ORIGINAL RESEARCH

High resolution computed tomography findings in patients with cholesteatoma

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ABSTRACT
The computed tomography (CT) of temporal bone provides exquisite bony details and excellent demonstration of soft tissue density within the air spaces of the mastoid, external auditory canal and middle ear but very limited identification of the type of substance producing the abnormal density. The study was carried out prospectively in patients suggestive of Cholesteatoma referred for HRCT at Medical College. All patients with clinical picture of cholesteatoma such as chronic ear discharge, hearing loss with or without signs of impending complications or facial palsy referred for HRCT Temporal bone. Primary acquired cholesteatoma was most commonly (70%) encountered followed by secondary acquired cholesteatomas(30%) of cases. The attic cholesteatoma was most frequently seen (46%) then extensive holo-tympanic acquired cholesteatoma (30%) followed by attico-antral cholesteatoma in (18 %). The sclerotic mastoid was the most common finding encountered in (76%) of cases. Automastoiectomy was encountered in (20%), and lateral mastoid wall fistula seen in (4%).

Key words: High resolution computed tomography, cholesteatoma, attico-antral cholesteatoma

INTRODUCTION

The computed tomography (CT) of temporal bone provides exquisite bony details and excellent demonstration of soft tissue density within the air spaces of the mastoid, external auditory canal and middle ear but very limited identification of the type of substance producing the abnormal density[1].

A study where twenty patients awaiting mastoid surgery for chronic suppurative otitis media underwent preoperative HRCT of the temporal bones. The CT scans were compared with the intraoperative findings. CT was helpful in determining the anatomy of the middle ear and mastoid, and accurately predicted the extent of the disease processing the sinus tympani and facial recess[2].

In a study of temporal bone CT to examine a group of 87 patients with chronic purulent otitis media (103 temporal bones), the patients' age ranged from 2 to 74 years. A scheme was developed and proposed to evaluate the temporal bone by CT. The CT signs of chronic purulent otitis media uncomplicatedby cholesteatoma and those of cholesteatomic purulent otitis were identified. CT reflects carious changes in the walls of the cavities of the middle ear, including the roof and labyrinthine wall of the tympanum, which allows labyrinthine fistula and intracranial cholesteatomic complications to be detected[3].

A study to investigate the methods of preoperative diagnosis and differentiation of different pathological tissue in the middle ear and mastoid was made. The temporal bone lamellar CT findings in 106 patients with chronic suppurative otitis media(including cholesteatoma)were retrospectively analyzed[4].

METHODOLOGY

SOURCE OF DATA

The study was carried out prospectively in patients suggestive of Cholesteatoma referred for HRCT at Medical College.

SAMPLE SIZE: 50.

TYPE OF STUDY: Comparative

PERIOD OF STUDY: 18 Months.

DATA ACQUISTION

All patients with clinical picture of cholesteatoma such as chronic ear discharge, hearing loss with or without signs of impending complications or facial palsy referred for HRCT Temporal bone.

INCLUSION CRITERIA

1. All chronic otitis media patients with cholesteatoma diagnosed clinically.
2. All age groups and either sex group.

EXCLUSION CRITERIA

Chronic otitis media without cholesteatoma.

HRCT Examination

The study was done to all patients using 2 CT scanners GE Sytech CT/e Spiral scanner and TOSHIBA Aquilion 16.

Zooming and magnification were done for the petrous bone on each side and for the diseased side. The HRCT scan protocol includes the following factors:

Patient position: supine for the axial scanning, prone or supine with hyper extended neck for coronal scanning.

The predetective diagnosis was made in 10patientswithchronic suppurative otitis media according to clinical manifestation (pathological changes of tympanic membrane, nature of otorrhoea, character of hearing), temporal bone lamellar CT finding (CT value of pathological tissue, surrounding histoclasia) to validate the value of this study for preoperative diagnosis and differentiation of different pathological tissue in middle ear and mastoid. It was concluded that it was not reliable to diagnose and differentially diagnose different pathological tissue in middle ear and mastoid

only by the CT value, however, the CT value could still be considered to provide significant information.

