

Clinical Profile of Squamosal Chronic Otitis Media among Paediatric and Adult Patients in Rural Population of Central India: A Cross-sectional Study

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ABSTRACT

Introduction: Chronic Otitis Media (COM) is one of the major preventable causes of hearing impairment, especially in children. Hearing loss in children affects speech, language, communication, auditory processing, psychosocial and cognitive development, and academic progress. Since studies addressing and comparing COM in the paediatric and adult population are few and far between, present study attempted to fill this research hiatus.

Aim: To analyse and compare the clinical profile of squamosal COM in paediatric and adult populations.

Materials and Methods: The present cross-sectional study was carried out in the Department of Otorhinolaryngology, Acharya Vinod Bhave Hospital, Sawangi, Wardha, Maharashtra, India, from December 2020 to December 2022. All the selected patients with squamosal COM (active or inactive) in the paediatric age group (0-15 years) and adult age group (16-60 years) was considered in this study. The study included patients (12 patients in adult age group and 14 patients in paediatric age group) and was evaluated based on intraoperative and radiological findings such as grades of retraction pocket, extent of ossicular erosion, extent, and spread of granulation and cholesteatoma, and pneumatization pattern among both age groups were carefully

analysed. Chi-square test (χ^2) of independence was used to compare data between the two groups. A p-value ≤ 0.05 was considered statistically significant.

Results: Erosion of scutum was predominantly noted in 6 (42.9%) paediatric patients. In both age groups, attic perforation were more common than marginal perforation, which was found to be statistically significant (p-value=0.045). Grade 2 Posterosuperior Retraction Pocket (PSRP) in paediatric (2, 14.2%) and Grade 4 PSRP in adults (4, 33.3%) were commonest whereas none of the paediatric patients showed Grade 4 PSRP. This difference in PSRP grade in both age groups was found statistically significant (p-value=0.038). Short process of incus was more frequently involved in 3 (25.0%) paediatric and long process of incus in 6 (60%) adult (p-value=0.040). There was frequent involvement of protympanum in 7 (50%) paediatric patients (p-value=0.035). Diploic pattern of pneumatization was least common in both age groups.

Conclusion: Greater grades of PSRP were found among adult patients. This might be contributed to the longer duration of exposure to disease pathogenesis in adults. One of the vital features in the ossicular involvement is the total absence of incus and malleus more frequently in paediatric patients indicating its extensiveness.

Keywords: Grades of posterior-superior retraction pocket, Ossicular erosion, Pneumatization pattern

INTRODUCTION

Chronic Suppurative Otitis Media (CSOM) is a chronic inflammatory disorder of the middle ear mucosa and mastoid cavity which occurs through a perforated eardrum and often associated with recurrent ear discharge (otorrhoea) [1]. Since COM may occur without otorrhoea, the literature prefers the term COM [2]. COM affects 57% individuals of developing nations. Malnutrition, overcrowding, poor cleanliness, inadequate healthcare, and high rates of upper respiratory tract infections in preschoolers (<five-year-old) make low-income communities vulnerable. Middle ear infections account for over 30% of paediatric clinical visits [3-5]. COM is financially and non financially unsustainable. To reduce disease burden and risk, a better healthcare delivery system is needed. COM is a major cause of preventable hearing loss, especially in children, affecting speech, language, communication, auditory processing, psychosocial and cognitive development, and academic progress [5].

COM can be mucosal or squamosal. Mucosal COM has pars tensa perforation and middle ear irritation or mucopurulent discharge. Retraction of pars flaccida or postero-superior quadrant of pars tensa is related with squamosal COM [1,2]. Although adult and paediatric COM have many similarities in disease progression and pathological alterations, temporal bone architecture, pneumatization, immature

eustachian tube function, and varied illness course distinguish them [6]. Due to pneumatized temporal bone, children disseminate the disease more. Childhood cholesteatoma patients exhibited far greater rates of persistent and recurring disease. Ossicular erosion is more common in children. Since immature eustachian tube function causes numerous middle ear disorders, they are more likely to reoccur after surgery. One of the biggest distinctions between children and adults is their ability to endure intervention [7].

