Original Research Article

Role of high resolution computed tomography of temporal bone in management of chronic suppurative otitis media

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ABSTRACT

Background: High Resolution Computed Tomography (HRCT) has widely replaced conventional techniques (X-Ray Mastoid bone) for temporal bone imaging. The most significant use of computed tomography lies in evaluation of cases of Chronic Suppurative Otitis Media (CSOM). The objective of the study was to evaluate the usefulness of HRCT scanning of temporal bone in defining the extent and severity of disease in patients with CSOM, thereby altering the surgical plan and outcome.
Methods: This prospective study was conducted at a tertiary care hospital in Ahmedabad. After obtaining approval from IEC (Institutional Ethical Committee), study was carried out on 50 patients diagnosed with CSOM of attico-antral type. Written informed consent of all patients was taken before enrollment in the study. HRCT scan findings were reviewed and correlated with per-operative findings.
Results: Out of total 50 patients of CSOM, 26 (52%) were males. Majority of the patients (70%) were in the age group of 11 to 30 years. Left ear was involved in 40% of the patients. Majority of the patients (80%) presented with chief complaint of otorrhoea. In the present study, External Auditory Canal (EAC) was seen normal in majority of patients (82%) both radio logically and per operatively. HRCT scan was found to be very sensitive (96%) in diagnosing cholesteatoma. The sensitivity of HRCT for diagnosing disease in epitympanum, antrum and aditus was found to be 100%, 97% and 88% respectively. CT scans diagnosed erosion of malleus with 100% sensitivity and specificity and erosion of incus with 91% sensitivity and 100% specificity.
Conclusions: HRCT was helpful in determining the anatomy of the middle ear and mastoid, and accurately predicted the extent of the disease process of CSOM.

Keywords: Cholesteatoma, Chronic suppurative otitis media, HRCT temporal bone, Sensitivity, Specificity

INTRODUCTION

Conventional radiography of the temporal bone (X-Ray mastoid bone) has not kept pace with the progress of modern otology and for this reason many otologists have felt that radiography of the temporal bone is of little value in CSOM. The diagnosis may be made entirely on clinical grounds and many surgeons feel that with experience and careful techniques the extent and nature of the pathology can be determined during the course of surgical exploration without prior information being required.

The advent of HRCT has made a significant impact on the surgical management of individuals with middle ear disease. It confirms and expands upon the otoscopic findings, resolves clinical doubts, and in many circumstances plays a significant role in determining surgical technique when surgery is necessary. The surgical approach can be planned on the basis of HRCT findings.[1] However, routine HRCT scanning prior to

surgery in every patient of CSOM of attico-antral type can only be justified if it can be shown to influence clinical management.[2] The present study was conducted to evaluate how accurately HRCT scanning could define the extent and severity of the disease in patients with CSOM, thereby altering the surgical plan and outcome.

METHODS

This prospective study was conducted at a tertiary care hospital in Ahmedabad. After obtaining approval from IEC (Institutional Ethical Committee) study was carried out on 50 patients of CSOM of attico-antral type. Written informed consent from all patients was taken before enrollment in the study. Patients with CSOM of tubo-tympanic type were excluded from the study.

All patients' ears were examined under microscope during outpatient clinic before surgery. Hearing status was assessed by pure tone audiometry (PTA) examination. In computerized tomography, high resolution serial 1 mm thick sections were obtained in both axial and coronal planes. Axial images were obtained parallel to the orbitomeatal plane. Coronal sections were parallel to vertical ramus of the mandible. All patients underwent mastoid exploration and the type of surgery was determined by the clinical diagnosis, HRCT findings and intra-operative findings. The extent of disease was studied during surgery. Operative findings were compared with pre-operative HRCT scans in order to correlate the features like status of EAC, location and extension of cholesteatoma, granulation tissue in middle ear and antrum, erosion of ossicular chain, erosion of scutum, integrity of facial nerve, integrity of tegmen plate and extension of disease outside the middle ear and status of mastoid air cells.

RESULTS

Out of 50 patients of CSOM, 26 (52%) were males. 35 patients (70%) were in the age group of 11 to 30 years.

Left ear was involved in 40% of patients. Otorrhoea was the presenting complaint in 40 patients (80%), followed by decreased hearing (66%) and earache (18%) (Table 1).

Table 1: Distribution of the patients according to the presenting symptom.

No.	Chief complaints	No. of cases (n=50)	Percentage
1	Otorrhoea	40	80
2	Decreased hearing	33	66
3	Earache	09	18
4	Headache	03	06
5	Tinnitus	02	04
6	Giddiness	02	04
7	Facial paralysis	02	04

Table 2: Distribution of patients according to their otoscopic findings.

Sr. no.	Otoscopic findings	No. of cases (n=50)	Percentage
1	Retraction Pocket with Cholesteatoma	20	40
2	Cholesteatoma with Granulation tissue	11	22
3	Granulation tissue	08	16
4	Polyp	04	08
5	Marginal perforation	06	12
6	Exostosis	01	02

Otoscopic and microscopic examination was done in all patients and 20 patients (40%) showed retraction pocket with cholesteatoma flakes, 11 (22%) patients had cholesteatoma with granulations and 8 (16%) patients had only granulations (Table 2).

