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COMPUTED TOMOGRAPHY STAGING OF CHOLESTEATOMA WITH INTRAOPERATIVE CORRELATION : AN OBSERVATIONAL STUDY

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Abstract

Background : Cholesteatoma is a medical condition characterized by the presence of an abnormal growth of skin cells within the middle ear. Computed tomography(CT) imaging is commonly used in the evaluation of cholesteatoma. CT scans assist in preoperative planning by providing a roadmap for the surgical intervention.

Aim and Objective : To find CT staging of middle ear Cholesteatoma and to determine its impact on the selection of operative procedure.

Material and Method : This was an observational study to be carried out on 60 patients attended in department of Radiology in collaboration with department of ENT in Surabhi Institute of Medical sciences and Hospital, Siddipet, for the duration of one year, after obtaining the consent from ethical committee and a written consent from the patients and following inclusion and exclusion criteria.

Results : The maximum number of patients were seen in the age group of 10 to 30 years. There were 28 male (46.7%) and 32 female (53.3%) patients. The overall sensitivity of CT staging of middle ear cholesteatoma in comparison with operative findings is 87.4% with underestimation in 12.7% of patients. There is an excellent agreement and correlation between CT staging of cholesteatoma and surgical findings. (K=0.94; 95% CT = 0.86 – 0.984; V=0.924, P<0.01).

Conclusion: High resolution computed tomography staging of middle ear cholesteatoma helps surgeon to select the appropriate type of surgery in order to reduce complications.

Keywords: Cholesteatoma, Computed Tomography, Attic cholesteatoma, Tympanic

Introduction

Cholesteatoma is a medical condition characterized by the presence of an abnormal growth of skin cells within the middle ear. This growth typically forms a cyst-like structure and can lead to a variety of symptoms and complication. It is often the result of the repeated infection, such as chronic otitis media, where the middle ear becomes inflamed and infected. The condition can also occur due to congenital defects or trauma to the ear

The main symptom of cholesteatoma is a persistent, foul-smelling discharge from the affected ear. Other common symptoms include hearing loss, ear pain, dizziness or balance problems, tinnitus(ringing in the ears), and a feeling of fullness or pressure in the ear. If it is left untreated, cholesteatoma can lead to complications. The abnormal growth can erode the bones of the middle ear, leading to hearing loss and damage to other nearby structure, such as the facial nerve or inner ear. It can also cause recurrent ear infections, which can further exacerbate the condition,

Computed tomography(CT) imaging is commonly used in the evaluation of cholesteatoma. CT scans provide detailed cross-sectional images of the ear and surrounding structures, allowing to assess the extent and characteristics of the cholesteatoma. CT scans can

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help to confirm the presence of cholesteatoma and differentiate it from other ear condition. The imaging can reveal the characteristic appearance of cholesteatoma, such as a mass or cystic structure within the middle ear. CT scans help to determine the size and extent of the cholesteatoma. They can show if the cholesteatoma is limited to the middle ear or if it has extended into adjacent areas, such as the mastoid bone or inner ear. This information is crucial for surgical planning.

CT scans assist in preoperative planning by providing a roadmap for the surgical intervention. Surgeons can use the image to visualize the anatomy, plan the surgical approach, and determine the best strategies for cholesteatoma removal and reconstruction. After surgical removal of the cholesteatoma, follow-up CT scans may be performed to evaluate the effectiveness of the surgery, assess any residual or recurrent cholesteatoma, and monitor the healing process. The aim of this study is to find CT staging of middle ear Cholesteatoma and to determine its impact on the selection of operative procedure.

Material and Method

This was an observational study to be carried out on 60 patients attended in department of Radiology in collaboration with department of ENT in Surabhi Institute of Medical sciences and Hospital, Siddipet, for the duration of one year, after obtaining the consent from ethical committee and a written consent from the patients and following inclusion and exclusion criteria given bellow.

Inclusion Criteria

All patients diagnosed with cholesteatoma on clinical examinations with otoscope and otoendoscope are included.

Exclusion Criteria

Those with active mucosal chronic otitis media ,revision surgery ,inactive chronic otitis media , inactive squamosal chronic otitis media, congenital ear disease, suspicious malignant ear pathology, history of temporal bone fracture ,systemic disease which may affect the ear

Method

The time interval between the CT and surgery is 5-10 days. Surgery is planned according to CT staging of Cholesteatoma for all patients. All imaging examinations were done using 16 slice multidetector CT Scanner. Helical transverse scans of temporal bone were captured in a plane parallel to orbitomeatal plane with slice thickness of 0.5mm, spacing of 0.3mm with overlap, mA of 250ms, kV of 120ms, helical pitch of 0.625, rotation time of 0.8 seconds and field of view of 240mm. The obtained data was reconstructed by using bony algorithm to provide optimal visualization of temporal bone anatomy.