This article analyses the various aspects of squamosal COM in the background of grades of retraction pockets, extent of cholesteatoma and granulation, ossicular involvement and temporal bone pneumatization in paediatric and adult rural population. The studies addressing comparison among paediatric and adult patients are few and far between. This study may help in designing and developing protocol bringing precision in intervention for the management of paediatric and adult patients with COM.

MATERIALS AND METHODS

This cross-sectional study was steered in the Department of ENT, Acharya Vinobha Bhave Rural Hospital, Sawangi (Meghe), Wardha, Maharashtra, India, from December 2020 to December 2022 on patients diagnosed with squamosal COM (active or inactive). The

study has been granted by the ethical committee with Ref. No. DMIMS (DU)/IEC/2020-21/9327 on 22/12/2020.

The study was conducted among 26 patients of which 12 patients were in adult age group and 14 patients in paediatric age group.

Inclusion criteria:

- All patients between the age group of 0-15 years as paediatric population;
- All patients between the age group of 16-60 years as adult population;
- Any gender;
- Patients with active or inactive squamosal COM with cholesteatoma and retraction.

Exclusion criteria:

- Patients with congenital Sensorineural Hearing Loss.
- Patients with known immunodeficiency disorder.
- Patients with cranio-facial anomalies.
- Patients with granulomatous disorder of temporal bone.

Sample size calculation: Minimum sample size required

$$N = \frac{Z_{1-\alpha/2}^2 * p * (1-p)}{D^2}$$

$Z_{1-\alpha/2} = 1.96$ at 5% level of significance

$p =$ prevalence of Squamosal COM = 1.8% [8]

$= 0.014$

$D =$ estimated error (5%)

$N = \{(1.96)^2 * 0.018 * (1 - 0.018)\} / 0.05^2$

$= 26.16$

Study Procedure

All the selected patients included in the study patients were comprehensively and diligently examined as per the proforma. The patients were evaluated with a comprehensive clinical examination of ear, nose and throat, complete blood count and other relevant blood investigations. Specific investigations like Examination of ear Ender Microscope (EUM) was performed to know more about perforated tympanic membrane, cholesteatoma, and retraction pockets.

The type of perforation encountered in squamosal COM can be either attic or marginal type. A marginal perforation is one where the perforation reaches the annulus of the tympanic membrane. An attic perforation is a perforation above the short process of the malleus in the pars flaccida.

A retraction pocket is an invagination of tympanic membrane, is seen in the attic or posterosuperior area of pars tensa. Retraction pockets were graded based on the Toss' Classification. Grade 1 is when dimpling of pars flaccida occurs while when the retraction touches the neck of malleus it is considered as Grade 2. Grade 3 includes features of Grade 2 along with minimal erosion of lateral attic wall (scutum). Grade 4 is complete erosion of scutum. Partial or complete ossicular erosion was observed [8]. In ossicles with partial erosion the part involved was noted such as head of malleus, handle of malleus, short process and long process of incus and stapes suprastructure.

Pure tone audiometry, impedance audiometry and Brainstem Evoked Response Audiometry (BERA) was done for assessment and grading of hearing impairment. High-Resolution Computed Tomography (HRCT) temporal bone to look for pneumatisation patterns such as diploic, cellular and sclerotic types. The associated abnormalities of temporal bone along with any other incidental findings was also noted. A predesigned proforma was used to record the relevant information obtained by clinical examination, specific investigations, and surgical exploration. Type of perforation, grade of retraction pocket, erosion of scutum, status of ossicular

erosion, extent of granulation and cholesteatoma in middle ear and pneumatisation status was noted.

STATISTICAL ANALYSIS

All data were coded, entered and examined using the statistical sequencer of Statistical Package for Social Science (SPSS) version 25.0. The Chi-square (χ^2) test of independence was used to examine and compare the data between the two groups. Differences were considered statistically significant if the p-value was ≤ 0.05 .

RESULTS

In both age groups, attic perforation were more common than marginal perforation, which was found to be statistically significant (p -value=0.045) [Table/Fig-1]. Marginal perforation was seen in a 36-year-old adult [Table/Fig-2].

