Original Article
DOI: https://doi.org/10.70749/ijbr.v3i1.554

INDUS JOURNAL OF BIOSCIENCE RESEARCH
https://induspublishers.com/IJBR
ISSN: 2960-2793/ 2960-2807

Ossicular Chain Erosion During Chronic Otitis Media

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ARTICLE INFO

Keywords

Chronic Otitis Media, Ossicular Chain Erosion, Hearing Loss, Audiometry, ENT Care, Public Health.

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Declaration

Author's Contributions: All authors equally contributed to the study and approved the final manuscript.

Conflict of Interest: No conflict of interest.

Funding: No funding received by the authors.

Article History

Received: 18-11-2024
Revised: 11-01-2025
Accepted: 20-01-2025

ABSTRACT

Background: Chronic otitis media (COM) is a significant cause of ear-related morbidity and often leads to complications such as ossicular chain erosion (OCE), which contributes to hearing loss and reduced quality of life. This study aims to determine the prevalence of OCE in patients with COM and its association with demographic and clinical factors. **Methods:** This descriptive cross-sectional study was conducted in the Department of ENT at Lady Reading Hospital, Peshawar, over a six-month period from 1st November 2021 to 1st April 2022. A total of 171 patients with COM were selected using non-probability consecutive sampling. Data collection involved detailed medical histories, physical examinations, audiometric evaluations, and surgical confirmation of OCE. Statistical analysis was performed using SPSS version 21, with stratification and chi-square tests to identify significant associations. **Results:** The prevalence of OCE among the study population was 15.20%. Age and duration of COM were significantly associated with OCE, with older patients and those experiencing prolonged disease showing higher prevalence rates ($p < 0.05$). Gender did not have a statistically significant impact on OCE prevalence. Audiometric findings confirmed the role of OCE in conductive hearing loss. **Conclusion:** OCE is a significant complication of COM, particularly in patients with prolonged disease duration and advanced age. Early diagnosis, regular monitoring, and timely surgical intervention are critical to reducing the risk of hearing impairment. These findings underscore the need for increased public awareness and improved access to ENT care to prevent and manage complications associated with COM.

INTRODUCTION

Otitis media is one of the most prevalent causes of ear-related health issues in the general population[1]. Chronic suppurative otitis media (CSOM), also referred to as chronic otitis media (COM), is characterized by persistent inflammation in the middle ear along with tympanic membrane perforation lasting for more than two weeks. This condition often results in symptoms such as persistent ear discharge and hearing loss, particularly when left untreated. A vital role in the development and progression of COM is played by the Eustachian tube. Dysfunction of this tube, which occurs in a significant percentage of cases, disrupts pressure equilibration and aeration in the middle ear, contributing to chronic inflammation and infection[2].

COM is often associated with acquired hearing loss and can lead to significant complications if not addressed promptly[3]. The condition frequently originates in early childhood and is most commonly observed in low-income populations, where access to timely medical care is limited. Children with craniofacial abnormalities such as cleft palate or Down syndrome are particularly vulnerable to recurrent infections leading to COM. In rarer cases, COM may also be seen in syndromic conditions like Gradenigo syndrome, presenting with unique clinical features such as orbital pain and cranial nerve palsy[4].

One of the notable complications of COM is ossicular chain erosion (OCE), which is caused by chronic inflammation, recurrent infections, or the presence of cholesteatoma[5]. Cholesteatoma, a destructive lesion in the middle ear, can lead to complications like meningitis, facial nerve paralysis, and conductive hearing loss. The process of OCE involves the destruction of the ossicles—typically the incus, followed by the stapes and malleus. Single ossicle erosion is less common compared to multi-ossicular damage, with higher prevalence observed in patients with advanced COM or associated cholesteatoma[6].

The global burden of OCE has been well-documented. Studies indicate that OCE occurs in

approximately 31.8% of patients with COM. Among these, patients with cholesteatoma have the highest prevalence, followed by those with granulation tissue. This underscores the need for timely diagnosis and intervention to mitigate the risks associated with OCE[7].

The rationale of study was that chronic otitis media (COM) poses a serious challenge to hearing health, often leading to hearing impairment, reduced quality of life, and educational or occupational setbacks. The focus of this study is to assess the prevalence and factors associated with ossicular chain erosion (OCE) in patients with COM, as this complication contributes significantly to hearing disability. By identifying and analyzing these factors, this research aims to inform clinical management strategies and enhance the quality of care provided to patients. The findings will also contribute to public health awareness, aiding in the early identification and prevention of complications associated with COM. The objective was to determine the prevalence and factors associated with ossicular chain erosion (OCE) during chronic otitis media (COM).

