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Epidemiology and Microbiological Profile of Chronic Suppurative Otitis Media in India - A Narrative Review

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Abstract

Background: Chronic Suppurative Otitis media (CSOM) is a major cause of preventable hearing loss in low- and middle-income countries and remains highly prevalent in India, particularly among children and young adults from socioeconomically disadvantaged and rural communities.

Objective: To synthesize current evidence on the epidemiology, clinical profile, microbiology, and antimicrobial resistance patterns of CSOM in India, and to highlight implications for public health and clinical practice.

Methods: A narrative review of Indian studies was conducted by searching Pub Med and major Indian Otorhinolaryngology and public health journals for CSOM-related articles focusing on prevalence, clinico - epidemiology, microbial spectrum, and complications, with particular attention to studies from tertiary care centres and community settings.

Results: Indian data consistently indicate a CSOM prevalence of around 4–5% in community surveys, with higher burden in rural populations and among children from lower socioeconomic strata. Most patients present with conductive hearing loss and central (tubo tympanic, "safe") perforations, though atticoantral ("unsafe") disease and serious intracranial complications persist. The predominant bacterial pathogens are Pseudomonas aeruginosa and Staphylococcus aureus, accompanied by Gram-negative bacilli and an increasingly recognized contribution of fungal organisms such as Aspergillus and Candida, especially in Immuno compromised hosts and those with prior broad-spectrum antibiotic exposure. Several reports document rising multidrug resistance, particularly among S. aureus and P. aeruginosa, complicating empirical therapy and underscoring the need for local surveillance.

Conclusion: CSOM in India remains a significant public health problem, concentrated in rural, low - income communities and associated with substantial hearing morbidity. Strengthening primary prevention, improving living conditions, rationalizing antibiotic use, and ensuring access to timely ENT care and appropriate surgical intervention are critical to reducing CSOM-related disability.

Keywords: Chronic Suppurative Otitis Media, Epidemiology, Microbiology, Antimicrobial Resistance, Hearing Loss.

Introduction

Chronic Suppurative Otitis media (CSOM) is typically defined as a long-standing infection of the middle ear cleft characterized by persistent ear discharge through a permanent tympanic membrane perforation.[1]

The condition often begins in childhood, leads to progressive conductive hearing loss, and can result in serious complications, including intracranial infection, particularly where access to timely otologic care is limited. [2]

Globally, chronic Suppurative Otitis media (CSOM) disproportionately affects populations in low- and middle-income countries. Factors such as overcrowding, poor hygiene, malnutrition, recurrent upper-respiratory infections, inadequate healthcare access, and delayed treatment contribute to its occurrence. India has traditionally been classified as a high-prevalence country for CSOM, with reported national average estimates of approximately 4 - 5% - although prevalence varies substantially by population, geographical area, age group, and diagnostic definition.

CSOM is an important cause of preventable hearing impairment and may adversely affect communication, educational performance, employment, and social participation.[3] This narrative review synthesizes available Indian evidence on the epidemiology and clinico - microbiological profile of CSOM, highlighting the burden in community and hospital settings, common pathogens and resistance trends, and key risk factors. The aim is to inform ENT clinicians and public health practitioners regarding current patterns and gaps, and to support development of context - appropriate preventive and therapeutic strategies.

Methods

Literature search strategy

A narrative review approach was adopted to capture the breadth of Indian CSOM research across Otorhinolaryngology and public health domains. Electronic searches were performed in Pub Med and key Indian journals, including Indian Journal of Otology, Indian Journal of Otolaryngology and Head and Neck Surgery, and regional Otorhinolaryngology journals, using combinations of the terms “chronic Suppurative Otitis media”, “CSOM”, “India”, “prevalence”, “micro biology”, “antibiotic resistance”, and “complications”.

Additional sources were identified from reference lists of relevant articles, institutional reports, and teaching materials describing CSOM classification and pathophysiology.

- The review primarily considered studies from India that reported

1. Prevalence or clinico - epidemiological data
2. Microbiological findings and sensitivity profiles
3. Fungal flora in CSOM
4. Otogenic intracranial complications attributed to CSOM.

