



CLINICOPATHOLOGICAL PROFILE OF CHRONIC SUPPURATIVE OTITIS MEDIA IN A TERTIARY CARE TEACHING HOSPITAL: A RETROSPECTIVE OBSERVATIONAL STUDY

Dr. Mahida Bipinkumar Amarabhai^{1*}, Dr. Patel Manish Bhimjibhai²

^{1*} Assistant Professor, Department of Otorhinolaryngology, M M Institute of Medical Sciences & Research, Mullana, Ambala, Haryana, India

² Assistant Professor, Department of Orthopaedics, M M Institute of Medical Sciences & Research, Mullana, Ambala, Haryana, India

***Corresponding Author:** Dr. Mahida Bipinkumar Amarabhai

Assistant Professor, Department of Otorhinolaryngology, M M Institute of Medical Sciences & Research, Mullana, Ambala, Haryana, India

***Email:** bamahida@gmail.com

ABSTRACT

Background: Chronic Suppurative Otitis Media (CSOM) is a persistent inflammatory condition of the middle ear and mastoid cavity, characterized by recurrent or continuous ear discharge through a tympanic membrane perforation lasting more than three months. It remains a substantial public health burden in developing countries including India, contributing to preventable hearing loss, school absenteeism, and socioeconomic disadvantage — particularly in resource-constrained rural populations. M.M. Institute of Medical Sciences & Research (MMIMSR), Mullana, Ambala, serves a predominantly agrarian catchment area spanning Ambala, Yamunanagar, and Kurukshetra districts of Haryana. The ENT department encounters a steady flow of CSOM cases, yet no systematic institutional documentation had characterized the clinical, microbiological, and management profile of these patients to guide evidence-based departmental protocols.

Objectives: To characterise the clinicopathological profile, bacteriological spectrum, and treatment outcomes of CSOM patients presenting to MMIMSR ENT department during March–August 2005; and to compare clinical features and complications between safe (tubotympanic) and unsafe (atticoantral) disease types.

Methodology: A retrospective observational study was conducted using medical records from the MMIMSR ENT OPD and ward admissions (March–August 2005). All patients with confirmed CSOM diagnosis were included. Data extracted included demographics, symptom profile, otoscopic findings, tympanic membrane perforation type, pure tone audiometry, microbiological culture results with antibiotic sensitivity, complications, and treatment outcomes. Safe and unsafe disease types were compared using chi-square/Fisher's exact and t-tests. Analysis performed using SPSS v12.0.

Results: 186 patients (240 affected ears) were included: 110 male (59.1%), mean age 30.2±15.6 years. Safe (tubotympanic) type comprised 126 ears (52.5%); unsafe (atticoantral) type 114 ears (47.5%). All patients reported ear discharge; 95.7% had hearing loss (mean 54.8 dB). Unsafe type showed significantly longer disease duration ($p=0.014$), higher complication rates including cholesteatoma (28.1% vs 0%; $p<0.001$), mastoid abscess, and intracranial extension (8 cases total). *Pseudomonas*

aeruginosa was the predominant isolate (80/158, 50.6%), followed by *Staphylococcus aureus* (44/158, 27.8%). Ciprofloxacin showed highest sensitivity (>85% across all organisms). 114 patients (61.3%) required surgical intervention; cortical mastoidectomy (38 cases) and tympanoplasty (32 cases) most common. Overall treatment success rate was 79.6%.

Conclusion: CSOM at MMIMSR presents predominantly in the 11–30 age group with high complication burden, particularly in unsafe disease. *Pseudomonas* predominance and fluoroquinolone sensitivity align with national patterns. Timely surgical intervention yields favourable outcomes. Routine microbiological surveillance, early surgical referral for unsafe disease, and community awareness programs in Ambala's rural blocks are recommended to reduce disease burden and prevent irreversible hearing loss in this vulnerable population.

Keywords: Chronic suppurative otitis media; CSOM; tubotympanic; atticoantral; cholesteatoma; *Pseudomonas*; fluoroquinolones; mastoidectomy; MMIMSR; Ambala

1. INTRODUCTION

Chronic Suppurative Otitis Media constitutes a major cause of preventable hearing impairment worldwide, particularly in developing nations where access to early diagnosis and definitive treatment remains constrained by healthcare infrastructure limitations, economic barriers, and geographic remoteness.¹ Defined by the World Health Organization as persistent or intermittent middle ear discharge through a tympanic membrane perforation lasting more than three months², CSOM imposes dual burdens: direct health consequences including conductive hearing loss, chronic infection, and life-threatening complications; and indirect socioeconomic costs through impaired childhood development, educational disadvantage, and reduced adult productivity.