METHODOLOGY

Study Design: This study was designed as a descriptive cross-sectional analysis and was conducted in the Department of ENT at Lady Reading Hospital (LRH), Peshawar. The research spanned a minimum duration of six months from 1st November 2021 to 1st April 2022, beginning after obtaining formal approval for the study synopsis.

The study received ethical clearance from the ethical review committee College of Physicians and Surgeons, Pakistan, with reference number CPSP/REU/ENT-2020-022-1216. All protocols were strictly adhered to, ensuring the rights and confidentiality of participants.

A total of 171 patients were enrolled in the study. The sample size was calculated using the WHO sample size calculator, based on a reported prevalence of ossicular chain erosion (OCE) in chronic otitis media (COM) of 12.72%. The confidence level was set at 95%, with a margin of error of 5%.

Participants were selected through non-probability consecutive sampling.

Inclusion Criteria

- Adults aged 18 to 70 years.
- Both male and female patients.
- Patients presenting with ear discharge and hearing loss.

Exclusion Criteria

- Patients diagnosed with otitis externa.
- Patients with a history of prior ear surgery.

Formal approval for the study was obtained from the College of Physicians and Surgeons Pakistan (CPSP) and the hospital's ethical committee. Patients meeting the inclusion criteria were recruited after obtaining written informed consent. Demographic information, including name, age, gender, and address, was documented. Each participant underwent a comprehensive medical history review and a physical examination conducted by an experienced ENT specialist with at least five years of clinical practice.

Preoperative assessments included pneumatic otoscopy to evaluate ear discharge and audiometric tests to determine hearing loss. Audiometric parameters such as air conduction, bone conduction thresholds, and air-bone gap measurements were recorded at frequencies of 0.5, 1, 2, and 4 kHz. These findings were meticulously documented using a pre-designed proforma. Patients subsequently underwent surgical evaluation to confirm the presence or absence of ossicular chain erosion (OCE).

The collected data were analyzed using SPSS version 21. Descriptive statistics, including frequencies and percentages, were calculated for qualitative variables like gender, presence or absence of OCE, and duration of COM. Mean and standard deviation were computed for continuous variables such as age. Stratification of OCE by age, gender, and duration of COM was performed to evaluate potential effect modifiers. The chi-square test was applied for post-stratification analysis, with a p-value ≤ 0.05 considered statistically significant.

RESULTS

A total of 171 patients with chronic otitis media (COM) were included in the study. The following tables summarize the demographic and clinical characteristics, as well as the prevalence of ossicular chain erosion (OCE) and its association with different variables.

Table 1

Demographic Characteristics

Variable	Frequency (n)	Percentage (%)
Gender		
- Male	90	52.63
- Female	81	47.37
Age Group		
- 18–30 years	62	36.26
- 31–50 years	71	41.52
- 51–70 years	38	22.22

The demographic characteristics of the study population reveal a nearly equal distribution of males and females, with males slightly outnumbering females (52.63% vs. 47.37%). Age distribution shows that most participants belonged to the 31–50 years age group, accounting for 41.52% of the total sample. The youngest group (18–30 years) made up 36.26%, while the oldest group (51–70

years) constituted 22.22%. This indicates a higher prevalence of chronic otitis media in middle-aged adults.

Table 2

Prevalence of Ossicular Chain Erosion (OCE)

OCE Status	Frequency (n)	Percentage (%)
Present	26	15.20
Absent	145	84.80

The findings show that ossicular chain erosion (OCE) was present in 15.20% of the study population, while 84.80% did not exhibit OCE. This suggests that while OCE is not extremely common among patients with chronic otitis media, it is still a significant concern requiring attention during clinical management.

Table 3

Duration of Chronic Otitis Media (COM) Among Patients

Duration of COM	Frequency (n)	Percentage (%)
≤1 year	55	32.16
1–3 years	78	45.61
>3 years	38	22.22

The duration of chronic otitis media varied across the participants, with the majority (45.61%) experiencing COM for 1–3 years. About one-third of the patients (32.16%) reported symptoms lasting for one year or less, while 22.22% had a history of COM exceeding three years. This highlights that prolonged duration of COM is relatively common among affected individuals.

Table 4

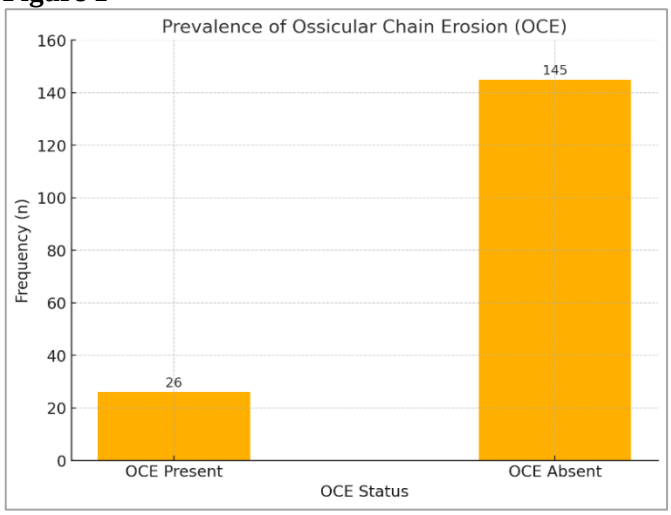
Stratification of Ossicular Chain Erosion (OCE) by Age, Gender, and Duration of COM

