclerosed mastoid; and (b) showing otoendoscopic picture of right atticoantral disease.

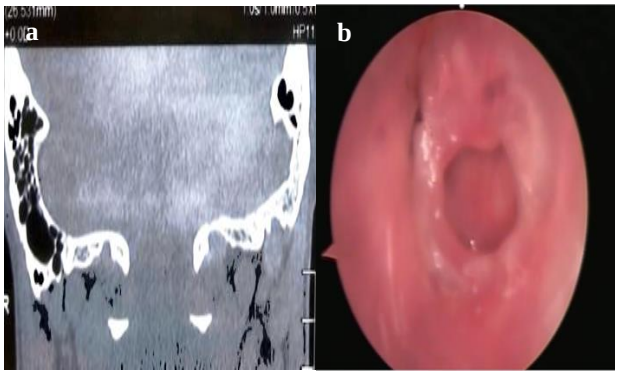

Figure 2: Left active mucosal disease (a) coronal section showing left tympanomastoid disease with poor pneumatisation of mastoid; and (b) showing otoendoscopic picture of left active mucosal disease with wet middle ear mucosa and central perforation.

Figure 3: Axial section showing soft tissue density noted in the right tympanic cavity with erosion of long process of incus and complete erosion of ossicles on the left side without soft tissue density.

Figure 4: Axial section showing soft tissue density noted in the left mastoid air cells and aditus, with partial erosion of left malleus and erosion of incus with high riding jugular bulb.

DISCUSSION

In this study, the youngest patient was 16 years and the eldest was 65 years. The mean age was about 39.91 years, which is similar to study by Gerami et al.[3] Paparella and Kim et al (1977), claim an average of about 35.1 years, male:female ratio was 2:3, more in females, which not correlating with Vlastarakos et al.[4,5] Unilateral disease noted predominantly than bilateral involvement. Right side more common than left side.

In mastoid air cells, HRCT more sensitive and more specific in identifying soft tissue mass noted by Gerami and Naghavi. Mafee et al and O'Reilly et al have similar results, whereas Jackler et al and Garber and Dort found it to be less sensitive and specific.[6-9] HRCT is less reliable in differentiating cholesteatoma from granulations. However, HRCT detected scutum erosion accurately in all cases. Hence, HRCT is more reliable to detect scutum erosion as per this study. This is in accordance to study by Rocher et al.[10]

In this study, mastoiditis complicated with subperiosteal abscess was found in 1% cases of COM. This is not similar to findings by Leskinen and Jero who found it in 7% cases.[11] Incidence of low-lying dura and anteposed sigmoid sinus varies widely among previous studies.[12]

Limitation

In our study, due to disparity in the distribution of the number of patients had mucosal (75%) and squamosal (25%) disease, results are expressed using percentage (%).

CONCLUSION

The HRCT scan is the standard imaging technique for the temporal bone. HRCT Temporal bone has got high reliability for detecting the presence of complications such as mastoiditis and mastoid abscess in COM patients. With the advent of HRCT and improvements in radiological technique has definitely improved study of the temporal bone in patients with COM. It includes evaluation of the extent and sites of involvement and inter-relationships of the tympanomastoid compartment with adjacent neurovascular structures. So, this study highly recommends preoperative HRCT Temporal bone for all COM patients planned for surgery, it will be helpful in mapping and knowing the extent of disease in each ear. In our study HRCT Temporal bone done preoperatively was used to exclude 10% of unnecessary mastoidectomy surgery and its surgery related complications.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

REFERENCES

1. Rai T. Radiological study the temporal bone in chronic otitis media: Prospective study of 50 cases. Indian J Otol. 2014;20:48-55.
2. Bluestone CD. Epidemiology and pathogenesis of chronic suppurative otitis media: implications for prevention and treatment. Int J Pediatr Otorhinolaryngol. 1998;42:207-23.
3. Gerami H, Naghavi E, Wahabi-Moghadam M, Forghanparast K, Akbar MH. Comparison of pre-operative computerized tomography scan imaging of temporal bone with the intra-operative findings in patients undergoing mastoidectomy. Saudi Med J. 2009;30:104-8.
4. Paparella MM, Kim CS. Mastoidectomy update. Laryngoscope. 1977;87:1977-88.

5. Vlastarakos PV, Kiprouli C, Pappas S, Xenelis J, Maragoudakis P, Troupis G, et al. CT scan versus surgery: How reliable is the pre-operative radiological assessment in patients with chronic otitis media? Eur Arch Otorhinolaryngol. 2012;269:81-6.
6. Mafee MF, Levin BC, Applebaum EL, Campos M, James CF. Cholesteatoma of the middle ear and mastoid. A comparison of CT scan and operative findings. Otolaryngol Clin North Am. 1988;21:265-93.
7. O'Reilly BJ, Chevretton EB, Wylie I, Thakkar C, Butler P, Sathanathan N, et al. The value of CT scanning in chronic suppurative otitis media. J Laryngol Otol. 1991;105:990-4.
8. Jackler RK, Dillon WP, Schindler RA. Computed tomography in suppurative ear disease: A correlation of surgical and radiographic findings. Laryngoscope. 1984;94:746-52.
9. Garber LZ, Dort JC. Cholesteatoma: Diagnosis and staging by CT scan. J Otolaryngol. 1994;23:121-4.
10. Rocher P, Carlier R, Attal P, Doyon D, Bobin S. Contribution and role of the scanner in the pre-operative evaluation of chronic otitis. Radiosurgical correlation apropos of 85 cases. Ann Otolaryngol Chir Cervicofac. 1995;112:317-23.
11. Leskinen K, Jero J. Acute complications of otitis media in adults. Clin Otolaryngol. 2005;30:511-6.
12. Beig S, Khalid S, Sharma SC. Radiographic imaging of mastoid in chronic otitis media: need or tradition? Int J Otorhinolaryngol Head Neck Surg. 2020;6.

Cite this article as: Murugesan G, Vadivel S, Balu S. A study of radiological assessment of chronic otitis media in both mucosal and squamosal disease. Int J Otorhinolaryngol Head Neck Surg 2022;8:647-51.