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Research Article

A Study of the Correlation of the Clinical Feature, Radiological Evaluation and Operative Finding in CSOM with Cholesteatoma

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Abstract: Acquired cholesteatoma which occurs as sequelae to the chronic otitis media, has proved to cause many complications when left undetected and untreated. The extension of the cholesteatoma in mastoid and middle ear occurs frequently. Cholesteatoma is traditionally diagnosed by otoscopic and microscopic examination and treated by exploratory surgery. It is necessary to know the type of extension of cholesteatoma and to decide the type of surgery to be done. The hidden areas in the middle ear, which cannot be well assessed by otomicroscopy alone, CT scan and X - ray, have proved to be valuable diagnostic tools. This study helps to establish the accuracy with which the preoperative radiological findings and the clinical findings are correlated with the surgical diagnosis of cholesteatoma. Study was conducted on 60 patient. Study showed that CT finding of temporal bone correlated well with surgical findings.
Keywords: CSOM, Cholesteatoma, CT temporal bone, Complications of CSOM.

INTRODUCTION

In India the middle ear cholesteatoma is a common disease and also in other developing countries. With the availability of antibiotics, operative microscope and the microsurgical operating instruments it has become easier to successfully treat middle ear infection and cholesteatoma.

The global burden of illness from CSOM involves 65-330 million individuals with draining ear, 60 % of whom (39- 200 million) suffer from significant hearing impairment . CSOM accounts for 28000 deaths and disease burden of over 2 million DALYs (WHO-2004) [1].

Cholesteatoma is the presence of squamous epithelium in the middle ear, mastoid or epitympanum. The major sequelae are bone erosion, which results in erosion of the ossicular chain and otorrhea. In some cases, cholesteatoma can become complicated over time and result in sensorineural hearing loss, dizziness, facial nerve injury and suppurative complications such as acute mastoiditis, subperiosteal abscess, sigmoid sinus thrombosis, meningitis and brain abscess.

In the chronically infected cholesteatoma, granulation tissue and polyps accompany the epithelial debris. Otoscopically, the otologist can diagnose most cholesteatomas but one cannot determine the size and extent of the lesion in the epitympanum and mastoid. To minimize the interpretative errors of the mild bone erosions, particularly the tegmen, the lateral semicircular canal and horizontal potion of the facial nerve canal, familiarity with the radiographic variations and comparisons with the normal side are necessary.

The decision for the choice of surgical technique is of particular importance to preserve a higher hearing rate and prevent recurrence and treatment failure. Mastoid surgery has been undertaken only after otoscopy, audiometry and plain x-rays as the only preoperative investigations. Imaging of the temporal bone, with CT is playing an increasingly important role for diagnosis, surgical decision and follow-up. Evidence of location and extent of disease and of asymptomatic complications, secondary to bony destruction should also influence management. CT can undoubtly provide reliable details of temporal bone anatomy and its congenital malformations. It confirms and expands upon otoscopic findings, resolves clinical role in determining surgical efficacy when surgery is necessary, the approach can be planned on the basis of CT finding.

Prior to the availability of high resolution CT, the mainstay of radiological diagnosis of cholesteatoma was conventional X ray filming and complex motion

tomography. The exact extent of the soft tissue mass was very difficult to delineate with these methods and one have to believe on indirect findings such as bony erosions. The radiographic appearances do not generally affect the surgical approach or the course of the operation which must be exploratory. Nevertheless multidirectional or computed tomography can demonstrate the soft tissue mass of a small cholesteatoma as well a typical attico antral erosion and ossicular disruption and destruction that occur. Tomographic investigation is needed when the diagnosis is in doubt, as when the ear drum is obscured or when complications develop, but should not cause delay in instituting necessary surgery.

The ability of the high resolution computed tomogram to depict the status of the structure of the temporal bone represents a major advance in delineating pathology prior to surgical exploration of ear in cholesteatoma. A CT scan is valuable in early diagnosis of cholesteatoma, when the disease is confined to attic or posterior tympanum, beyond otoscopic view. The computerized tomographic evaluation of the acquired cholesteatoma is based on the detection of a non-dependent, homogenous soft tissue mass with a focal area of bone destruction. Of the two findings the second one is reliable since radiographic density of a cholesteatoma is the same as that of granulation tissue and other soft tissue masses [2]. On occasion, a decision to operate may hinge on the detection of cholesteatoma presence by CT scan alone.