Study selection and data extraction

Eligible studies included cross - sectional community surveys, prospective or retrospective hospital-based clinico - epidemiological analyses, microbiological and mycological investigations, and observational reports on CSOM-related complications. Data extracted from each study comprised setting and sample characteristics, type of CSOM (tubotympanic vs atticoantral), prevalence estimates, socio-demographic correlates, clinical presentation, microbiological spectrum, antifungal and

antibacterial susceptibility, and reported complications. Given heterogeneity, formal Meta-Analyses was not attempted; instead, findings were summarized descriptively.

CSOM Classification and Clinical Features

CSOM is commonly divided into tubotympanic ("safe") and atticoantral ("unsafe") types based on anatomical involvement and risk of complications. [4] Tubotympanic disease is confined to the mucosa of the middle ear, generally associated with central perforation and relatively lower risk of bone erosion and serious complications. In contrast, atticoantral CSOM is typically associated with attic or marginal perforations, cholesteatoma or granulations, and carries a higher risk of bone destruction and intracranial spread. [5]

Clinically, patients with CSOM present with ear discharge (otorrhoea), varying degrees of hearing loss, and, in some cases, associated nasal or nasopharyngeal complaints such as nasal obstruction, postnasal drip, or headache.[6] Pure tone audio metry in Indian series has demonstrated predominantly conductive hearing loss, with smaller proportions exhibiting mixed loss or normal hearing at presentation. Understanding these clinical patterns is essential for triaging patients in resource-limited settings and prioritizing those at risk of complications.[6]

Epidemiology and Burden of CSOM in India

Community - based cross - sectional surveys among schoolchildren in Muzaffarnagar, Uttar Pradesh, provide insight into CSOM prevalence in rural and urban populations. In one study of 2158 children aged 5–15 years, the overall prevalence of CSOM was higher in rural schools (5.11%) compared with urban schools (2.32%), reflecting differential exposure to environ mental and socioeconomic risk factors. Most children had tubotympanic disease, and active CSOM was present in around one - third of cases, while the remainder had inactive disease.[7]

Clinico - epidemiological studies at tertiary centres similarly report that CSOM predominantly affects younger individuals, with mean ages in the second and third decades, and a slight male preponderance. [8] In a series of 200 CSOM patients at Jawaharlal Nehru Medical College, Aligarh, 60.5% of cases were from rural backgrounds, nearly one - quarter were illiterate, and most belonged to the lower-middle or lower socioeconomic groups according to Kuppuswamy classification. These findings underscore CSOM's strong association with poverty, overcrowded living conditions, and limited access to preventive and curative ENT services. [9]

Teaching materials and institutional guidelines further emphasize that in India, up to 5% of the total population may have a discharging ear at any given time, making CSOM one of the most common causes of preventable deafness nationally.[10] The public health burden is therefore substantial, particularly considering the impact on language development and school performance in children.[10]

Clinical and Audio Logical Profile

In the Aligarh clinico - epidemiological series, conductive hearing loss was documented in approximately three - quarters of CSOM patients, with mixed hearing loss in about 15% and no demonstrable loss in fewer than 10%. (9) These patterns were broadly similar between safe (mucosal) and unsafe (squamous) types, suggesting that hearing impairment is pervasive across CSOM subtypes.[9]

Community - based surveys among schoolchildren also highlight the association between CSOM and

educational disadvantage, with many affected children living in homes with smoking fathers, indoor cooking with kerosene oil, and unhygienic ear cleaning practices.[10] Such exposures may contribute to recurrent upper respiratory tract infections and chronic tonsillitis, both recognized risk factors for CSOM. Timely identification of conductive hearing loss through school screening and audio Metry could facilitate early referral and intervention, mitigating long - term disability.[10]

Microbiological Spectrum of CSOM

Bacterial flora

Multiple Indian studies have delineated the bacterial spectrum of active mucosal CSOM, consistently identifying Pseudomonas aeruginosa and Staphylococcus aureus as predominant pathogens.

