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Case Series

A case series of cholesteatoma spread in middle ear cleft

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ABSTRACT

This study aimed to describe the spread of cholesteatoma in middle ear cleft. The 20 patients diagnosed with chronic otitis media, squamosal type (cholesteatoma) who underwent mastoidectomy exploration were included in this study. The main emphasis was to find out the extent and spread of cholesteatoma into the middle ear cleft. The result of the study showed 50% of cases spread to middle ear cavity (20% -meso tympanum, 15%-sinus tympani,15%-facial recess), 20% into the attic, 30% into adits, antrum and mastoid air cell system. All of our patients underwent mastoid exploratory surgery. In half of the cases, the cholesteatoma was restricted to middle ear cavity, while in remaining 50% it has extended to attic, aditus mastoid antrum and mastoid air cells. Disease clearance was effective with no post-operative complication or recurrence in first 50% cases. Other 50% of cases required extensive surgery for disease clearance.

Keywords: Middle ear cleft, Cholesteatoma, Mastoid exploratory surgery

INTRODUCTION

Cholesteatoma is a benign, expanding and destructive epithelial lesion of the temporal bone.

If undetected and left treated, cholesteatoma may lead to significant complications including hearing loss, temporal bone destruction and intra and extra cranial complications. Recent advances in imaging modalities have allowed for high sensitivity and specificity in identifying the presence of cholesteatoma.

Cholesteatoma is a cystic sac formed by accumulation of desquamated keratinizing squamous epithelium which is surrounded by a fibrous matrix.[1] It is often known as "skin in wrong place." There are 2 major types of middle ear cholesteatomas, namely congenital and acquired.

Congenital cholesteatomas are derived from the remnants of epithelium that get trapped behind the tympanic membrane during development.

Acquired cholesteatomas do not result from an embryonic phenomenon, but are result of pathologic changes that cause the uncontrolled growth of squamous keratinizing epithelium in the middle ear.[2] Acquired cholesteatomas, are further divided into the primary acquired and secondary forms. Primary acquired cholesteatoma occurs as a retraction pocket in which the desquamated keratin epithelium accumulates behind an apparently intact eardrum, usually in the region of the pars flaccida.

Secondary acquired cholesteatoma appears secondary to epithelial migration into the middle ear through a perforated eardrum, which is in turn caused by infection, trauma, or iatrogenesis.[3]

The advent of high-resolution CT scans (HRCT) has brought about significant enhancement in the pre-operative assessment of temporal bone pathology and fine anatomical details of the disease advancement.

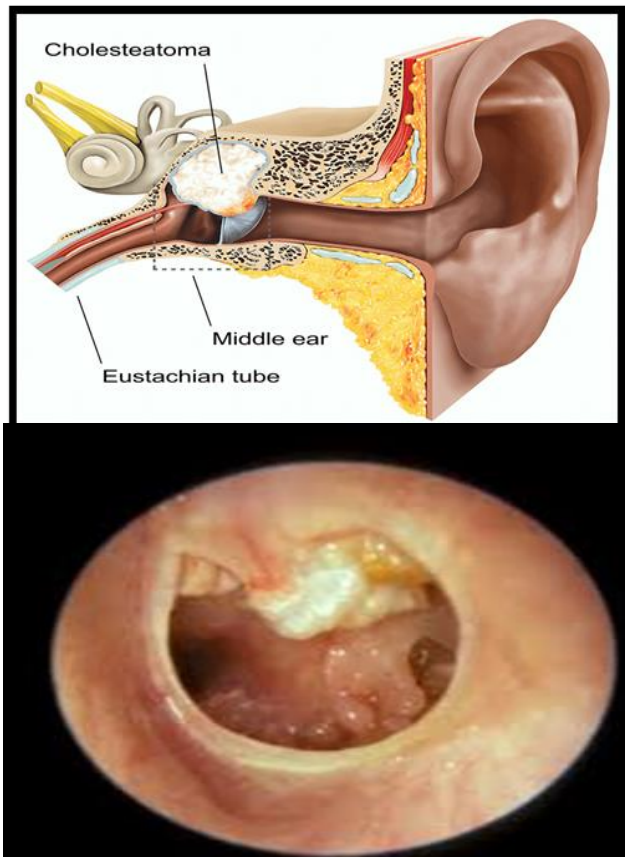

Figure 1: Cholesteatoma sac extending into the middle ear.