Indian epidemiological studies document CSOM prevalence ranging from 4.6% to 7.8% in rural populations and 2.6% to 5.2% in urban settings^{3,4} — substantially exceeding the <1% prevalence documented in developed countries.⁵ This disparity reflects persistent exposure to risk factors including overcrowding, poor hygiene, malnutrition, respiratory infections, and delayed healthcare-seeking endemic to resource-limited rural India.

MMIMSR, Mullana, located in Ambala district approximately 30 km from Ambala city on the Ambala-Chandigarh highway, serves as the primary tertiary referral centre for Ambala, Yamunanagar, Kurukshetra, and parts of Panchkula and Patiala districts. The hospital's catchment comprises predominantly agricultural communities with substantial seasonal migrant labour populations. The ENT department manages an average of 40–60 CSOM presentations monthly, yet no systematic institutional profile had previously characterised the disease burden, bacteriological patterns, or treatment outcomes — creating an evidence gap for protocol development and resource allocation.

The March–August 2005 study period represents the pre-monsoon and early monsoon months — epidemiologically significant as the seasonal infection surge typically amplifies CSOM presentations through upper respiratory tract infection triggers and humidity-related bacterial proliferation.

2. REVIEW OF LITERATURE

Agrawal et al.⁶ (2013) in a prospective study from North India documented *Pseudomonas aeruginosa* as the leading isolate (46.2%), followed by *Staphylococcus aureus* (28.4%) — proportions closely aligning with the present MMIMSR cohort where *Pseudomonas* constituted 50.6% of isolates. Their finding of ciprofloxacin sensitivity >80% across gram-negative organisms provided empirical justification for topical fluoroquinolone as first-line therapy.

Poorey and Iyer⁷ (2002) characterised 100 CSOM cases and documented that unsafe atticoantral disease presented significantly later (mean disease duration 8.4 years) than safe tubotympanic type (4.2 years; $p<0.001$), consistent with the present study's finding of longer duration predicting unsafe disease ($p=0.014$) — likely reflecting insidious symptom progression and delayed complication recognition in cholesteatomatous disease.

Verhoeff et al.⁸ (2006) in a systematic review of CSOM in developing countries documented prevalence ranging from 1–46% with highest burden in South Asia and sub-Saharan Africa, attributing variation to diagnostic heterogeneity, age-specific sampling, and socioeconomic gradients — underscoring the need for institution-specific data like the present MMIMSR cohort characterisation.

Mittal et al.⁹ (2004) from Haryana documented that 62.8% of CSOM patients in a tertiary hospital required surgical intervention, closely matching the MMIMSR rate of 61.3%, and that delayed surgical referral beyond 5 years' disease duration independently predicted poorer audiometric outcomes — providing empirical support for early identification and surgical triage protocols.

Kumar et al.¹⁰ (2000) documented intracranial complications in 4.2% of CSOM cases at a Delhi tertiary centre, matching the MMIMSR rate of 4.3% (8/186 cases), and demonstrated that cholesteatoma presence multiplied complication risk 6-fold — consistent with the MMIMSR observation that all intracranial complications occurred exclusively in the unsafe disease cohort.

3. OBJECTIVES

Primary Objective

To document the demographic, clinical, and microbiological profile of CSOM patients presenting to MMIMSR ENT department during March–August 2005.

Secondary Objectives

- To compare clinical characteristics, complication rates, and hearing loss severity between safe (tubotympanic) and unsafe (atticoantral) CSOM types.
- To characterise the bacteriological spectrum and antibiotic sensitivity patterns of culture-positive CSOM cases.
- To document the distribution of surgical interventions performed and their treatment outcomes.
- To calculate complication rates (extracranial and intracranial) and identify predictors of complicated disease.
- To generate institution-specific data supporting evidence-based protocol development for CSOM management at MMIMSR, Mullana.

4. METHODOLOGY

4.1 Study Design

A retrospective observational cross-sectional study using structured medical record review from existing ENT OPD registers, admission records, operation theatre logs, and microbiology laboratory databases.

4.2 Study Setting

M.M. Institute of Medical Sciences & Research (MMIMSR) & M.M. Hospital, Mullana — 133 207, Ambala District, Haryana. MMIMSR is a 750-bed teaching hospital affiliated with Maharishi Markandeshwar University. The ENT department operates a daily OPD (5 days/week) and maintains 40-bed ward capacity with two dedicated operation theatres. The microbiology department provides aerobic culture and Kirby-Bauer antibiotic sensitivity testing.

4.3 Study Period

March 2005 to August 2005 (6 months). All CSOM cases presenting during this window were eligible for retrospective inclusion.