Clinical findings		Paediatric patients, n (%)	Adult patients, n (%)	χ^2	p-value
Perforation	Marginal	2 (14.3%)	1 (8.3%)	5.724	0.045
	Attic	9 (64.3%)	4 (33.3%)		
Posterior-superior retraction pocket		3 (21.4%)	7 (58.4%)	3.718	0.105 ^{FET}
Thickened tympanic membrane		2 (14.3%)	5 (41.6%)	2.462	0.190 ^{FET}
Tympanosclerotic patch		1 (7.14%)	5 (41.6%)	7.222	0.012 ^{FET}
Erosion of scutum		6 (42.9%)	4 (33.3%)	0.247	0.701 ^{FET}

[Table/Fig-1]: Comparison of clinical findings in Squamosal COM among paediatric and adult age groups.

FET: Fisher's-exact test



[Table/Fig-2]: Otoendoscopy image showing marginal perforation in a 36-year-old male patient.

In the current study, in 3 (21.3%) out of 14 paediatric patients, retraction pocket was observed, in which Grade 2 retraction was seen in 2 (14.2%) and Grade 3 retraction in 1 (7.1%) [Table/Fig-3].

PSRP	Paediatric, n (%)	Adult, n (%)	χ^2	p-value
Grade 1	0	0	6.803	0.038
Grade 2	2 (14.2)	1 (8.3)		
Grade 3	1 (7.1)	2 (16.6)		
Grade 4	0	4 (33.3)		
Total PSRP	3 (21.3)	7 (58.3)		

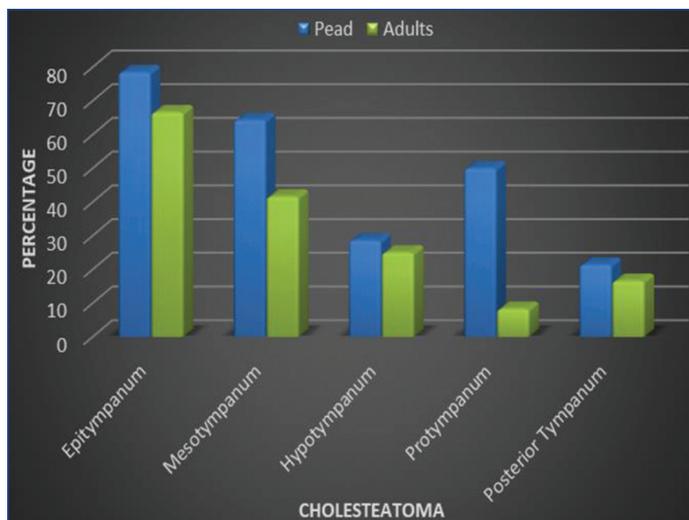
[Table/Fig-3]: PSRP in squamosal COM among paediatric and adult patients.

Granulations were noted in 6 (35.7%) of paediatric patients and nine (75.0%) adult patients [Table/Fig-4]. Cholesteatoma was observed in eight paediatric patients [Table/Fig-5]. Short process of incus was more frequently involved in 3 (25%) paediatric and long process of incus in 6 (60%) adult (p -value=0.040) [Table/Fig-6].

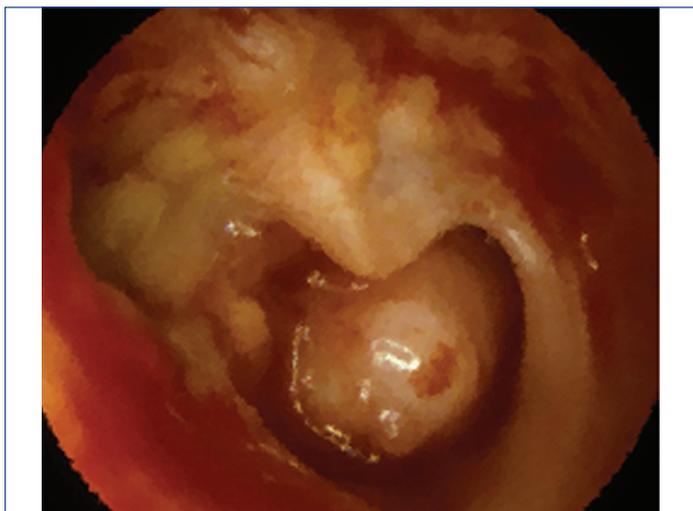
11 (78.5%) paediatric and eight (66.6%) of adults had epitympanum involvement. Mesotympanum was found to be involved nine (64.3%) of paediatric and five (41.6%) of adult groups. Involvement