The CT staging classified Cholesteatoma according to its locations within

- Tympanic cavity (T)
- Mastoid involvement (M) and
- associated complications (C)

Accordingly, Cholesteatoma is staged into 4 stages

- Stage – I - Cholesteatoma restricted to one region of middle ear cavity (T1 or T2)
- Stage- II - Cholesteatoma involving more than one compartment of middle ear cavity with or without mastoid involvement.

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- Stage – III - Cholesteatoma with extracranial or intratemporal complications.
- Stage- IV - Cholesteatoma with intracranial complications.

Surgery was done according to the CT staging of Cholesteatoma for all patients.

- Stage I Cholesteatoma : Postauricular atticotympanotomy
- Stage II Cholesteatoma : Intact canal wall tympanomastoidectomy
- Stage III Cholesteatoma : Canal wall down mastoidectomy
- Stage IV Cholesteatoma : Canal wall down mastoidectomy

Observation and Results

The range of the age of the patients was from 10 to 72 years with mean age of 38.4 with standard deviation of 10.45 years. The maximum number of patients were seen in the age group of 10 to 30 years. There were 28 male (46.7%) and 32 female (53.3%) patients, shown in the bellow table.

Table 1 : Socio-Demographic profile among study participants

Parameter	Frequency	Percentage
Age		
< 20 Years	14	23.3
21-30 Years	15	25
31-40 Years	10	16.7
41-50 Years	13	21.7
> 50 Years	8	13.3
Gender		
Male	28	46.7
Female	32	53.3
Side of Cholesteatoma		
Right	30	50
Left	30	50
Staging		
Stage I	7	11.7
Stage II	42	70
Stage III	8	13.3
Stage IV	2	3.3

Table 2 : Distribution of organ involvement among study participants.

Classification	On CT	On Surgery	Sensitivity
Tympanic Cavity Involvement (T)			
Attic Cholesteatoma	16	16	100%
Tympanic Cholesteatoma	11	11	
Atticotympanic Cholesteatoma	34	34	
Mastoid Cavity Involvement (M)			
No Mastoid Cavity	19	19	100%

Cholesteatoma extending into the Mastoid Antrum	41	41	
Cholesteatoma extending into the Mastoid Air cells	0	0	
Complication			
Uncomplicated Cholesteatoma	56	54	
Extracranial Complication	1	3	59.12%
Intracranial Complication	3	3	

Table 3 : Distribution of organ involvement among study participants.

Classification	Sensitivity	Cohens Kappa value	95% CI		R-Value	P-value
			Lower	Upper		
Attic tympanum	100%	1	1	1	1	<0.001
Mastoid	100%	1	1	1	1	<0.001
Complication	62%	0.79	0.643	0.86	0.784	<0.01
CT staging	87.40%	0.94	0.86	0.984	0.924	<0.01

Table 3 is showing the agreement and correlation of CT staging for middle ear cholesteatoma with operative findings. The overall sensitivity of CT staging of middle ear cholesteatoma in comparison with operative findings is 87.4% with underestimation in 12.7% of patients. There is an excellent agreement and correlation between CT staging of cholesteatoma and surgical findings. (K=0.94; 95% CT = 0.86 – 0.984; V=0.924, P<0.01)

Figure A : Female Patient having age of 28 years with Attic Cholesteatoma
Figure B : Female patients having age of 44 Years with Tympanic Cholesteatoma