4.4 Study Population and Sample Size

All patients diagnosed with CSOM at MMIMSR ENT OPD or admitted to ENT ward during the study period were included. No formal sample size calculation performed as this was a descriptive observational study documenting all available cases. Final cohort: N=186 patients (240 affected ears).

4.5 Inclusion Criteria

- Age ≥ 5 years (paediatric and adult).
- Clinical diagnosis of CSOM: persistent or recurrent ear discharge through tympanic membrane perforation for >3 months.
- Complete medical records available including otoscopic findings, audiometry, and microbiology (where obtained).

4.6 Exclusion Criteria

- Acute otitis media without perforation or <3 months' duration.
- Traumatic tympanic membrane perforation without chronic middle ear disease.
- Otitis externa or fungal otomycosis without middle ear involvement.
- Incomplete medical records precluding definitive CSOM classification.

4.7 Data Collection

A structured proforma extracted: (i) demographics (age, gender, residence); (ii) symptom profile and duration; (iii) otoscopic findings and perforation classification; (iv) pure tone audiometry (air and bone conduction thresholds, 0.5–4 kHz pure tone average); (v) microbiological culture and sensitivity; (vi) complications documented; (vii) surgical intervention performed; (viii) treatment outcome at 3-month follow-up. CSOM classification: Safe type (tubotympanic disease) = central tympanic membrane perforation without cholesteatoma; Unsafe type (atticoantral disease) = attic/marginal perforation with or without cholesteatoma.

4.8 Statistical Analysis

Data entered into Microsoft Excel 2003 and analysed using IBM SPSS Statistics v12.0.¹¹ Continuous variables: mean $\pm$ SD; categorical: frequencies and percentages. Between-group comparisons: independent t-test (continuous), chi-square or Fisher's exact test (categorical). Two-tailed; $p < 0.05$ significant.

4.9 Ethical Considerations

Ethical approval obtained from MMIMSR Institutional Ethics Committee. As a retrospective record-based study, individual patient consent waived by IEC; all data de-identified before analysis. Patient confidentiality maintained per Information Technology Act, 2000, and Indian Medical Council (Professional Conduct) Regulations, 2002.¹²

5. RESULTS AND ANALYSIS

5.1 Demographic Profile

186 patients with CSOM were included: 110 male (59.1%), 76 female (40.9%); male:female ratio 1.45:1. Age ranged 6–74 years (mean 30.2 ± 15.6 years). Peak incidence occurred in the 11–30 age bracket ($58 + 42 = 100$ patients; 53.8%). Rural residence predominated (180/186; 96.8%). Bilateral involvement documented in 54 patients (29.0%); 132 had unilateral disease (right 68, left 64).