MATERIAL AND METHODS

This study consisted of 60 cases of chronic, suppurative, otitis media of unsafe type requiring mastoid exploration, admitted in the Otolaryngology department of the NIMS medical college hospital, Shobha Nagar, Jaipur during the period of Sep 2012 to July 2014.

Only those patients who had unsafe type of CSOM were included in the study. Criterion of inclusion was CSOM with choesteatoma or granulations or polyp or posterior canal wall sagging or foul smelling discharge.

Criterion of exclusion was also made. Patient with revision surgery, history of temporal bone fracture , known cases of temporal bone neoplastic/ granulomatic diseases and cases unsuitable for surgery or scanning (such as ischemic heart disease or pregnancy) was excluded from study.

A clinical proforma filled up for each patient incorporating details regarding particulars of the patient, history, clinical examination and investigations. All patients were examined carefully under microscope during outpatient otology special clinic and before surgery under operating microscope. Hearing status was assessed by pure tone audiometric examination according to the age and compliance of the patient.

Radiological investigation consisted of both conventional plain radiography and computerized tomography. Conventional plain radiography was in the form of a lateral oblique view (Law's) of both ears.

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 done in scanning angle that is parallel to verticle ramus of the mandible.

All patients underwent mastoid exploration and the type of surgery was determined by the intra operative findings. The type and extent of disease, ossicular erosion and complications were studied during surgery.

All patients were followed up regularly in ENT out patient department after 6 weeks and 12 weeks of surgical exploration to determine the state of the mastoid cavity.

RESULTS

This study is based on 60 patients who underwent mastoid exploration for cholesteatoma at NIMS medical college and hospital, Jaipur during the period of Sep 2012 to July 2014.

The youngest patient studied was 6 year of age and the oldest was 50 years. Maximum incidence of cholesteatoma occurred in the age group of 16 – 30 years ie 53.3 cases (Fig. 1). The mean age of the series is 20.6. There were 31 males and 29 females in this study. Male to female ratio is 1:1.06 (Fig. 2).

The commonest presenting complain was otorrhoea (100 %) followed by hearing loss (96.6).Chronic otitis media with cholesteatoma is often described as scanty and foul smelling otorrhoea. But in our study 10 patients had profuse discharge, characteristic of tubotympanic type rather than attico antral type. Two patients had blood stained discharge, which was further supported by the otoscopic finding of granulation tissue in middle ear. Most of the patient had hearing loss. Two patients had normal hearing in presence of cholesteatoma, probably they were cholesteatoma hearer. Two patients presented with facial weakness and two patient presented with postauricular fistula. Ten patients presented with pain in ear which was non specific. No patient presented with Vertigo, headache and Vomiting (Table 1).