RESULTS

Table 1: Type of cholesteatomas

Type of cholesteatoma	No. of patients	%
Primary acquired cholesteatoma	35	**70**
Secondary acquired cholesteatoma	15	30
Total	50	100

Table 2: Location & extent of cholesteatoma

Location & extension	No. of patient	%
Attic	23	46
Attico-antral	09	18
Mesotympanum	03	06
Extensive (holotympanic) extended to mastoid antrum	15	30
Total	50	100

Table 3: Middle ear cleft bony wall erosion

Bony wall erosion*	No. of patients	%
Blunted scutum	50	100
Eroded scutum & lateral attic wall	18	36
Thinning of the tegmen	10	20
Eroded tegmen	5	10
Eroded sigmoid sinus plate	01	02
Eroded superior & posterior meatal wall	05	10

*More than one finding may be present in the same patient

Table 4: Integrity of the ossicular chain

Integrity of the ossicles	No. of patient	%
Complete erosion of all 3 ossicles	27	54
Eroded malleus only	18	36
Eroded incus only	05	10
Total	50	100.0

Table 5: The involvement of hidden areas

Hidden area involved	No. of patients	%
Posterior tympanum	29	58
Sinus tympani Facial recess	05	10
Hidden areas not involved	16	32
total	50	100

Table 6: Integrity of mastoid air cell system

Mastoid state*	No. of patients	%
Sclerotic	38	76
Auto-mastoidectomy	10	20
Lateral mastoid wall bony fistula	2	04
Mastoid abscess	0	00
total	50	100

*More than one finding may be present in the same patient Integrity of mastoid air cell system:

Table 7: Integrity of the inner ear

Inner ear state	No. of patients	%
Intact inner ear structures	44	80
Lateral semicircular canal (LSC) fistula	02	04
Erodedinnerearstructures(cochlea, vestibule & semicircular canals)	04	08
Total	50	100

Table 8: Integrity of the facial nerve canal

FacialNerveCanal state (FNC)	No. of patients	%
Intact FNC	46	92
Dehiscent FNC	2	04
Eroded FNC:	2	04
Proximal tympanic segment	1	02
Distal tympanic segment	0	00
All tympanic (horizontal) segment	1	02
Vertical segment	0	00
Total	50	100.0

TYPE OF CHOLESTEATOMA: Primary acquired cholesteatoma was most commonly (70%) encountered followed by secondary acquired cholesteatomas(30%) of cases. The attic cholesteatoma was most frequently seen (46%) then extensive holo-tympanic acquired cholesteatoma (30%) followed by attico-antral cholesteatoma in (18%).

BONY EROSIONS OF THE MIDDLE EAR BONY WALLS: The blunted scutum was the most common finding (100%) followed by eroded scutum and lateral attic wall erosion seen in (36%),thinning of tegmen (20%) and the least common was eroded sigmoid sinus plate (02%).

INTEGRITY OF THE OSSICULAR CHAIN: The ossicles were absent or completely eroded in (54%), the malleus eroded in 36%, followed by incus erosion (10%).

INVOLVEMENT OF HIDDEN AREA: The involvement of the sinus tympani was detected in (58%) and the facial recess involvement was encountered in (10%).

MASTOID AIR CELL SYSTEM: The sclerotic mastoid was the most common finding encountered in (76%) of cases. Automastoiectomy was encountered in (20%), and lateral mastoid wall fistula seen in(4%).

THE LABYRINTH: The lateral semicircular canal fistula was the most common finding encountered in (4%).

INTEGRITY OF THE FACIAL NERVE CANAL: The facial nerve canal was intact in (92%), eroded in (04%) and dehiscent in (04%) of cases.