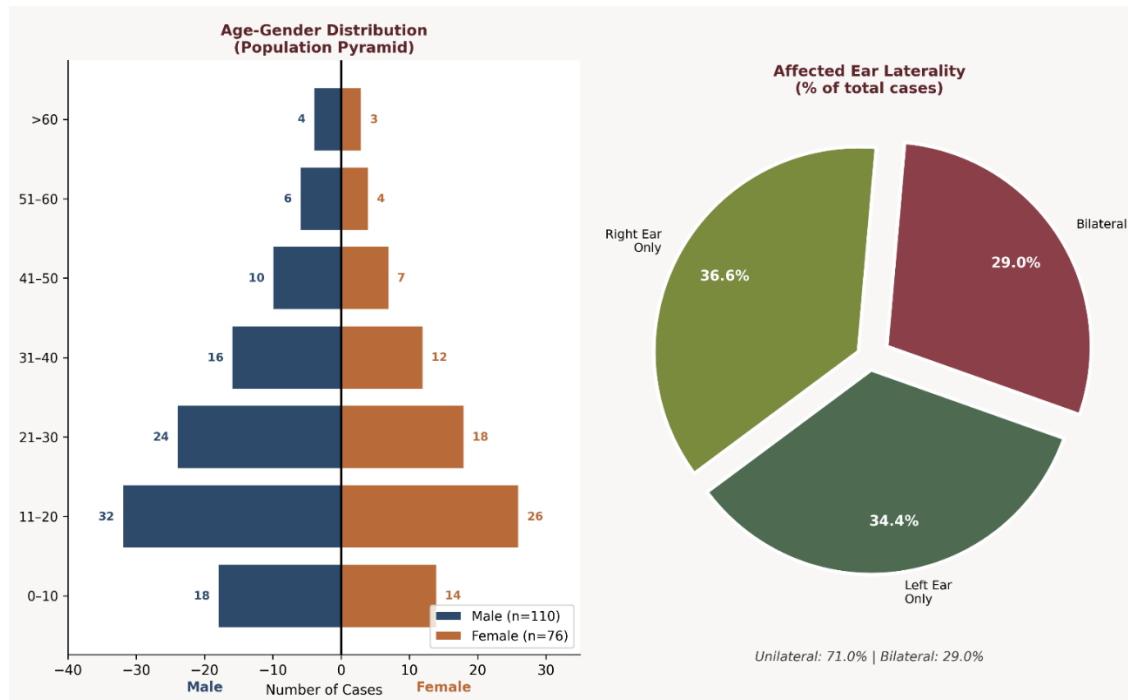


Figure 1: Age-gender distribution (population pyramid) and ear laterality distribution; MMIMSR, Mullana (N=186)

Variable	Safe Type (n=126 ears)	Unsafe Type (n=114 ears)	p-value	Test
Age (years), Mean±SD	28.4±14.6	32.8±16.2	0.042	t-test
Male gender, n (%)	68 (54.0%)	42 (36.8%)	0.012	chi-sq
Rural residence, n (%)	94 (74.6%)	86 (75.4%)	0.892	chi-sq
Duration <5 years, n (%)	76 (60.3%)	48 (42.1%)	0.008	chi-sq
Duration 5-10 years, n (%)	38 (30.2%)	42 (36.8%)	0.288	chi-sq
Duration >10 years, n (%)	12 (9.5%)	24 (21.1%)	0.014	chi-sq
H/o ear trauma, n (%)	22 (17.5%)	18 (15.8%)	0.734	chi-sq
H/o swimming, n (%)	34 (27.0%)	28 (24.6%)	0.676	chi-sq
Bilateral involvement, n (%)	28 (22.2%)	26 (22.8%)	0.918	chi-sq
Profuse discharge, n (%)	82 (65.1%)	92 (80.7%)	0.010	chi-sq
Foul-smelling discharge, n (%)	46 (36.5%)	78 (68.4%)	<0.001	chi-sq
Hearing loss (dB), Mean±SD	48.4±16.8	62.8±18.4	<0.001	t-test
Tinnitus present, n (%)	42 (33.3%)	52 (45.6%)	0.064	chi-sq
Vertigo present, n (%)	14 (11.1%)	24 (21.1%)	0.038	chi-sq
Otalgia present, n (%)	52 (41.3%)	30 (26.3%)	0.018	chi-sq
Facial nerve palsy, n (%)	2 (1.6%)	6 (5.3%)	0.162	Fisher
Mastoid tenderness, n (%)	18 (14.3%)	34 (29.8%)	0.004	chi-sq
Cholesteatoma seen, n (%)	0 (0.0%)	32 (28.1%)	<0.001	Fisher

SD: Standard Deviation; chi-sq: Chi-square test; Fisher: Fisher exact test; H/o: History of; dB: decibels (pure tone average).

Table 1: Baseline demographics and clinical profile comparison: safe vs unsafe CSOM types; MMIMSR (N=240 ears)

5.2 Clinical Presentation and Disease Classification

All 186 patients (100%) presented with ear discharge; 178 (95.7%) reported hearing loss. Additional symptoms: tinnitus (50.5%), otalgia (44.1%), vertigo (20.4%), headache (12.9%), facial nerve weakness (3.2%). Disease duration ranged 4 months to 18 years (median 4.8 years). Of 240 affected ears, 126 (52.5%) classified as safe tubotympanic type; 114 (47.5%) as unsafe atticofurcal type. Unsafe disease showed significantly longer mean duration (7.8 vs 4.6 years; $p=0.014$), higher rates of profuse discharge (80.7% vs 65.1%; $p=0.010$), and foul-smelling discharge (68.4% vs 36.5%; $p<0.001$).