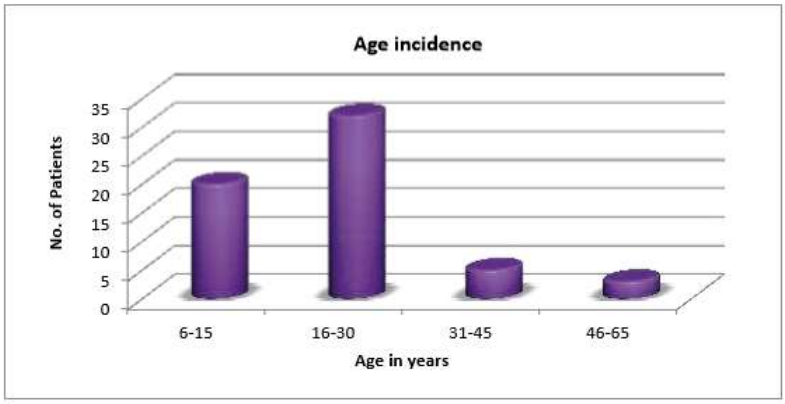

Fig. 1: Age incidence

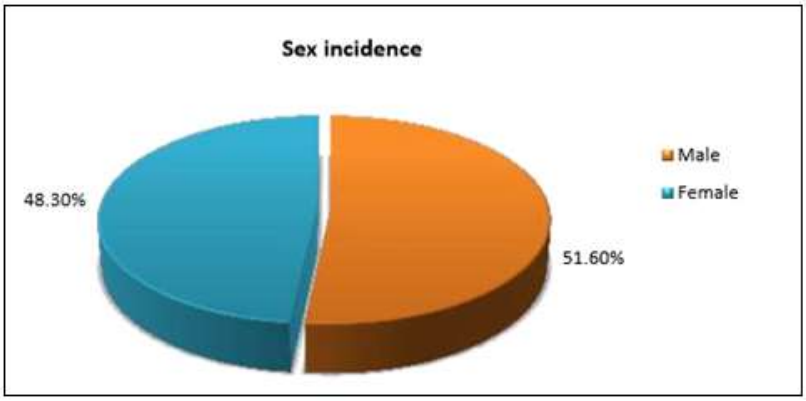

Fig. 2: Sex incidence

Table 1: Symptoms Distribution

Symptoms		No. of patients	Percentage
Otorrhoea	Profuse	10	16.6
	Scanty	50	83.3
	Foul smelling	52	86.6
	Blood tinged	2	3.3
Earache		10	16.6
Hearing loss		58	96.6
Vertigo		0	0
Headache		0	0
Vometing		0	0
Facial weakness		2	3.3
Postaural Fistula		2	3.3

Among all 60 patients 41 patients (68.3 %) had complain of otorrhoea for > 5years., 16 patient (26.6 %) had the complain of duration 2 to 5 years whereas 3 patient (5 %) had complain of discharge only for 1 year.

For complain of hearing loss 31(51.6) patient had complain for >5 years, 19 patients (31.6%) had complain for 2 to years and 5 patients (8.3%) had complain for 1 years.

The average duration of Otorrhoea among patient was 8.21 years, and the average duration of hearing loss among them was 6.9 years.

On microscopic examination of the diseased ear, presence of posterosuperior perforation was the commonest finding. Sixteen (26.6%) patients showed posterosuperior perforation and 8(13.3%) showed subtotal perforation, while only 4 (6.6%) patients had total perforation. Cholesteatoma with granulation was seen in 16 (26.6%) patient and was the commonest feature , followed by 12 (20%) patients who showed only cholesteatoma flakes. 4 (6.6) patients presented with polypoidal mass in the external auditory canal obscuring the view of the tympanic membrane. 8 (13.3%) patient had polyp with foul smelling cholesteatoma flakes. 4 (6.6%) patients had posterior canal wall erosion with cholesteatoma.

In our study, in 34 patients ossicular involvement of the disease could be visualized, mostly through microscopic examination, out of which 18 patients showed erosion of incus and 16 cases showed malleus erosion. However, stapes involvement could not be assessed.

On microscopic examination bone erosion could be visualized in 22 cases of which 12 showed attic erosion and 10 showed posterior canal wall erosion.

Tuning fork test (Rennies, weber, ABC) were performed in all cases and findings were confirmed by PTA. Fifty eight out of 60 patient had hearing loss. Two patients had normal hearing most probably they were cholesteatoma hearer. Most of the patient had moderate degree of hearing loss. Thirty six (60%) patient had moderate hearing loss, followed by mild conductive hearing loss in 20 (33.3%) patient. Two patients had moderately severed conductive deafness and they had mixed hearing loss (Table 2). Among 58 patients 56 had conductive hearing loss and 2 had mixed hearing loss. None of the patient had sensorineural hearing loss (Table 3).

Table 2: Degree of Hearing Loss

Hearing Loss (db)	No. of patient	Percentage
0- 25 db	2	3.3
26- 40 db	20	33.3
41- 55db	36	60
56- 70 db	2	3.3
71- 90 db	0	0
>90 db	0	0

Table 3: Type of Hearing Loss

Type of hering loss	No. of patients	Percentage
Conductive	56	93.3
Sensorineural	0	0
Mixed	2	3

Amount patients with mild hearing loss two had only erosion of incus whereas 14 had erosion of malleus and incus and among all ossicles where involved. Among patients with moderate hearing loss four had involvement of incus, 26 patients had involvement of malleus and incus and four had all ossicles involved. Two patients had moderately severe hearing loss and in them all ossicles are involved. Two patients had normal hearing but incus was found eroded in them.

