Correlative Study of HRCT in Attico-Antral Disease

Ranga Reddy Sirigiri · K. Dwaraknath

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Abstract There is lot of controversy over the utility of pre-operative radiology in management of attico-antral disease. This study was done to find correlation between pre-operative HRCT and intra-operative findings in patients with attico-antral disease. Study revealed varying degrees of sensitivity and sensitivity for different aspects of the disease. We conclude that though HRCT given good visualization of the key areas, high levels of false positive and false negative prevent the wholesome reliability on it.

Keywords High Resolution Computerized Tomography (HRCT) · Attico-antral disease · Cholesteatoma

Introduction

The history of radiology of cholesteatoma dates back to 1905, when Schuller described the first view to visualize pathologic lesions in the area frequently involved in chronic ear disease, namely Attic–aditus–antrum or the key area. Thereafter many views developed to further enhance the visibility of pathological findings but none of them gave sufficient information. The advent of HRCT has significantly altered the contribution of radiological imaging

in pre-operative diagnosis of cholesteatoma of middle ear cleft. It not only displays internal bony architecture of the skull base, but also evaluates the soft tissue pathology associated with a bone the disease process which helps in deciding the approach to surgery and also the expected intra operative and post operative complication.

There are contradicting view points in contemporary literature on the utility of pre-operative radiology in treatment of cholesteatoma e.g. Smyth et al. [1] and Dulac et al. [2]. These two extreme viewpoints motivated us to do a study of correlation between pre operative HRCT findings and intra operative findings of cholesteatoma.

Material and Methods

This study was conducted at Govt. ENT hospital, Hyderabad with selected 25 patients whose clinical diagnosis was CSOM–attico antral disease, all of them were underwent surgery eventually. A detailed clinical examination and microscopic examination was done and findings noted. Then we subjected them for pre operative HRCT—temporal bone in both axial and coronal sections, all the findings on HRCT noted and tabulated.

The following criteria proposed by Liu and Bergeron were used to diagnose cholesteatoma by HRCT

- Erosion and destruction of the lateral wall of the attic (scutum)
- Widening of the aditus ad antrum
- Displacement of the ossicular chain
- Destruction of the ossicles
- Labyrinthine fistula
- Erosion of the facial canal
- Dehiscence of the tympanic roof (tegmen tympani)

R. R. Sirigiri · K. Dwaraknath
Kamineni Institute of Medical Sciences, Sreepuram,
Marketpally, India

R. R. Sirigiri (✉)
Department of Pediatric Otolaryngology, Childrens Hospital
of Michigan, Detroit, MI 48201, USA
e-mail: rangareddysirigiri@gmail.com

R. R. Sirigiri
2864 Somerset Blvd, Apt# 105, Troy, MI 48084, USA

Destruction of the mastoid (automastoidectomy cavity)
Dehiscence of the sigmoid plate
Erosion of the roof of the external auditory canal (poster superior wall).

Complete or partial destruction of the malleus and incus and sometimes displacement medially or laterally.

All patients underwent surgery and intra operative findings were noted. All findings were tabulated and correlated.

Observations and Discussion

Out of total the 25 patients 14 were males and 11 were females. 15 of them were between 20 and 40 years of age, six of them were less than 20 yrs age and four of them were more than 40 yrs age. Patients presented with wide spectrum of symptoms like otorrhoea, hearing loss, earache, tinnitus, post aural abscess and vertigo. On examination we found postero superior granulations, attic perforations, polyp, posterior canal wall sagging and cavity with granulations.

Observations

The different findings on pre-operative HRCT and intra-operative and their correlation is as shown in the tables below (Tables 1, 2, 3, 4).

Discussion

Preoperative CT Scan could diagnose non-dependent soft tissue density mass in 23 of the 25 cases (92%), with two false positive and one false negative interpretation. On the

Table 1 HRCT findings, extent of the disease

Extent	Soft tissue density mass	Soft tissue density mass + bony erosion	Total	Percentage
Protympanum	5	4	9	36
Mesotympanum	10	1	11	44
Posterior tympanum	10	3	13	52
Epitymapnum	4	18	22	88
Hypo tympanum	9	2	11	44
Antrum	9	13	22	88
Aditus	0	21	21	84
Mastoid air cells	1	18	19	76
Perilabyrinthine cells	0	6	6	24

Table 2 HRCT findings, complications of cholesteatoma

CT findings			No. of patients	Percentage
Ossicular destruction	Malleus	Handle	13	52
		Head	11	44
	Incus		15	60
	Stapes		Inconsistent visualization	
Facial canal dehiscence			4	16
Lateral semicircular canal erosion			2	8
Mastoid cortex dehiscence			3	12
Sinus plate dehiscence			1	4
Dural plate dehiscence			0	0

whole CT was 92% sensitive and 66% specific in identifying soft tissue density mass. Mafee [3] and O' Reilly [4] have similar results, whereas jackler [5] and Garber [6] found it to be less sensitive and specific. However, CT scan is less sensitive in differentiating cholesteatoma from granulations. Most authors are in agreement with this finding [3–6]. However Mafee et al. [3] believed it was possible to identify cholesteatoma by its low attenuation value and Johnson et al. found that the presence of a well-differentiated edge of mass was a sure indication of cholesteatoma.