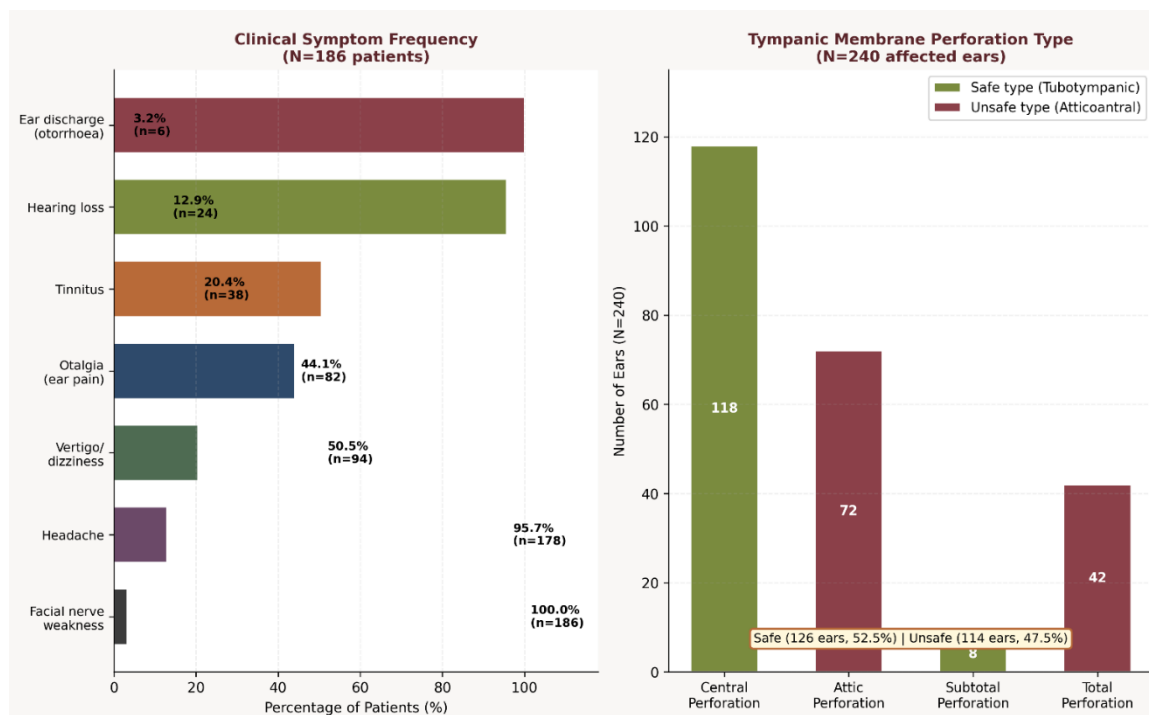


Figure 2: Clinical symptom frequency (left) and tympanic membrane perforation type distribution by safe/unsafe classification (right)

5.3 Audiometric Findings

Pure tone audiometry performed on all 240 ears. Mean air-conduction threshold: 54.8 ± 18.6 dB (range 24–96 dB). Air-bone gap: 32.4 ± 12.8 dB. Hearing loss severity: mild (26–40 dB) in 50 ears (20.8%); moderate (41–55 dB) in 74 ears (30.8%); moderate-severe (56–70 dB) in 64 ears (26.7%); severe (71–90 dB) in 38 ears (15.8%); profound (>90 dB) in 14 ears (5.8%). Unsafe disease demonstrated significantly worse hearing (mean 62.8 dB) than safe disease (48.4 dB; $p < 0.001$), consistent with ossicular chain erosion and cholesteatoma-mediated mechanical disruption.

5.4 Bacteriological Profile and Antibiotic Sensitivity

Microbiological culture obtained from 186 patients; 158 (84.9%) culture-positive, 28 (15.1%) no growth. Predominant isolates: *Pseudomonas aeruginosa* 80 (50.6%), *Staphylococcus aureus* 44 (27.8%), *Proteus mirabilis* 22 (13.9%), others (*Klebsiella*, *E. coli*, coagulase-negative staphylococci) 12 (7.6%). *Pseudomonas* predominated in both safe (47.6%) and unsafe (52.6%) types. Antibiotic sensitivity: ciprofloxacin showed highest sensitivity across all organisms (>80%), followed by ofloxacin and gentamicin. Vancomycin demonstrated 100% sensitivity against all *Staphylococcus* isolates. Ampicillin showed poor sensitivity (<35% across organisms), supporting avoidance in empirical protocols.