X-rays of all the 60 (100%) patients showed sclerotic mastoid. 36 (60%) of these patients showed erosion in the X-rays. Computed tomography was done in 60 patients. Preoperative computed tomography diagnosis of cholesteatoma was made in 58 cases (Fig. 3). The hallmark of cholesteatoma was soft tissue density alone and/or bony erosion or smooth bony expansion was present in all these cases.

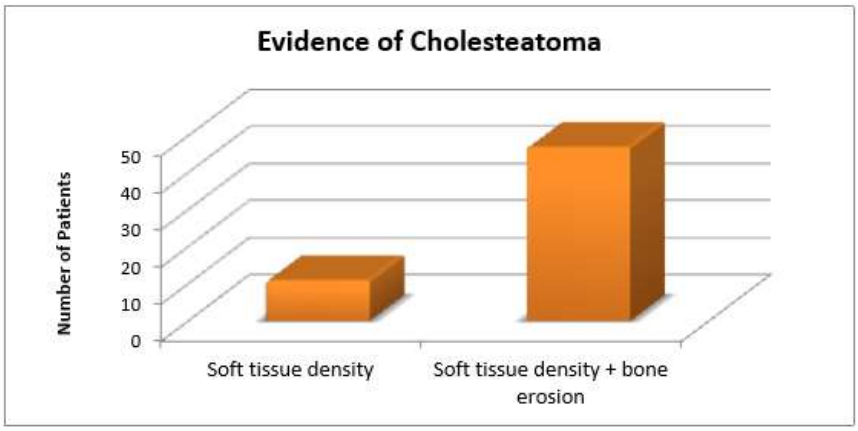

Fig. 3: Evidence of cholesteatoma on CT

On CT, epitympanum and antrum were the commonest sites of cholesteatoma, 90% each. Aditus was involved in 42 (70%) cases and posterior tympanum in 9 (15%) cases. 27 (45%) of the cases had involvment of mesotympanum and24(40%) hypotympanum and 18(30%) cases had involvment of protympanum. Peril abyrinthine cells were involved in 27 (45%) cases (Fig. 4). Destruction of malleus could be identified in 48 (80%) cases. Incus was eroded in 54 (90%) cases. However, stapes visualization was inconsistent in CT (Table 4).

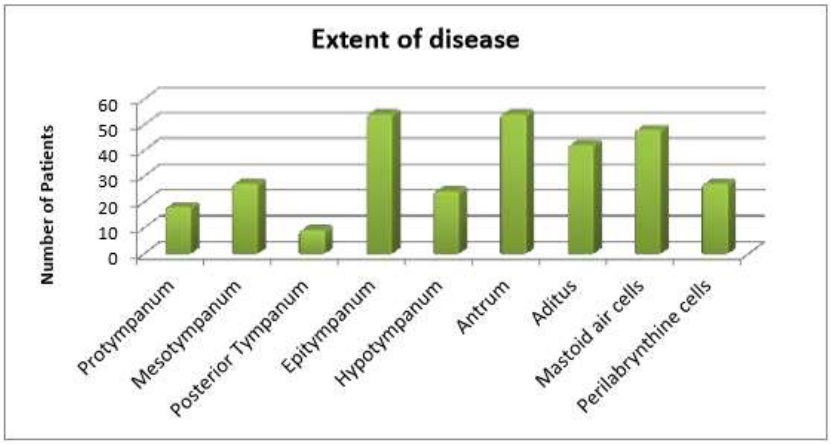

Fig. 4: Extent of disease seen on CT

Table 4: Involvement of ossicle seen on CT

Ossicle	No. of patient	Percentage
Malleus	48	80
Incus	54	90
Stapes	Inconsistent visualisation	

Preoperative CT diagnosed dehiscence of horizontal segment of facial canal in 6 (10%) cases. Lateral semicircular canal erosion was seen in 2 (3.3%) case. Sinus plate dehiscence was seen in 1 patient. Dural plate dehiscence and any intracranial finding were not seen in any patient. Mastoid cortex dehiscence was seen in 3 (5%) patient. CT showed ossicular destruction in 54(90%) cases (Table 5).