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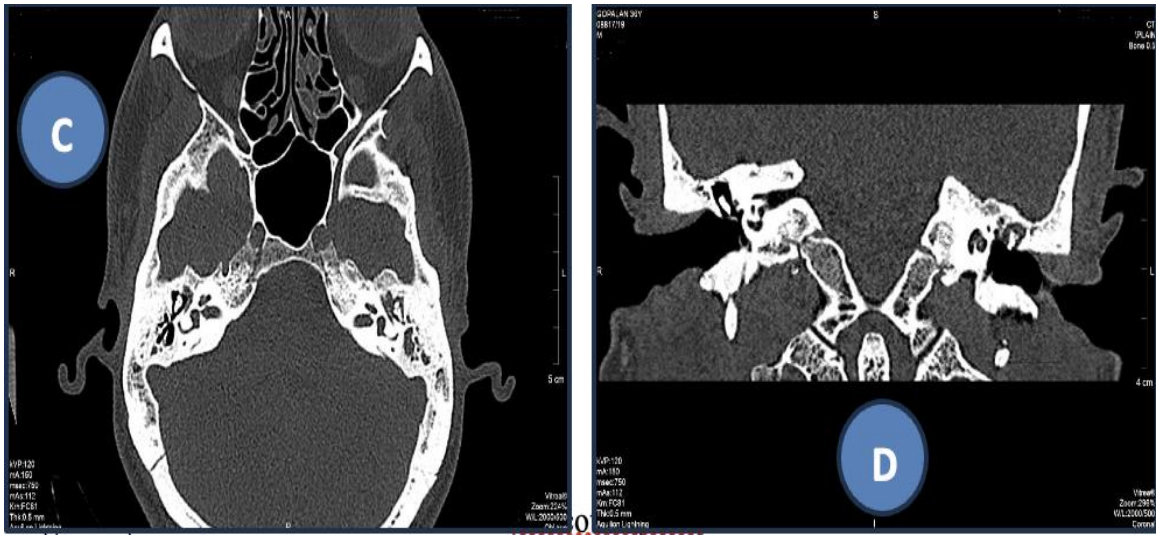

Figure C, D : 36 Years male Patient with Atticotympanic Cholesteatoma with facial nerve canal involvement and Scutum Erosion

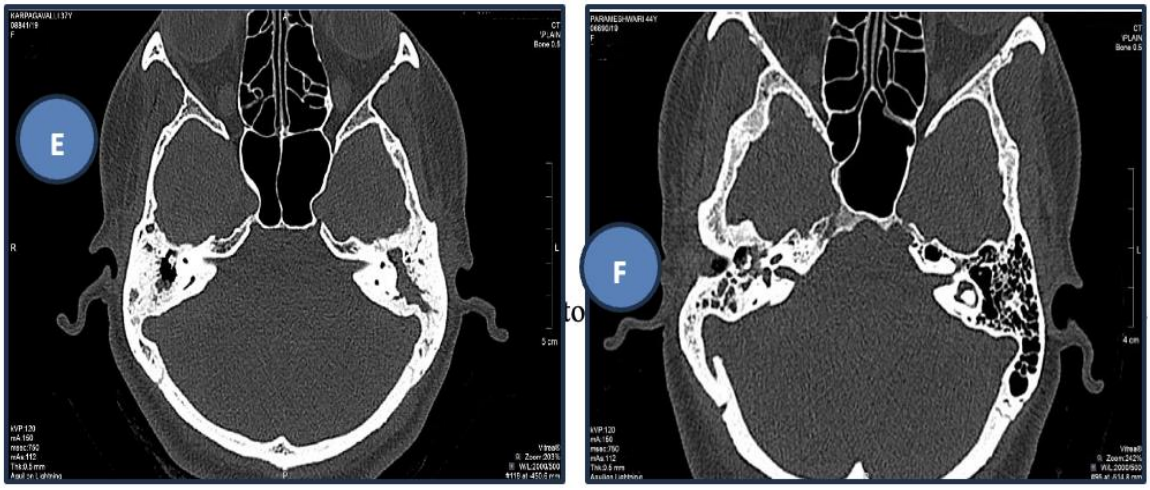

Figure E : 37 Years Female Patient with Mastoid Air Cells Involvement, Figure F : 44 Years Female with Labyrinthine Fistula.

Discussion

Present study we have conducted in the department of radiodiagnosis with collaboration of Department of ENT, among 60 patients to know CT staging of middle ear Cholesteatoma and to determine its impact on the selection of operative procedure. In the study we have observed that, The range of the age of the patients was from 10 to 72 years with mean age of 38.4 with standard deviation of 10.45 years. The maximum number of patients were seen in the age group of 10 to 30 years. There were 28 male (46.7%) and 32 female (53.3%) patients. In the present study the sensitivity of CT staging for middle ear cholesteatoma is 87% with excellent agreement and correlation with surgical findings. The underestimation (13%) of the extent of cholesteatoma at CT may be attributed to cholesteatoma sac, associated granulation tissue, mucosal edema and effusion that may be indistinguishable in HRCT scans. Although cholesteatoma revealed a attenuation value lower than granulation tissue, the difference is subtle on CT and the differentiation of cholesteatoma using attenuation values is impossible.[1,2].