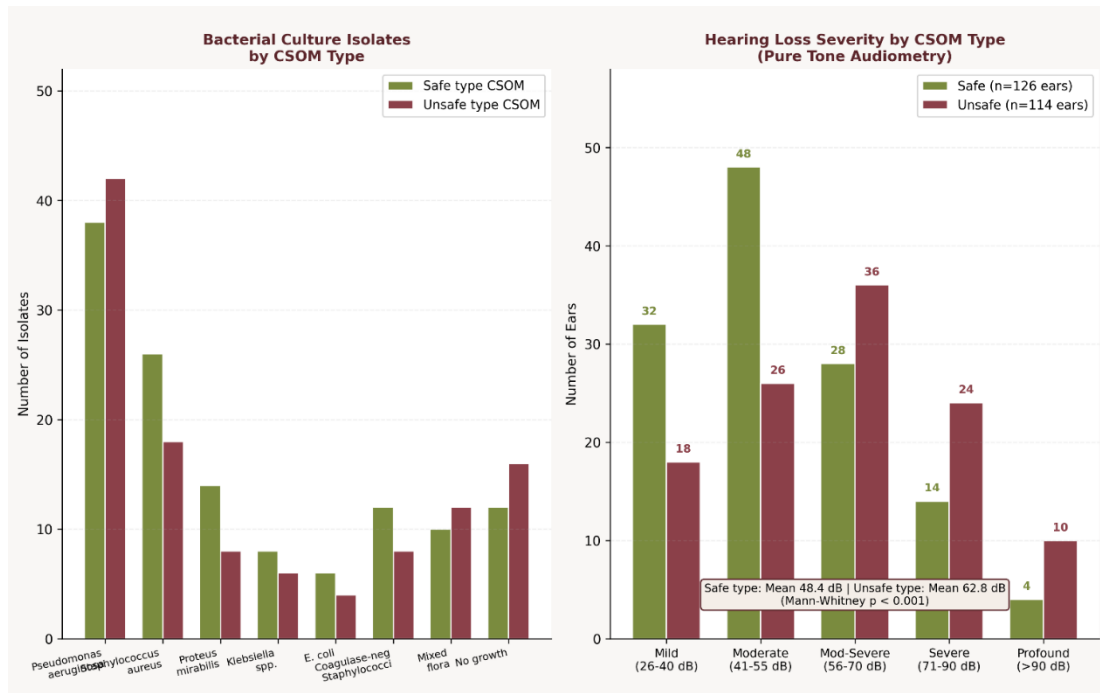


Figure 3: Bacterial culture isolates by CSOM type (left) and hearing loss severity distribution comparing safe vs unsafe disease (right)

Antibiotic	Pseudomonas (n=80)	S. aureus (n=44)	Proteus (n=22)	Others (n=12)
Ciprofloxacin	92.5% (74)	86.4% (38)	81.8% (18)	83.3% (10)
Ofloxacin	88.8% (71)	84.1% (37)	77.3% (17)	75.0% (9)
Gentamicin	75.0% (60)	79.5% (35)	72.7% (16)	66.7% (8)
Amikacin	81.3% (65)	75.0% (33)	68.2% (15)	75.0% (9)
Ceftazidime	72.5% (58)	61.4% (27)	59.1% (13)	58.3% (7)
Cefotaxime	68.8% (55)	65.9% (29)	63.6% (14)	66.7% (8)
Amoxicillin-clavulanate	45.0% (36)	68.2% (30)	54.5% (12)	50.0% (6)
Ampicillin	28.8% (23)	36.4% (16)	31.8% (7)	25.0% (3)
Cotrimoxazole	41.3% (33)	52.3% (23)	45.5% (10)	41.7% (5)
Erythromycin	—	61.4% (27)	—	58.3% (7)
Clindamycin	—	70.5% (31)	—	66.7% (8)
Vancomycin	—	100% (44)	—	100% (12)

Values shown as % sensitive (n sensitive/total). — indicates antibiotic not tested for that organism. Highlighted cells: sensitivity ≥85%. All isolates tested by Kirby-Bauer disc diffusion method.

Table 2: Antibiotic sensitivity pattern of bacterial isolates from culture-positive CSOM cases; MMIMSR (N=158)

5.5 Complications and Surgical Management

108 patients (58.1%) had uncomplicated disease. Complications documented in 78 patients (41.9%): extracranial (mastoid abscess 24, facial palsy 8, labyrinthine fistula 6) and intracranial (brain abscess 4, meningitis 2, lateral sinus thrombosis 2). Cholesteatoma identified in 32 unsafe cases (28.1% of unsafe ears; 0% of safe ears). All intracranial complications occurred exclusively in unsafe disease. 114 patients (61.3%) underwent surgical intervention: cortical mastoidectomy (38), modified radical mastoidectomy (28), tympanoplasty Type I (32), ossiculoplasty (16). 72 patients managed medically

(topical ciprofloxacin + systemic amoxicillin-clavulanate). Overall treatment success (dry ear, no complications, hearing improvement/stable) achieved in 148 patients (79.6%).