Table 5: Complications Seen On CT

Complication	No. of patient	Percentage
Ossicular Destruction	54	90
Facial Canal Dehiscence	6	10
Lateral Semicircular Canal Dehiscence	2	3.3
Mastoid Cortex Dehiscence	3	5
Sinus Plate Dehiscence	1	1.6
Dural Plate Dehiscence	0	0
Intracranial	0	0

On surgical exploration, commonest pathology was cholesteatoma, which was found in 54(90%) patients. 4 (6.6%) cases had only granulations. 18 (30%) cases had both cholesteatoma and granulations. 8 (13.3%) patient had polyp with cholesteatoma and 2 (3.3%) patient had mucosal hypertrophy only (Table 6). Epitympanum and antrum were the commonest sites of cholesteatoma, 85% each. Aditus was involved in 42 (70%) cases and posterior tympanum in 21 (35%) cases. 21 (35%) of the cases had involvment of mesotympanum and 6 (10%) hypotympanum and 12(20%) cases had involvment of protympanum. Peril abyrinthine cells were involved in 9 (15%) cases (Table 7).

Table 6: Pathology seen on surgery

Pathology	**No. of Patient**	**Percentage**
Cholesteatoma	28	46.6
Granulation tissue	4	6.6
Cholesteatoma + Granulation tissue	18	30
Cholesteatoma+ polyp	8	13.3
Mucosal Hypertrophy	2	3.3

Table 7: Extent of Disease Seen on surgery

Extent	No. of Patient	Percentage
Protympanum	12	20
Mesotympanum	21	35
Posterior Tympanum	21	35
Epitympanum	51	85
Hypotympanum	6	10
Antrum	51	85
Aditus	42	70
Mastoid Air cells	42	70
Peri labrynthine cells	9	15

On surgery it was noticed that incus (93.3%) was frequently involved followed by malleus (53.3%). Only 10 (16.6%) had necrosis of stapes suprastructure (Table 8).

Table 8: Ossicular involvement seen on surgery

Ossicles	No. of Patient	Percentage
Malleus	32	53.3
Incus	56	93.3
Stapes	10	16.6

In our study 54(90%) patients showed cholesteatoma on surgical exploration and in other 6(10%) patients showed pathologies like granulation tissue and mucosal hypertrophy. Among these 54 patients only 40(66.6%) patients correlated well with the otoscopic findings of cholesteatoma with or without granulation tissue or polyp. All 4(6.6%) patients in whom only polypoidal mass was seen on otoscopic examination, there was associated cholesteatoma sac or debris seen on surgical exploration. Mucosal hypertrophy observed in surgical exploration was missed out in two cases in which otoscopic findings showed foul smelling discharge with granulation tissue (Table 9).

Table 9: Correlation between otoscopic and surgical findings

Finding	Otoscopic	Surgical	Case in agreement
Cholesteatoma	40	54	40
Other	20	6	6

The CT found to be very sensitive (96.67%) in diagnosing cholesteatoma accurately; however CT could not differentiate cholesteatoma from granulations (Table 10).

Table 11: Correlation between CT findings and surgical findings

Correlation	CT	Surgery	Cases in agreement
Evidence of cholesteatoma	58	54	54

Our study shows that sensitivity of CT for diagnosing the erosion of chain of ossicles is 84% and specificity is 100%. However sensitivity decreases for diagnosing the erosion of individual ossicles. Stapes visualization is inconsistent in CT.

CT diagnosed erosion of horizontal segment of facial canal accurately in 5 cases. There was false positive interpretation in one case (sensitivity 66% and specificity 84%). It was 100% sensitivity and 94% specific for diagnosis of erosion of LSCS with only one false positive interpretation. CT diagnosed mastoid cortex erosion accurately in 3 cases (sensitivity 100% and specificity 94%). It was 100% sensitive and specific for sinus plate erosion (Fig. 5).