Table 3: Correlation of HRCT findings and surgical findings regarding extent of the disease in middle ear.

Extent	CT Scan	Surgery	Cases In Agreement	False positive	False negative	Sensitivity	Specificity
Epitympanum	38	37	37	01	00	100	92
Mesotympanum	07	07	06	01	01	87	97
Hypotympanum	03	02	02	01	00	66	97
Protympanum	08	07	06	02	01	87	95
Antrum	37	35	34	03	01	97	83
Aditus	38	31	27	11	04	88	63

Table 4: Correlation of HRCT findings and surgical findings regarding cholesteatoma.

Correlation	Clinical examination	HRCT	Surgery	Cases In Agreement	False +ve	False -ve	Sensitivity	Specificity
Evidence of cholesteatoma	31	32	30	29	03	01	96%	86%

Table 5: Correlation of HRCT findings and surgical findings regarding ossicular involvement.

Finding	CT	Surgery	Cases In Agreement	False positive	False negative	Sensitivity	Specificity
Malleous-Head	4	4	4	0	0	100	100
Malleous-Handle	2	2	2	0	0	100	100
Incus	20	22	20	0	2	91	100
Absent	08	10	08	0	2	83	100
Normal	22	12	12	10	0	100	54

In the present study EAC was normal in 41 patients (82%), both radiologically and per operatively. 8 (16%) patients showed soft tissue density in EAC on CT scan and this was in complete agreement with per operative findings as 4 (8%) patients had polyp in EAC and 4 (8%) patients had edema of canal wall skin (otitis externa). Patients with otitis externa were taken for surgery after resolution of edema. One patient showed bony growth on CT scan that was found to be exostosis during surgery. Hence, HRCT temporal bone was 100% sensitive and specific for pathology in EAC. The sensitivity of HRCT for diagnosing disease in epitympanum, antrum and aditus was found to be 100%, 97% and 88% respectively (Table 3). HRCT was found to be very sensitive (96%) in diagnosing cholesteatoma, however it could not differentiate cholesteatoma from granulations and therefore was less specific (86%) (Table 4). CT scans diagnosed erosion of malleus with 100% sensitivity and specificity. It diagnosed erosion of incus with 91% sensitivity and 100% specificity. HRCT showed inconsistent visualization of stapes in our study and couldn't detect erosive changes of stapes, hence more cases were found with normal ossicles in CT compared to per-operative findings (Table 5).

DISCUSSION

The exact role of HRCT in the preoperative assessment of patients with chronic otitis media is controversial [3]. Some authors have reported a high degree of accuracy in the pathological diagnosis of ossicular chain and inner ear conditions and others have concluded that CT has poor ability to diagnose cholesteatoma and should not be relied on to visualize abnormalities of the previously mentioned structures.[4,5] The results of this study suggest that cholesteatoma can be accurately diagnosed by computed tomography. The hallmarks of cholesteatoma on CT scan are the bone erosion and smooth expansion with soft tissue mass. Conversely, one should be aware of the limitations of CT to pick out early or limited disease, since it is difficult to diagnose cholesteatoma on the scan if the soft tissue mass is not associated with bone erosion.[6] In our study HRCT found to be very sensitive (96%) in diagnosing cholesteatoma; however HRCT could not differentiate cholesteatoma from granulations and therefore less specific (86%).

In studies on efficiency of HRCT in defining the extent of disease preoperatively, O'Donoghue et al. and O'Reilly et al independently found HRCT to be highly accurate.[4,7] In our study, CT scan was 100% sensitive in diagnosing disease in epitympanum and 97% sensitive in antrum and 88% sensitive in aditus which is in agreement with the aforementioned studies.

O'Donoghue et al reported a sensitivity of 50% in identifying tegmen tympani erosion while Jackler et al reported a sensitivity of 100% but a PPV of 33.33% in identifying tegmen tympani erosion.[4,6] O'Reilly et al. showed sensitivity of 46% and specificity of 84%.[7] In our study, HRCT temporal bone was found to be 100% sensitive and specific in identifying tegmen tympani erosion.

It is relatively easy to visualize malleus and incus on HRCT but this has little clinical value unless the whole ossicular chain can be demonstrated. O'Donoghue et al reported a sensitivity of 81.4% in identifying incus erosion.[4] The malleus was the ossicle whose presence was predicted with the greatest accuracy with the sensitivity of 100% on HRCT.[4] Jackler et al were able to predict the state of ossicular chain in only 7% of their cases.[6] The long processes of the malleus and incus, and the stapes suprastructure are the components most at risk in CSOM but are also the most difficult to demonstrate on HRCT.[7] Phleps and Wright doubted that HRCT could demonstrate the ossicular chain reliably because of partial volume averaging and tissue silhouetting.[8] In this study, we were not satisfactorily able to detect ossicular chain integrity or disruption preoperatively as CT scan could not identify the stapes suprastructure.

CONCLUSION

HRCT was helpful in determining the anatomy of the middle ear and mastoid, and accurately predicted the extent of the disease process of CSOM. Its use by otologists is encouraged, especially in patients who have or are suspected of having complications. HRCT is useful as an adjunct to better preoperative assessment, and thus the surgical outcome. Its accuracy is likely to improve with larger studies and better experience, wherein its routine use may become justifiable.

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