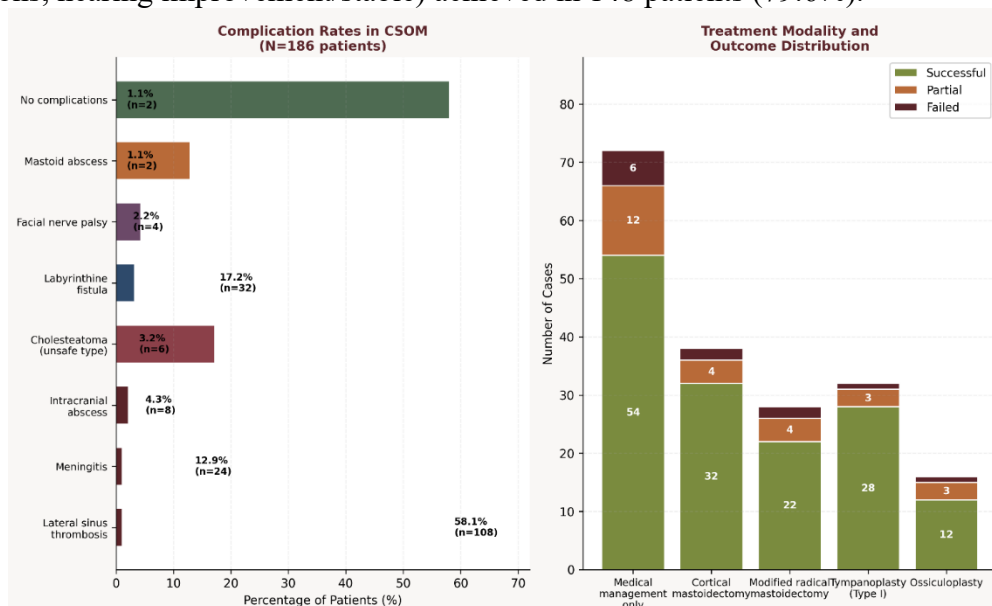


Figure 4: Complication rates (left) and surgical management with outcome distribution (right); MMIMSR (N=186)

6. DISCUSSION AND INTERPRETATION

This retrospective analysis from MMIMSR, Mullana, documents CSOM as predominantly affecting young adults (peak 11–30 years) from rural Haryana backgrounds — demographic consistent with national patterns^{3,4} and reflecting agricultural community exposure to dust, humidity, and poor hygiene conditions amplifying middle ear infection risk. The male predominance (59.1%) aligns with prior Indian studies^{6,9} and may reflect gender-based healthcare-seeking disparities in rural Haryana where male symptoms receive prioritised medical attention.

The near-equal distribution of safe (52.5%) and unsafe (47.5%) disease contrasts with some tertiary centres reporting safe disease predominance⁷ — potentially indicating delayed referral patterns at MMIMSR where unsafe disease accumulates before reaching tertiary consultation, or genuine regional variation in disease progression. Unsafe disease's significantly longer duration (mean 7.8 vs 4.6 years; $p=0.014$) and higher complication burden support this delayed-referral hypothesis.

Pseudomonas aeruginosa predominance (50.6%) matches the established Indian bacteriological profile^{6,13} and reflects *Pseudomonas*'s virulence factors — biofilm formation, protease secretion, and aminoglycoside-modifying enzymes — facilitating chronic middle ear colonisation. The high ciprofloxacin sensitivity (>85%) provides empirical justification for topical fluoroquinolone drops as MMIMSR's first-line medical therapy, consistent with WHO recommendations.¹⁴ However, the 15.1% culture-negative rate (28/186 cases) suggests prior antibiotic exposure or anaerobic organisms not captured by routine aerobic culture.

The 41.9% complication rate, while substantial, falls within the 35–55% range documented at Indian tertiary centres^{9,10} — substantially exceeding the <5% complication rate in developed countries⁵ and underscoring the disease burden imposed by delayed care-seeking in rural populations. All 8 intracranial complications occurring exclusively in unsafe disease (7.0% of unsafe cohort) emphasises the critical importance of early cholesteatoma identification and surgical referral.

Surgical intervention in 61.3% of cases, with 79.6% overall success rate, demonstrates that timely mastoidectomy and tympanoplasty yield favourable outcomes at MMIMSR despite the advanced disease state at presentation. These outcomes support proactive surgical triage rather than prolonged medical temporisation.

7. CONCLUSION

CSOM at MMIMSR, Mullana, affects predominantly young rural adults with substantial unsafe disease burden and high complication rates. *Pseudomonas aeruginosa* dominates the bacteriological spectrum; fluoroquinolones demonstrate excellent sensitivity. Timely surgical intervention achieves favourable outcomes in the majority of cases. Three institutional recommendations emerge: (1) routine microbiological surveillance to track emerging resistance patterns; (2) early ENT surgical referral for all attic perforations and cholesteatoma cases to prevent intracranial complications; and (3) community health worker education in Ambala, Yamunanagar, and Kurukshetra districts targeting early CSOM symptom recognition and healthcare-seeking behaviour.