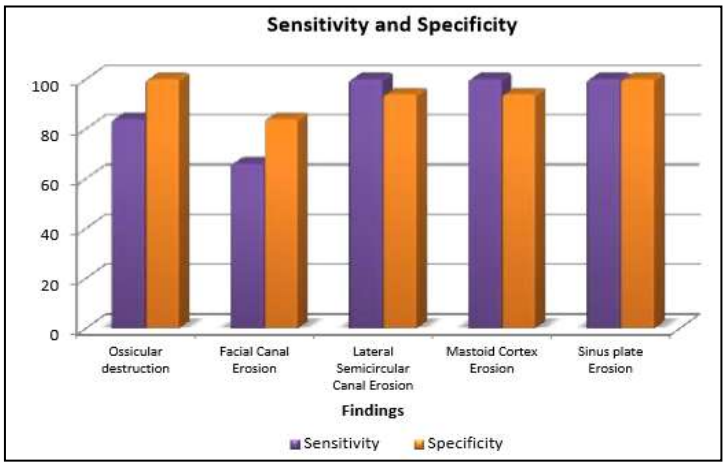

Fig. 5: Sensitivity and specificity for various complications

The findings on CT i.e. presence of soft tissue density mass with or without bony erosions in the various designated regions, was compared with the operative findings for presence of cholesteatoma. The widening of the aditus together with presence of soft tissue density mass was indicative of a presence of cholestetoma in that region. However, in the perilabyrinthine area, erosion of the cells alone was taken as an indicator of cholesteatoma. CT was 100% sensitive for cholesteatoma in protympanum, hypotmpanum and perilabyrinthine cells and sensitivity varied from 95% to 64% for other regions. CT was 100% specific for cholesteatoma in epitympanum,post tympanum and aditus and specificity varied from 86% to 74% for other regions.

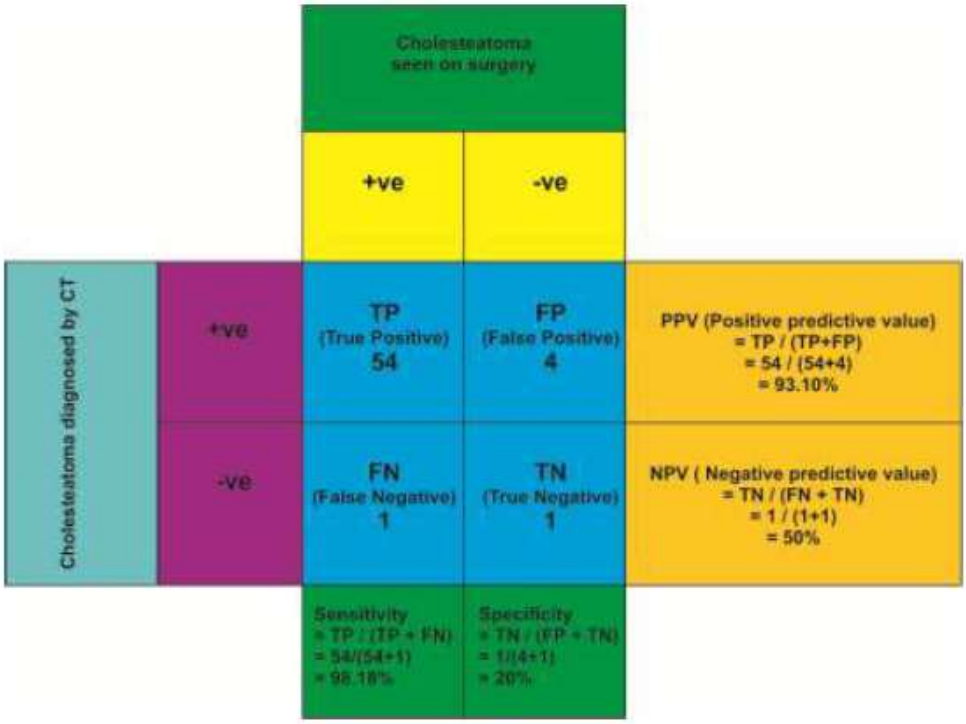

Fig. 6: Correlation of CT with operative findings for cholesteatoma

Sensitivity of CT in relation to surgery = 98.18%
Specificity of CT in relation to surgery= 20%
Positive predictive value of CT in relation to surgery = 93.10%
Negative predictive value of CT in relation to surgery =50%

DISCUSSION

Clinical feature

The diagnosis of cholesteatoma is usually made on otological examination [2, 12]. Approximately one-third of individuals with COM have their diagnosis made as an incidental finding during routine physical examination. However, when symptomatic, the two hallmark presenting symptoms are otorrhea and hearing loss. Since the signs and symptoms of ear disease may be lacking cholesteatoma may go undetected for many years in children and adults [4]. In cases in which diagnosis is not obvious, computerized tomography may demonstrate a soft tissue mass with characteristic ossicular displacement and erosion of the bone. Cholesteatoma in the hidden areas, such as the posterior tympanic recess, may be revealed by radiological examination even if it is not detected by on otological examination.