This study analyses and compare the spread of cholesteatoma into the middle ear cleft.

Objectives

Objectives were to study the extent of spread of cholesteatoma and to compare the disease progression between compartments of the middle ear cleft.

CASE SERIES

A prospective study done to know the extent of spread of cholesteatoma in middle ear cleft, data collected from February 2021 to February 2022 in tertiary care center. We assessed 40 consecutive ears with acquired cholesteatoma.

Inclusion criteria

Patients with age above 15 years, history of recurrent ear infections, presence of hearing loss and HRCT imaging of the temporal bone were included in the study.

Exclusion criteria

Patients with congenital cholesteatoma, presence of comorbidities and patients not giving consent were excluded.

Computed tomography with thin cuts (2 mm) of the temporal bone without contrast is used as a diagnostic imaging modality in the study.

All cases were subjected to HRCT Temporal bone.

Four patients did not have CT scans and were excluded from the study leaving 16 cases for evaluation.

The CT scans of the temporal bones were all performed in the department of radiology at ASRAM medical hospital, had axial and coronal plane thickness of 2 mm with an overlap of 1 mm

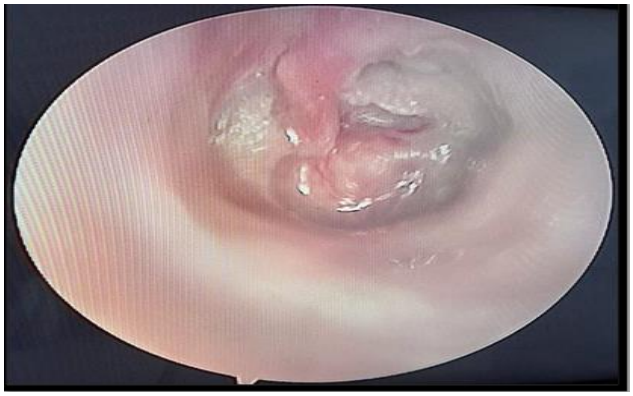

Figure 2: Otoscopic image of cholesteatoma invading the pars tensa.

On otoscopic examination, a cluster of pearly white structure in the attic region (sac) protruding from the pars flaccida is seen.

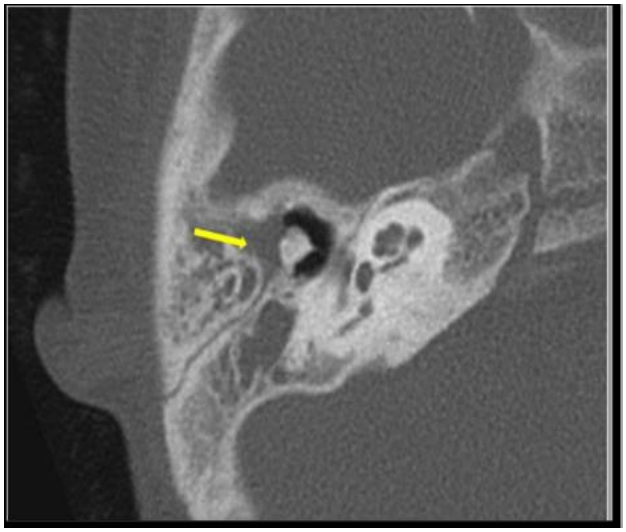

Figure 3: Axial CT image of non-dependent soft tissue in the Prussack's space, lateral to ossicles in a patient with pars flaccidacholesteatoma.

Axial CT image showing non-dependent soft tissue in the Prussack's space, lateral to ossicles in a patient with pars flaccidacholesteatoma (arrow).