A microbiological review synthesizing data from Indian centres reported that P. aeruginosa and S. aureus are the most frequent isolates, with additional contributions from Klebsiella, Proteus, Escherichia coli, anaerobic organisms such as Bacteroides fragilis and Prevotella, and occasional yeast and mould species.[11]

A prospective observational study from Idukki district, Kerala, involving 137 patients with active mucosal CSOM found microbial growth in 94.1% of cases, with aerobic bacteria in 83.5%, anaerobes in 6.25%, and fungi in 7%. In this cohort, P. aeruginosa accounted for approximately 39.8% of isolates, and S. aureus for 31.2%, reinforcing their dominant role in CSOM etiology. [11,12] The high prevalence of these organisms reflects the moist, nutrient-rich environment of the chronically discharging middle ear and the frequent use of topical and systemic antimicrobials.[12]

Fungal flora

Fungal involvement in CSOM has gained increased attention, particularly in the context of widespread broad-spectrum antibiotic use and corticosteroid-containing ear drops. In a prospective study from a tertiary hospital in Bangalore, 150 ear swabs from CSOM patients were examined, and fungal culture was positive in 32% of samples. Aspergillus species were isolated in the majority (40 cases), with Candida identified in a minority (8 cases), and over half of fungal cases occurred in Immunocompromised patients.[12,13]

These findings suggest that clinicians must maintain a high index of suspicion for fungal infection in patients with persistent otorrhoea despite adequate antibacterial therapy, particularly in those with diabetes, Immunosuppression, or prolonged topical steroid exposure. Routine consideration of mycological culture in recalcitrant CSOM may improve diagnostic precision and guide appropriate antifungal therapy.[3,13,14]

Antimicrobial Resistance Patterns

The microbiological review of CSOM in India highlights troubling trends in antimicrobial resistance among common pathogens. For P. aeruginosa, colistin and polymyxin B were reported as the most effective antibiotics, with near 100% sensitivity in several series, while carbapenems also retained good activity, but commonly used agents such as piperacillin–tazobactam, amikacin, gentamicin, ceftazidime, and ciprofloxacin showed declining sensitivity.[3]

In the Idukki study, P. aeruginosa demonstrated highest susceptibility to piperacillin–tazobactam and greatest resistance to ampicillin, whereas S. aureus showed highest susceptibility to gentamicin and marked resistance to ampicillin and ceftriaxone. Across studies, vancomycin and line zolid maintained ≥90% activity against S. aureus, including methicillin-resistant strains, while amino glycosides and fluoroquinolones displayed variable resistance profiles.[11]

The increasing prevalence of multi drug - resistant organisms in CSOM is attributed to irrational and prolonged use of empirical antibiotics without culture guidance, limited surveillance, and suboptimal patient adherence. These patterns underscore the need for routine culture and sensitivity testing in active CSOM, judicious antibiotic stewardship, and periodic local antibiogram updates to inform empirical treatment protocols.[11,12]

Risk Factors and Socio-demographic Correlates

Indian studies have consistently linked CSOM with markers of socioeconomic deprivation and adverse environmental exposures. In the Muzaffarnagar school survey, a substantial proportion of CSOM cases were associated with lower socioeconomic status, crowded housing, presence of smoking fathers, indoor cooking with kerosene, and unhygienic ear cleaning practices.[7] Additionally, recurrent upper respiratory infections, chronic tonsillitis, and adenoid hypertrophy were common co morbidities among affected children.

The Aligarh hospital - based study similarly demonstrated that most CSOM patients originated from rural areas, had limited formal education, and belonged to lower or lower - middle socioeconomic classes. Poor access to primary ENT services, lack of awareness regarding early symptoms, and cultural practices such as self-medication or use of non - sterile implements for ear cleaning may further exacerbate risk. Targeted health education campaigns and environmental improvements are therefore critical components of CSOM prevention strategies.[15]