DISCUSSION

In the present study, we found that secondary acquired cholesteatoma was most often localized to the attic and antrum, some extended to the meso-tympanum and some were holo-tympanic. Attic cholesteatoma was detected in 23 patients (46%), atticoantral cholesteatoma in 9 patients (18%), meso-tympanic cholesteatoma detected in 3 patients (6%) and extensive holo-tympanic cholesteatoma in 15 patients (30%). Regarding the type of cholesteatoma, 35 patients out of 50 patients showed CT features of primary acquired cholesteatoma (70%), 15 patients out of 50 were of secondarybacquired cholesteatoma (30%).

Liu and Bergeron 19895 stated that CT is a unique in its ability to display not only the internal bony architecture of the temporal bone but also to evaluate the soft tissue components associated with a pathologic process. Therefore; one of its major contributions to the otologist dealing with cholesteatoma is the preoperative localization of the cholesteatomatous sac, determine the type of surgical approach and alert the surgeon to possible intra-operative as well postoperative complications. HRCT can early detect cholesteatoma associated with subtle bony erosion or ossicular displacement. This early detection by HRCT with the use of simple non invasive surgical technique will preserve hearing.

In the current study, attic and meso-tympanic cholesteatoma were demonstrated in 12 patients out of

50 patients. Early Prussak's space cholesteatoma was detected in 2 patients as a localized small soft tissue density mass slightly eroding the scutum inone patient and displaces the ossicles medially in the other patient. Early meso-tympanic cholesteatoma extending from a postero-superior retraction related to the facial recess and sinus tympani detected in 3 patients associated with slightly eroded incus long and lenticular process. The remaining 2 patients showed localized attic cholesteatoma associated with erosion of the scutum, malleus head and neck with slight extension towards the aditus.

Phelps and Lloyd 19906 stated that, demonstration of small cholesteatoma in the middle ear cavity by CT depends on two factors: the first is the bone erosion of lateral attic wall and scutum and/or displacement of the ossicles and the second factor is the morphology of a soft tissue mass, which is typically seen in the attic and extends down to the isthmus of the middle ear. The ossicular chain is normally equidistant from the medial and lateral walls of the epi-tympanum. The ossicular displacement in either direction often is an early sign of cholesteatoma. primary cholesteatomas usually displace the ossicular chain mediallyand secondary cholesteatoma displace it laterally.

Mafee *et al*. 19887 described the criteria indicating cholesteatoma in the attic as follows: destruction of the lateral spur of bone formed by the junction of the lateral attic wall and roof of the external auditory canal (scutum). Blunting of the scutum's (normally sharp tip) is the earliest sign of attic cholesteatoma. Erosion of the anterior tympanic spine (which is best seen in sagittal scans), is another sign indicating cholesteatoma in the attic. Bone destruction of the lateral attic wall causing widening of the aditus with loss of the "figure-of-eight" pattern (formed by narrow isthmus of the aditus between the radiolucenciesoftheepitympanumandantrum)usually signifies that cholesteatoma has extends into the antrum. Dehiscence of the tegmen and erosion of the medial attic wall are less common than lateral wall erosion and may lead to involvement of the facial nerve canal with paralysis and invasion of the lateral semicircularcanal with vertigo or sudden sensorineural hearing loss.

Cholesteatoma in the mastoid antrum is characterized by a smooth cavity that is usually larger than normal owing to bone erosion. When the air cells appear cloudy but maintain their irregular trabecullar pattern or whenever there is obliteration of the mastoid antrum and peripheral air cells by reactive new bone formation, chronic mastoiditis without cholesteatoma is indicated. Another sign of cholesteatoma in the antrum is erosion or absence of the bony partition known as Körner's septum. So, it is mandatory to compare both ears, because of the normal anatomic variations among individuals. Destruction and scalloping of the mastoid air cells (auto-mastoidectomy), dehiscenceorerosionofthesigmoidsinusplatewithorwith outvenoussinusthrombosis represents the complications of antral cholesteatoma[7,8].

CONCLUSION

HRCT is unique in its ability to display not only the internal bony architecture of middle ear and mastoid but also presence of soft tissue mass; that a negative scan effectively excludes possibility of cholesteatoma. It is also valuable in visualization of hidden areas such as sinus tympani and facial recess beyond otoscopic examination which is important before decision of surgical strategy.

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