Intraoperative findings		Paediatric, n (%)	Adult, n (%)	χ^2	p-value
Ossicular erosion		12 (85.7)	10 (83.3)	0.028	1.00 ^{FET}
Middle Ear Mucosa	Pale pink	3 (21.4)	3 (25.0)	1.843	0.606
	Congestion	3 (21.4)	5 (41.6)		
	Oedematous	3 (21.4)	2 (16.7)		
	Polypoidal	5 (35.7)	2 (16.7)		
Cholesteatoma		8 (57.1)	6 (50.0)	0.132	1.00 ^{FET}
Granulation		6 (42.85)	9 (75.0)	5.012	0.041 ^{FET}
Facial Nerve Dehiscence		2 (14.3)	1 (8.3)	0.224	1.00 ^{FET}
Polyp		4 (28.57)	2 (16.6)	1.191	0.391 ^{FET}

[Table/Fig-4]: Intraoperative findings in squamosal COM among paediatric and adult age groups.
FET: Fisher's-exact test



[Table/Fig-7]: Extent of cholesteatoma and granulations in squamosal COM.



[Table/Fig-5]: Otoendoscopy image showing cholesteatoma in an eight-year-old male patient.

Mastoid pneumatisation pattern	Paediatric patients, n (%)	Adult patients, n (%)	χ^2	p-value
Diploic	1 (7.1)	2 (16.6)	5.021	0.033
Sclerosed	4 (28.6)	7 (58.4)		
Cellular	9 (64.3)	3 (25.0)		

[Table/Fig-8]: Comparison of mastoid pneumatisation pattern in squamosal COM patients.

K et al., in which attic perforation in 72% patients and marginal perforation in 6% patients endorses present study findings [10]. PSRP were found to be 3 (21.4%) among paediatric and 7 (58.4%) among adults. Shwetha observed retraction pocket in 12% patients [9]. Thickened tympanic membrane in 2 (14.3%) and 5 (41.6%) of paediatric and adult patients respectively and erosion of scutum in 6 (42.9%) paediatric and 4 (33.3%) adult patients was noted. Since no study is available wherein comparison in paediatric and adult has been done authors were unable to compare and conclude.

Grades of PSRP: Maximum number of adult patients had Grade 4 retraction pocket (p-value=0.038) in present study, which was in contrast to observations of Charachon R et al., where no PSRP was found [11]. Longevity of the disease process in adult might be a reason for greater grade of retraction in comparison to the paediatric patients.

Intraoperative squamosal COM findings: A study done by Shwetha and Singh P et al., found ossicular erosion as the commonest intraoperative finding [9,12]. In yet another study by Sharma K et al., ossicular erosions (78%), granulations (50%) and cholesteatoma (42.9%) and hyperplastic polypoidal (28.6%) mucosa in the attic variant, were the common findings on exploration [10]. Akin to the observation of above study, present study observed hyperplastic polypoidal mucosa in 5 (35.7%) paediatric and 2 (16.7%) adult patients. Most of the findings were consistent with present study, ossicular erosion, granulation and cholesteatoma are major findings in descending order of frequency in adult patients. Thus, the observation that presence of granulation tissue is more frequently seen in adults was statistically significant (p-value=0.035).

Extent of ossicular erosion: One of the noteworthy features in ossicular involvement is the frequent involvement of malleus in 10 (83.4%) paediatric patients as compared to 5 (50%) adult patients. Absence of malleus in 7 (58.3%) paediatric patients was more frequent than in 3 (30%) adult patients. This difference was found to be statistically significant (p-value=0.029). Some of the studies like Sharma K et al., Singh P et al., Rashid Sheikh HH et al., Sharma RS and Kumar S and Varshney S et al., showed incus to be the most eroded ossicle [10,12-15]. Since studies comparing paediatric and adult patients are few so authors were not able to comment further.