In this study, the presenting clinical complaints were nonspecific. All the patients had complained of discharging ear (100%). Among them 50 (83.3%) patient had complain of scanty discharge. Most of them (52 ie 86.6%) had foul smelling discharge. Pain is unusual with COM and indicates either a reactive external otitis or the possibility of a developing intratemporal or intracranial complication. About 10 patients (16.6%) in the study presented with complaints of pain but no complication were found in them either by CT scan or on surgical exploration. None of the patient had complained of vertigo.

Hearing loss was also very common symptoms. About 58 patients (96.6%) had hearing loss. Two remaining patient had normal hearing but they had cholesteatoma on surgery, probably they were cholesteatoma hearer. These results are comparable to the studies done by Glasscock *et al*. [5].

Otoscopic finding

Based on the observations of Bluestone *et al*., the diagnosis of cholesteatoma is most effectively made with an otoscopic or, more accurately, with the otomicroscope [4]. In this study there were 40 (66.6%) cases which showed characteristic cholesteatoma flakes on examination, with or without granulation tissue or polyp. All these were in agreement with the surgical findings. 10(16.6%) cases showed granulation tissue on examination, but 8 cases among this also showed cholesteatoma on surgical exploration. This was in accordance to the results of Proctor Bruce [6] which suggested the association of granulation tissue in 93-95% of the cases of cholesteatoma. Polyp was seen in 4(6.6%) and 4(13.3%) patients presented with polyp in association with cholesteatoma on otoscopic examination. In very inflamed ears, a cholesteatoma may not be visible at the first presentation.

Sometimes there is an aural polyp obscuring the attic or posterior pars tensa; such a case should be assumed to be a cholesteatoma until proved otherwise [7].

Ossicular status could be assessed in only 18(3%) patients. The presence of granulation tissue and the polyp obscuring the view of the tympanic membrane made the visualization of the middle ear not possible in most of the cases. On otoscopic examination, the erosion of the incus (18 cases) was more common when compared to the malleus (16 cases). In surgery 56(93.3%) cases showed incus erosion and 32 (53%) cases showed malleolar erosion. However the involvement of the stapes could not be assessed well with otoscopic or microscopic examination in any of the cases.

Radiological examination

A conventional plain X ray or a CT scan provides information about congenital anatomic variations that may be encountered during surgery, as well as the complications of cholesteatoma [11]. HRCT provides a more precise definition of the anatomic extent of the disease of the middle ear and the relationship of these cholesteatoma masses to the contiguous structures. Comparison to the normal is useful in doubtful cases.

The hallmarks of cholesteatoma are the presence of soft tissue density in the middle ear cavity, ossicular erosions, smooth erosions of the middle ear borders and adjacent structures. These changes, when associated with bony expansion of the middle ear cavity, are highly suggestive of cholesteatoma. However they are not specific, like ectopic meningioma may simulate this finding and cannot be differentiated from cholesteatoma [3, 8].

Previous studies have measured the effectiveness of plain film examination in cases of cholesteatoma, rather than the more common erosive otitis media. In this study of the 60 patients reviewed, 36 (60%) patients were accurately diagnosed with cholesteatoma and correlated well with the surgical findings. Earlier series have given rates of detection of surgically confirmed cholesteatomas of about 45% - 75% [16].

Mac Millian [9] detected cholesteatomas in 45% of cases with law projection and Brunner *et al*. [10] detected cholesteatoma in 58% of cases with multiple plain films. The bony erosion could be appreciated; however, the ossicular erosions were not well visualized. In all the 60 cases there was considerable destruction and loss of aeration of the mastoid air cells (mastoid sclerosis).