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We observed organ involvement in the study was, Attic cholesteatoma was present in 26% of patients, tympanic in 18.33%, and atticotymapnic in 56.66%.[3] On HRCT, the attic cholesteatoma appears as nondependent soft dense mass opacity located in Prussak's space lateral to the middle ear ossicles, while tympanic cholesteatoma occupies the tympanic space medial to the middle ear ossicles, usually with typical involvement of the facial recess and sinus tympani. In atticotympanic cholesteatoma, cholesteatoma fills most of the tympanic cavity. [4,5].

The extent of mastoid involvement in patients with cholesteatoma has an impact on patient management. CT is important to determine the extent of the mastoid air cells to be exenterated to avoid disease recurrence [6–8].

In this study, the sensitivity of CT for detection of mastoid involvement was 100%. Extracranial and intracranial complications may be seen in patients with cholesteatoma. The presence of a complication and its location helps in the choice of treatment . Labyrinthine fistula with involvement of the lateral semicircular canal was reported in 6% of patients with cholesteatoma. The presence of a pneumolabyrinth is a definite sign of fistulas, but its detection is unusual .Subperiosteal abscess is the most common extratemporal complication caused by the spread of infection from the mastoid towards the periosteal space by erosion of the mastoid cortex [6-9]. Brain abscess especially in the temporal lobe and cerebellum is the most common intracranial complication of cholesteatoma [8-13]. Lateral or sigmoid sinus thrombosis also one of the intracranial complications of cholesteatoma. The mechanism is either bone erosion exposing the perisinus space, or spread of mastoid emissary vein thrombophlebitis . In this study, extracranial complications were detected in 1 patient and intracranial complications were reported in 3 patients with cholesteatoma.

Study encountered with some limitation of small sample size, comparing CT results with diffusion MR imaging and contrast MR imaging in complicated cases will improve the results otherwise higher multi-detector CT scanners, will improve the image quality.

Conclusion :

From overall observation and discussion with other studies we can conclude that, in order to decline the comorbidities, high resolution computed tomography staging of middle ear cholesteatoma helps surgeon to select the appropriate type of surgery

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Conflict of Interest : None

References :

1. Park M, Rah Y, Kim Y, Kim J: Usefulness of computed tomography Hounsfield unit density in preoperative detection of cholesteatoma in mastoid ad antrum. Am J Otolaryngol Head Neck Med Surg, 2011; 32: 194–97
2. Marchioni D, Mattioli F, Cobelli M et al: CT morphological evaluation of anterior epitympanic recess in patients with attic cholesteatoma. Eur Arch Otorhinolaryngol, 2009; 266: 1183–89
3. Lemmerling M, De Foer B, Verbist B, VandeVyver V: Imaging of inflammatory and infectious diseases in the temporal bone. Neuroimag Clin North Am, 2009; 19: 321–37
4. Rogha M, Hashemi SM, Mokhtarinejad F et al: Comparison of preoperative temporal bone CT with intraoperative findings in patients with cholesteatoma. Iran J Otorhinolaryngol, 2014; 26: 7–12
5. Phillips G, LoGerfo S, Richardson M, Anzai Y: Interactive web-based learning module on CT of the temporal bone: Anatomy and pathology. Radiographics, 2012; 32: E85–105

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6. Barath K, Huber A, Stampfli P et al: Neuroradiology of cholesteatomas. Am J Neuroradiol, 2011; 32: 221–29
7. Juliano AF, Ginat DT, Moonis G: Imaging review of the temporal bone: part I. Anatomy and inflammatory and neoplastic processes. Radiology, 2013; 269: 17–33
8. Más-Estellés F, Mateos-Fernández M, Carrascosa-Bisquert B et al: Contemporary non-echo-planar diffusion-weighted imaging of middle ear cholesteatomas. Radiographics, 2012; 32: 1197–213
9. Lemmerling M, De Foer B, Verbist B, VandeVyver V. Imaging of inflammatory and infectious diseases in the temporal bone. Neuroimag Clin North Am. 2009;19:321–37.
10. Bruce B, Ian G. Acquired cholesteatoma: classification and outcomes. Otol Neurotol. 2011;32:992–95.
11. Trojanowska A, Drop A, Trojanowski P, et al. External and middle ear diseases: radiological diagnosis based on clinical signs and symptoms. Insights Imaging. 2012;3:33–48.
12. Abdel Razek A, Huang B. Lesions of the Petrous Apex: Classification and Findings at CT and MR Imaging. Radiographics. 2012;32:151–73.
13. Yildirim-Baylan M, Ozmen C, Gun R, et al. An evaluation of preoperative computed tomography on patients with chronic otitis media. Indian J Otolaryngol Head Neck Surg. 2012;64:67–70.