Bony erosion, an additional sign for the presence of cholesteatoma was identified in 20 of the 24 cases. This is comparable to the reports by Jackler et al. [5] and O'Donoghue et al. [7], who found cholesteatoma to be present in 80% of the cases with bony erosion that were explored. Using the same criteria O'Reilly [4] detected 23 out of 29 cases of cholesteatoma (79%). Mafee et al. [3] found bone destruction in nine out of nine cases of acquired cholesteatoma.

CT was 100% sensitive for cholesteatoma in protympanum, posterior tympanum, hypotympanum and perilabyrinthine cells and sensitivity varied from 95 to 86% for other regions. CT was 100% specific for cholesteatoma in epitympanum and mastoid air cells and specificity varied from 86 to 66% for other regions. This is in comparison to Garber et al. [6] who did similar study.

We found CT to be most accurate in identifying ossicular destruction, which is in consonance with studies by Mafee et al. [3], Garber et al. [6], Jackler et al. [5] and Schwartz et al. [8]. In our study, CT detected ossicular destruction in 15 of the 17 patients (88% sensitivity) who had such lesion on surgery. Mafee et al. [3] were able to define the state of the ossicular chain in 89% of cases scanned and Jackler et al. [5] were able to predict the state of the ossicular chain in 83% of their cases and O'Reilly [4] could predict an intact ossicular chain correctly in only 50% of the cases. In our study incus was most commonly involved and CT could identify involvement of the incus in

Table 3 Correlation of CT scan and Operative findings, extent of the disease

Extent	CT scan	Surgery	Cases in agreement	False +ve	False –ve	Sensitivity	Specificity
Protympanum	9	6	6	3	0	100	84
Mesotympanum	11	8	7	4	1	87	76
Post-tympanum	13	9	9	4	0	100	75
Epitympanum	22	23	23	0	1	95	100
Hypotympanum	11	5	5	6	0	100	70
Antrum	22	22	21	1	1	95	66
Aditus	21	21	20	1	1	95	75
Mastoid air cells	19	22	19	0	3	86	100
Peril-lab cells	6	3	3	3	0	100	86

Table 4 Correlation of CT scan and operative findings

			CT Scan	Surgery	Cases in agreement	False +ve	False –ve	Sensitivity	Specificity
Ossicular destruction	Malleus	Handle	13	15	13	0	3	81	100
		Head	11	16	11	0	4	73	100
	Incus		15	17	14	1	3	82	87
		Stapes							
Facial canal dehiscence			4	3	2	2	1	60	90
Lateral semicircular canal			2	1	1	1	0	100	94
Mastoid cortex dehiscence			3	4	3	0	1	75	100
Sinus plate dehiscence			1	1	1	0	0	100	100

15 of the 17 cases, with destruction found during surgery. Mafee [3], O’Rielly [4] and Jackler [5] had similar results. O’Donoghue et al. [7] reported that they had detected erosion of the long process of the incus in 67% of cases scanned. In our study, however was detected in 11 (73%) patients on CT. CT Scan could detect erosion of the handle of the malleus in 13 of the 15 patients who showed this lesion on surgery. This is comparable to studies by Mafee, Garber and Jackler. Involvement of the stapes could not be analyzed due to inconsistent visualization on CT scan. Most authors had the same problem except O’Donoghue who reported that they could diagnose destruction of stapes suprastructure in 86% of the cases.

Dehiscence of the horizontal part of the facial canal was accurately diagnosed in three cases (60% sensitivity and 90% specificity) and there were two false positive interpretations and CT failed to identify the dehiscence in one case. This is in agreement with studies by O’Reilly, Jackler and Garber. However, Mafee et al. found CT to be very accurate in the diagnosis of erosion of facial canal.

Erosion of the lateral semicircular canal was reported in three cases however only one of the patient had a demonstrable lesion on operation. These findings have a sensitivity of 100% and specificity of 94% which is similar to that reported by Mafee et al.

However, we found CT to be most accurate in diagnosing destruction of mastoid cortex and sinus plate. This is in agreement with studies by most authors.

Conclusion

Advent of HRCT and improvements in radiological technology has definitely improved the pre operative diagnosis of cholesteatoma and assessment of extent of spread. But high levels of false positive and false negative prevent wholesome reliability on HRCT. A skilful, aware and alert surgeon still remains the lynchpin of successful diagnosis and surgical treatment of cholesteatoma.

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