Preoperative CT scan could diagnose soft tissue density mass in all the 60 patients, with six false positive interpretations. Mafee [11] had similar results, whereas Jackler [11] and Garber [12] 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 [11-13]. However Mafee *et al*. [14] believed it was possible to identify cholesteatoma by its low attenuation value and Johnson *et al*. [15] found that the presence of a well defined edge to mass was a sure indication of cholesteatoma.

In this study, homogenous and soft tissue densities were present in the mastoid antrum and middle ear cavity. About 30% of the cases had both granulation tissue and cholesteatoma which could not be radiographically distinguished. Cholesteatoma sac, associated with granulation tissue, mucosal oedema and effusion may be indistinguishable on CT scanning [11, 16]. Although cholesteatoma is said to show a lower attenuation than granulation tissue the difference is subtle and only magnetic resonance imaging can differentiate the two [3].

Bony erosion, an additional sign for the presence of cholesteatoma was identified in 47 of the 60 cases. This is comparable to the reports by Jackler *et al*. [11] who found cholesteatoma to be present in 80% of the cases with bony erosion who were explored. Mafee *et al*. [14] found bone destruction in 9 out of 9 cases of acquired cholesteatoma.

In this study, CT was found to be most accurate in identifying ossicular destruction, which is in consonance with studies by Mafee *et al*. [3], Garber *et al*. [12] and Jackler *et al*. [11]. CT detected ossicular destruction in 54 of 60 the patients 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*. [11] were able to predict the state of the ossicular chain in 83.3% of their cases. In this study incus was most commonly involved and CT could identify involvement of the incus in 27 of the 60 cases, with destruction found during surgery. Mafee [3] and

Jackler [11] had similar results. Involvement of the stapes could not be analyzed in only on CT scan due to the inconsistent visualization.

Dehiscence of the horizontal part of the facial canal was accurately diagnosed in 5 cases. In the studies performed by Jackler [11] and Garber [12]there was false negative cases observed in which CT failed to detect facial nerve dehiscence. However, Mafee *et al*. [3] found CT to be very accurate in the diagnosis of erosion of facial canal.

Erosion of the lateral semicircular canal was reported in 2 cases however only one of the patient had a demonstrable lesion on operation. This finding had a sensitivity of 100% and specificity of 94% which is similar to that reported by Mafee *et al*. [3].

In this study, 54 cases showed evidence of cholesteatoma on surgical exploration. CT scan was performed on all 60 cases; it showed cholesteatoma in 58 cases and ruled out choleteatoma in 2 cases. True positive cases were 54, false positive cases were 4, false negative cases were 1 which showed cholesteatma and 1case was true negative which showed mucosal hypertrophy on exploration. CT scan is less sensitive in differentiating cholesteatoma from granulations. Most authors are in agreement with this finding. However Mafee *et al*. [3] believed it was possible to identify cholesteatoma by its low attenuation value and Johnson *et al*. [16] found that the presence of a well defined edge to mass was a sure indication of cholesteatoma.

CT was 100% sensitive for cholesteatoma in protympanum, hypotmpanum and perilabyrinthine cells and sensitivity varied from 95% to 64% for other regions. CT was 100% specific for cholesteatoma in epitympanum, post-tympanum and aditus and specificity varied from 86% to 74% for other regions. This is in comparision to Garber *et al*. [12] who did similar study.

CONCLUSION

The diagnosis of cholesteatoma can be made with both otoscopic examination and radiological evaluation. In this study, 66.6% patients, on otoscopic examination revealed cholesteatoma, and were in agreement with the surgical findings, while in 90% patients, showed true positive cases on CT examination. Thus there was good correlation between the radiological evaluation and the surgical diagnosis of cholesteatoma compared to the otoscopic diagnosis. CT scan is valuable in cases suspected of intra and extra cranial complications and in those cases in which diagnosis is not obvious. Cholesteatoma in hidden areas and ossicular destruction can be revealed with CT scan, which cannot be assessed on otoscopic examination. CT scan was found to be sensitive in the diagnosis of cholesteatoma and the in the diagnosis of lateral semicircular erosion, facial nerve canal dehiscence, sinus plate and mastoid cortex destruction.

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