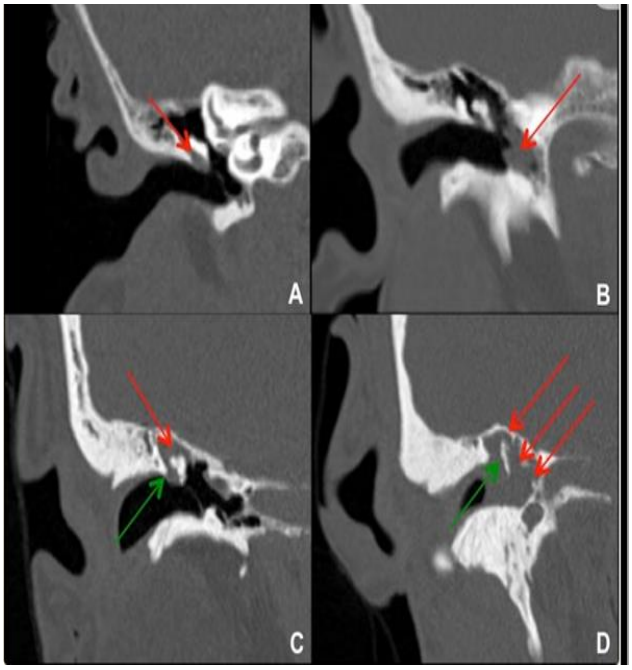

Figure 4 (A-D): Coronal images from temporal bone CTs in four different patients with right cholesteatoma. Small cholesteatoma in Prussak's space (red arrow) without bony erosion. This is a common site for pars flaccida retraction and acquired cholesteatoma formation. Cholesteatoma in the left mesotympanum to hypotympanum (red arrow), which is a less common site. Cholesteatoma in the right epitympanum (red arrow) with blunting or erosion of the right scutum (green arrow). This lesion probably started in Prussak's space adjacent to the bony scutum. Large cholesteatoma in the right epitympanum, mesotympanum, and hypotympanum (red arrows), with bony erosion of the scutum and malleus/ossicles (green arrow). Axial CT through the mesotympanum shows the sinus tympani (yellow arrow) and facial recess (white arrow) which are hidden areas by otological examination and should be carefully inspected on imaging for the presence of soft tissue.

Table 1: Percentage of spread of cholesteatoma in middle ear cleft.

Middle ear cavity	Involvement (%)
Mesotympanum	20
Sinus tympani	15
Facial recess	15
Attic	20
Aditus, antrum and mastoid air cells	30

The 20 patients diagnosed with chronic otitis media (cholesteatoma), who underwent mastoidectomy exploration were included in this study. The main emphasis was to find out the extent and spread of cholesteatoma into the middle ear cleft.

The result of the study showed 50% of cases spread to middle ear cavity (20%-mesotympanum, 15%-sinus tympani, 15%-facial recess), 20% into the attic, 30% into adits, antrum and mastoid air cell system.

DISCUSSION

Cholesteatoma is a common condition predominantly seen in developing countries.

Acquired cholesteatoma is common complication of unsafe/atticoantral type of chronic otitis media. Term cholesteatoma means presence of "skin in wrong place."

The cholesteatomatous sac is lined by stratified squamous epithelium constituting the matrix, which secretes the acellular keratin debris within. An outer perimatrix contains mesenchymal cells which produce proteolytic bone destroying enzymes.[1]

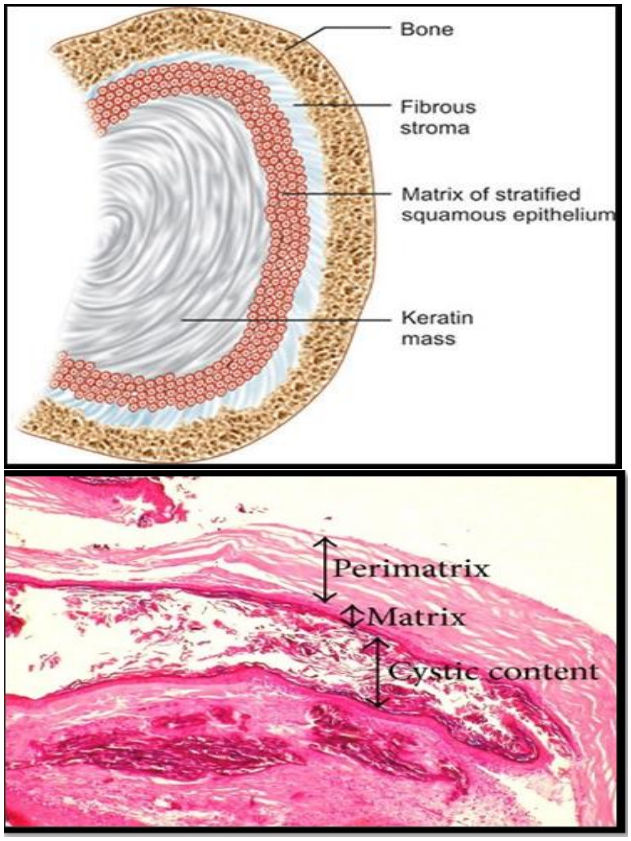

Figure 5: Cholesteatoma matrix shown histologically.