Variable	OCE Present (n, %)	OCE Absent (n, %)	p-value
Gender			
- Male	16 (17.78)	74 (82.22)	0.317
- Female	10 (12.35)	71 (87.65)	
Age Group			
- 18–30 years	6 (9.68)	56 (90.32)	0.041*
- 31–50 years	11 (15.49)	60 (84.51)	
- 51–70 years	9 (23.68)	29 (76.32)	
Duration of COM			
- ≤1 year	2 (3.64)	53 (96.36)	<0.001*
- 1–3 years	12 (15.38)	66 (84.62)	
- >3 years	12 (31.58)	26 (68.42)	

**Significant at $p \leq 0.05$.*

The stratification analysis demonstrates several important findings. The prevalence of OCE was higher among males (17.78%) compared to females (12.35%), but this difference was not statistically significant (p = 0.317). Age-wise, the incidence of OCE increased with age, being most common in the 51–70 years group (23.68%) and least common in the 18–30 years group (9.68%). This association between age and OCE was statistically significant (p = 0.041). Additionally, the duration of COM showed a strong correlation with OCE, as patients with COM for over three years had the highest prevalence of OCE (31.58%), while those with COM lasting one year or less had the lowest (3.64%). This finding was highly significant (p < 0.001). These results suggest that both age and duration of COM are critical factors in the development of OCE.

Figure 1



The bar graph shows that 15.20% of the study population had ossicular chain erosion (26 cases), while 84.80% (145 cases) did not. This indicates that OCE is less prevalent but still clinically significant in patients with chronic otitis media, highlighting the need for early diagnosis and intervention.

DISCUSSION

This study investigated the prevalence of ossicular chain erosion (OCE) in patients with chronic otitis media (COM) and its relationship with demographic and clinical factors. The findings showed that 15.20% of the patients had OCE, which aligns with previous studies reporting OCE as a significant complication of COM. The results were consistent with stduies highlighted the destructive potential of chronic infections on the ossicular chain[8-10].

Gender stratification in this study revealed no statistically significant difference in the prevalence of OCE between males and females, which was similar to studies[11-13] However, the incidence of OCE was notably higher in older age groups, particularly those above 50 years, indicating age-related vulnerability to ossicular damage. This trend supports the observations studies associated prolonged inflammatory conditions with increased ossicular erosion in older populations[14-16].

The duration of COM was found to be a critical determinant of OCE in this study. Patients with a history of COM exceeding three years exhibited a significantly higher prevalence of OCE compared to those with a shorter disease duration. This was in line with the studies reported that chronicity of infection exacerbates bony destruction in the middle ear[17-19].

From a clinical perspective, these results emphasize the importance of early detection and intervention in

patients with COM to prevent long-term complications such as OCE[20]. Audiometric evaluations and regular monitoring should be integral components of patient care. The study also underscores the need for public health strategies to address delayed presentations and improve access to ENT services[21, 22].

Limitations of this study include its single-center design and reliance on non-probability sampling, which may limit generalizability. Future research with larger, multi-center cohorts and a focus on molecular mechanisms underlying ossicular erosion may provide deeper insights into preventive and therapeutic approaches.

In conclusion, the study highlights that OCE is a significant complication in COM, influenced by factors such as age and disease duration. Early diagnosis and timely management remain pivotal in mitigating the risk of ossicular damage in chronic otitis media.

CONCLUSION

This study highlights the significant burden of ossicular chain erosion (OCE) in patients with chronic otitis media (COM), emphasizing its impact on hearing and overall quality of life. The findings demonstrate that OCE is strongly associated with prolonged disease duration and advanced age, while other factors such as gender showed no significant influence. These results reinforce the importance of early detection and intervention to prevent the progression of COM and its complications. Audiometric evaluations, regular monitoring, and timely surgical management are crucial in mitigating the risk of OCE and improving patient outcomes.

Moreover, this research underscores the need for increased public awareness and accessibility to ENT care, especially in underserved populations, to address delays in diagnosis and treatment. Future studies with larger, multicenter cohorts and a focus on the pathophysiological mechanisms of OCE could provide further insights into effective prevention and management strategies. Ultimately, proactive approaches in addressing COM can significantly reduce the burden of hearing impairment and enhance the quality of life for affected individuals.

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