Ossicular involvement		Paediatric patients (n=12, n (%))	Adult patients (n=10, n (%))	χ^2	p-value
Malleus	Head	2 (16.6)	2 (20.0)	3.734	0.029
	Handle of malleus	1 (8.3)	0		
	Absent	7 (58.3)	3 (30.0)		
Incus	Short process	3 (25.0)	0	8.276	0.040
	Long process	1 (8.3)	6 (60.0)		
	Absent	7 (58.3)	4 (40.0)		
Stapes	Superstructure	3 (25.0)	3 (30.0)	0.892	0.640
	Absent	1 (8.3)	0		
Total		12	10		

[Table/Fig-6]: Distribution of ossicular involvement in squamosal COM. Absent ossicle means complete absence of the ossicle and more than one ossicular involvement was observed in few patients

of hypotympanum and protympanum was four (28.6%) and seven (50.0%) of paediatric patients, respectively and three (25.0%) and one (8.3%) of adult patients, respectively [Table/Fig-7]. Another notable observation about spread of cholesteatoma and granulation was the frequent involvement of protympanum in paediatric patients (p-value=0.035). Mastoid pneumatisation pattern was evaluated on HRCT temporal bone in both adult and paediatric patients. Diploic pattern of pneumatisation was least common in both age groups [Table/Fig-8].

DISCUSSION

Clinical findings in squamosal COM: In both paediatric and adult patients in this study attic perforation was major finding while marginal perforation was less frequently observed. A study by Shwetha revealed attic perforation in 51% patients and marginal perforation in 30% [9]. In yet another study carried out by Sharma

When compared to other studies:

- Handle of malleus seems to be involved majorly in other studies [10,14,15] whereas in present study complete involvement of malleus was a common finding in both the groups.
- The long process of the incus was the most commonly involved ossicle in COM as per various studies mentioned above as well as in present study.

Extent of cholesteatoma and granulations in squamosal COM:

The spread of cholesteatoma involvement of epitympanum was observed in 11 (78.5%) paediatric and 8 (66.7%) adult patients. In a study by Rosito LS et al., conducted in Brazil found epitympanic cholesteatoma more prevalent in adults (40.8%), whereas retrotympanic cholesteatoma (43.0%), more prevalent in children [16]. In one of the studies by Shwetha, also found involvement of epitympanum to be the most frequent followed by mesotympanum for the extent and spread of cholesteatoma [9].

Pneumatisation pattern of mastoid in COM: In 14 paediatric patients, cellular mastoid in 9 (64.3%), sclerosed in 4 (28.6%), and diploic in 1 (7.1%) were observed whereas among 12 adult patients, 7 (58.4%) sclerosed, 3 (25%) cellular and 2 (16.6%) diploic were observed. Sclerosed mastoid was found in large number of adult patients whereas cellular pattern was frequently noted in paediatric patients. Diploic pattern of pneumatisation was least common on HRCT scan of temporal bone among both age groups. Similar findings were observed in studies by Khan FQ et al., (50%), Rai T (50%), Sunitha M et al., (53.7%), Kanotra S et al., (100%), and Datta G et al., (96%) showed presence of sclerotic mastoid in majority of patients [17-21].

Limitation(s)

Histopathological correlation was not done and postsurgery long-term follow-up was not studied.

CONCLUSION(S)

Erosion of scutum, Grade 2 PSRP, presence of cholesteatoma, polyp and polypoidal middle ear mucosa, involvement of protympanum and erosion of short process of incus were found to be more frequent in paediatric patients. Among adult patients, Grade 4 PSRP, presence of granulation tissue and erosion of long process of incus were more common. However, some features were found common in both age groups. Predominant presence of attic perforation over marginal perforation, involvement of incus and diploic pneumatisation pattern were seen in both group of patients.

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