Cholesteatoma can be classified as congenital/acquired.

Acquired is subdivided into primary and secondary acquired cholesteatoma.

HRCT temporal bone is currently advocated in all cases suspected of cholesteatoma clinically prior to surgery for assessment of the extent of disease, complications, and presence of variable anatomy.

Theories regarding formation of acquired cholesteatoma

Various theories exist regarding the formation of cholesteatoma.

Retraction pocket (invagination) theory

Most widely accepted theory, it states that weakest part of the tympanic membrane (TM), i.e., pars flaccida, retracts because of the negative pressure in the middle ear cavity caused by long-standing eustachian tube dysfunction. This leads to formation of posterosuperior attic pockets. Self-cleansing mechanism of these pockets is gradually lost with accumulation of desquamation keratinized epithelial layer of TM and results in formation of keratin debris. Repeated superadded infection occurs and later biofilms are also formed over these debris which make them resistant to any antimicrobial therapy.[4]

Invasion

It is also hypothesized that there is an invasion of the keratinized squamous epithelium into the middle ear cavity through small perforations in pars tensa, which forms cholesteatoma.[5]

Metaplasia

Due to the chronic irritation, the keratinized squamous epithelium is formed from the squamous or cuboidal epithelium of the middle ear.

Basal cell hyperplasia

There is a presence of microscopic defects even in the intact TM, through which epithelial cells can invade. These defects serve as direct contact between connective tissue of the mucoperiosteum with a middle ear space. In later stages, these areas become totally or partially covered with epithelium, and these epithelial breaks become connected to each other through the organization. The cholesteatoma seems to spread by using the connective tissue as scaffolding.[6]

Thus, acquired cholesteatomas can be classified based on the underlying pathogenesis as either "primary" or "secondary" where primary variety is seen behind pars flaccida of an intact retracted TM and the secondary variety grows into the middle ear through a perforated pars tensa part of TM.

Technique of HRCT study

Non-contrast axial scans parallel to the axis of and through the petrous temporal bone are taken on a multidetector CT scanner. Axial scanning is done with helical technique (section thickness 0.6-1 mm) in bone algorithm. Head is kept in neutral position and true axial images parallel to Reid's line (joining inferior margin of the orbit to the center of the orifice of EAC) are taken. Coronal multiplanar reconstruction is made perpendicular to the axial scans.[7]

Clinically, the lesion presents with foul-smelling otorrhea, earache, and hearing loss. On otoscopic examination, it classically appears as a cluster of pearly white structures in the attic region. It is also suspected beneath polyps protruding from the pars flaccida or when there is a marginal TM perforation or granulation tissue.[8,9] Cholesteatoma can be accurately diagnosed by HRCT scan in the vast majority of cases. All our cases exhibited at least one of the radiological features that are associated with cholesteatoma i.e., tissue mass, typical location and bone erosion. Cholesteatoma has a tendency to reside in the hidden areas such as sinus tympani and the anterior epitympanum, knowledge of the disease extent and information on the degree of mastoid pneumatization aid in planning the surgical approach.

CONCLUSION

All of our patients underwent mastoid exploratory surgery, in half of the cases, the cholesteatoma was restricted to middle ear cavity, while in remaining 50% it has extended to attic, aditus, mastoid antrum and mastoid air cells.

Disease clearance was effective with no post-operative complications in first 50%cases while other 50% of cases required extensive surgery for disease clearance.

Complications of cholesteatoma are associated with a high morbidity and can even be life threatening. However the surgical treatment itself is also fraught with risks to many important structures because of the complex anatomy of the temporal bone.

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