Sinonasal and Nasopharyngeal Associations

A prospective study from a tertiary centre in Gujarat explored sinonasal and nasopharyngeal pathology among 130 patients with chronic Otitis media, aiming to compare microbiological flora of the diseased ear and nasopharynx. Nasal complaints such as obstruction, postnasal drip, nasal discharge, sneezing, snoring, and headache were common, though approximately one - quarter of patients reported no nasal symptoms. Bilateral ear examination and pure tone audio metry confirmed hearing impairment, and nasopharyngeal swabs were collected using sterile technique.[16]

The comparative analysis revealed a statistically significant correlation between ear and nasopharyngeal microbial profiles, with a high proportion of swabs from both sites reported as sterile.[16] These findings support the concept that chronic Otitis media may be influenced by sinonasal and nasopharyngeal conditions, such as chronic rhino sinusitis and adenoid hypertrophy, which alter Eustachian tube function and middle ear ventilation.[17]Integrated management of upper airway pathology could therefore contribute to CSOM control. [17]

Complications of CSOM

Despite advances in medical and surgical management, otogenic intracranial complications of CSOM remain a concern in developing countries. A prospective study from Gwalior evaluated 30 patients with intracranial complications due to chronic Otitis media, documenting meningitis as the commonest presentation, along with associated extra cranial complications such as post aural abscess, facial nerve palsy, and labyrinthitis.[18]

The authors emphasized that signs and symptoms of intracranial spread are often subtle until late in the disease course, necessitating a high index of suspicion to avoid diagnostic delay and reduce morbidity and mortality.

Atticoantral CSOM with cholesteatoma is particularly prone to bone erosion and intracranial extension, and

timely surgical intervention (e.g., mastoidectomy) remains crucial. From a public health perspective, strengthening referral pathways and surgical capacity in district and regional hospitals is essential to managing such complications.[18,19]

Public Health and Clinical Implications

The reviewed evidence confirms that CSOM in India is concentrated among children and young adults living in rural, low - income settings and is closely tied to modifiable risk factors such as overcrowding, indoor air pollution, poor hygiene, and recurrent upper respiratory infections. Addressing these determinants through improved housing, reduced household smoke exposure, promotion of hygienic ear care practices, and enhanced access to early treatment for acute Otitis media could significantly lower CSOM incidence.[7]

At the clinical level, regular otologic screening in schools and primary health centres, combined with basic audiometric assessment, can identify children with conductive hearing loss and CSOM at a stage amenable to medical or surgical intervention.

ENT services should prioritize culture-guided therapy for active CSOM, adopt local anti-bio grams to inform empirical choices, and maintain vigilance for fungal and multidrug-resistant infections. Strengthening training of primary care providers in recognizing early otologic symptoms and encouraging prompt referral can further reduce the burden of preventable hearing disability.

Limitations of the Evidence

The available Indian literature on CSOM, while informative, has several limitations. Many studies are single - centre, hospital-based series with limited sample sizes, which may not fully represent community patterns across diverse regions. Community surveys are relatively few and often restricted to school-aged children, leaving gaps in understanding adult CSOM epidemiology.

Moreover, heterogeneity in diagnostic criteria, classification schemes, and microbiological methodologies makes direct comparison of prevalence and pathogen distributions challenging. Few studies incorporate longitudinal follow - up or standardized assessments of hearing outcomes after medical or surgical interventions. Future research should aim for multicentric, methodologically robust studies that integrate epidemiological, clinical, microbiological, and health systems perspectives.

Conclusion

CSOM remains a prevalent and preventable cause of hearing loss and otologic morbidity in India, disproportionately affecting children and young adults from rural and socioeconomically disadvantaged backgrounds.

The disease is characterized by a predominance of tubotympanic perforations with conductive hearing loss, frequent isolation of P. aeruginosa and S. aureus, and an emerging role of fungal pathogens, all against a backdrop of increasing antimicrobial resistance.

Addressing CSOM requires a dual approach that combines individual-level clinical management - emphasizing culture - guided antibiotic use, detection of fungal infections, and timely surgical care - with population - level interventions to improve living conditions, reduce environmental risks, and enhance health education and access to primary ENT services. Coordinated efforts among Otorhinolaryngologists, pediatricians, public health professionals, and policy-makers are essential to reducing CSOM burden and its long - term consequences for hearing and human capital development in India.

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