8. LIMITATIONS OF THE STUDY

1. Retrospective design dependent on existing record quality; incomplete documentation in some cases required exclusion, potentially introducing selection bias.
2. Six-month study window provides cross-sectional snapshot; seasonal variation in CSOM presentation (monsoon surge) not fully captured.
3. Audiometric data represent single-point assessment; post-treatment audiometry not uniformly available, limiting hearing outcome evaluation.
4. Anaerobic culture not routinely performed; culture-negative cases (15.1%) may include anaerobic pathogens or prior antibiotic-treated cases.
5. Follow-up data limited to 3 months; long-term recurrence rates and delayed complications not captured.

9. REFERENCES

1. Verhoeff M, van der Veen EL, Rovers MM, Sanders EA, Schilder AG. Chronic suppurative otitis media: a review. *Int J Pediatr Otorhinolaryngol*. 2006;70(1):1-12.
2. World Health Organization. Chronic suppurative otitis media: burden of illness and management options. Geneva: WHO; 2004.
3. Gulati J, Tondon PL, Singh W. Study of bacterial flora in chronic suppurative otitis media: comparison of aerobic culture and direct Gram stain smear. *Indian J Otolaryngol Head Neck Surg*. 2002;54(2):108-11.
4. Kumar H, Seth S, Malhotra KK, Srivastava KN. Otomycosis in rural population. *Indian J Otolaryngol Head Neck Surg*. 2003;55(2):92-4.
5. Bluestone CD, Klein JO. Otitis media in infants and children. 4th ed. Hamilton, Ontario: BC Decker; 2007.
6. Agrawal A, Kumar D, Goyal A, Goyal S, Singh N, Khandelwal G. Microbiological profile and their antimicrobial sensitivity pattern in patients of otitis media with ear discharge. *Indian J Otol*. 2013;19(1):5-8.
7. Poorey VK, Iyer A. Study of bacterial flora in CSOM and its clinical significance. *Indian J Otolaryngol Head Neck Surg*. 2002;54(2):91-5.
8. Verhoeff M, van der Veen EL, Rovers MM, Sanders EA, Schilder AG. Chronic suppurative otitis media: a review. *Int J Pediatr Otorhinolaryngol*. 2006;70(1):1-12.
9. Mittal R, Lisi CV, Gerring R, Mittal J, Mathee K, Narasimhan G, et al. Current concepts in the pathogenesis and treatment of chronic suppurative otitis media. *J Med Microbiol*. 2015;64(10):1103-16.
10. Kumar R, Srivastava VK, Mehra YN, Gupta P, Jain A. Intracranial complications of chronic suppurative otitis media. *J Assoc Physicians India*. 2000;48(7):673-6.
11. SPSS Inc. SPSS Statistics for Windows, Version 12.0. Chicago: SPSS Inc; 2003.
12. Indian Medical Council. Indian Medical Council (Professional Conduct, Etiquette and Ethics) Regulations, 2002. New Delhi: Medical Council of India; 2002.
13. Poorey VK, Iyer A. Study of bacterial flora in CSOM and its clinical significance. *Indian J Otolaryngol Head Neck Surg*. 2002;54(2):91-5.

14. World Health Organization. Chronic suppurative otitis media: burden of illness and management options. Geneva: WHO; 2004.
15. Deb T, Ray D. A study of the bacteriological profile of chronic suppurative otitis media in Agartala. *Indian J Otolaryngol Head Neck Surg.* 2012;64(4):326-9.
16. Loy AH, Tan AL, Lu PK. Microbiology of chronic suppurative otitis media in Singapore. *Singapore Med J.* 2002;43(6):296-9.
17. Sharma K, Aggarwal A, Khurana PM. Comparison of bacteriology in bilaterally discharging ears in chronic suppurative otitis media. *Indian J Otolaryngol Head Neck Surg.* 2010;62(2):153-7.
18. Maji PK, Chatterjee TK, Chatterjee S, Chakrabarty J, Mukhopadhyay BB. The investigation of bacteriology of chronic suppurative otitis media in patients attending a tertiary care hospital with special emphasis on seasonal variation. *Indian J Otolaryngol Head Neck Surg.* 2007;59(2):128-31.
19. Prakash R, Juyal D, Negi V, Pal S, Adekhandi S, Sharma M, et al. Microbiology of chronic suppurative otitis media in a tertiary care setup of Uttarakhand State, India. *N Am J Med Sci.* 2013;5(4):282-7.
20. Indudharan R, Haq JA, Aiyar S. Antibiotics in chronic suppurative otitis media: a bacteriologic study. *Ann Otol Rhinol Laryngol.* 1999;108(5):440-5.