e-ISSN: 0976-822X, p-ISSN:2961-6042

Available online on http://www.ijcpr.com/

International Journal of Current Pharmaceutical Review and Research 2023; 15(10); 854-859

Original Research Article

Clinical and Microbiological Profile and Antibiotic Sensitivity Pattern of Acute Otitis Media in Adults

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Received: 14-08-2023 / Revised: 02-09-2023 / Accepted: 08-09-2023
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Conflict of interest: Nil

Abstract

Background: Acute otitis media (AOM) is a common middle ear infection with limited data available regarding its clinical and microbiological profile in adults.

Aim: To evaluate the clinical presentation, microbiological profile, and antibiotic sensitivity pattern of AOM in adults.

Methods: A hospital-based cross-sectional study was conducted on 150 adult patients diagnosed with AOM at a tertiary care teaching hospital. Clinical evaluation, otoscopic examination, and microbiological analysis of ear discharge samples were performed. Antibiotic susceptibility testing was carried out using the Kirby–Bauer disc diffusion method.

Results: The majority of patients were aged 31–40 years (25.3%), and 68% were males. Otalgia was the most common symptom (94.7%), followed by hearing loss (73.3%) and aural fullness (69.3%). Tympanic membrane congestion was observed in 80% of cases, while perforation was present in 45.3%. Among culture-positive cases, Staphylococcus aureus (26.4%) and Pseudomonas spp. (20.5%) were the predominant isolates. Piperacillin-tazobactam, amikacin, and imipenem demonstrated the highest antimicrobial sensitivity.

Conclusion: Staphylococcus aureus and Pseudomonas spp. were the predominant pathogens in adult AOM. Culture-guided antibiotic therapy is essential for effective management and prevention of antimicrobial resistance.

Keywords: AOM (acute otitis media), AST (antibiotic sensitivity).

Introduction

Acute otitis media (AOM) is an acute inflammation of the middle ear cleft characterized by rapid onset of symptoms such as otalgia, fever, aural fullness, and hearing impairment. While it is one of the most common infections in the pediatric population, AOM in adults is comparatively less frequent but often more clinically significant due to delayed presentation, atypical symptoms, and a higher risk of complications. Adult patients may present with subtle or nonspecific complaints, leading to underdiagnosis or inappropriate treatment. [1]

The pathophysiology of AOM typically involves dysfunction of the Eustachian tube, often precipitated by upper respiratory tract infections, allergic conditions, or environmental factors such as smoking. This dysfunction facilitates the accumulation of secretions within the middle ear, creating a favourable environment for microbial proliferation. The most commonly implicated organisms in AOM include Streptococcus pneumoniae, Haemophilus influenzae, and Moraxella catarrhalis. However, in adults, the microbiological spectrum may differ due to factors such as prior antibiotic exposure, comorbid conditions, and local epidemiological variations. [2] In recent years, the emergence of antibiotic-resistant strains has become a significant concern in the management of AOM. Empirical antibiotic therapy, which is commonly practiced, may not always be effective due to changing resistance patterns. This highlights the need for periodic evaluation of the microbiological profile and antibiotic sensitivity patterns in specific populations. Furthermore, adults often have associated comorbidities such as diabetes mellitus, immunosuppression, or chronic sinusitis, which can influence disease severity, response to treatment, and risk of complications. [3]

The incidence of AOM in adults is considerably lower compared to children, but it is not negligible. Globally, adult AOM accounts for a small proportion of total otitis media cases; however,

precise epidemiological data are limited. In India, community-based data on adult AOM are scarce. Hospital-based studies suggest that otitis media constitutes a significant proportion of ENT outpatient visits, with AOM contributing to approximately 5–10% of these cases in adults. The prevalence varies across regions due to differences in socioeconomic status, healthcare access, environmental factors, and antibiotic usage patterns. Despite this, there is a lack of comprehensive, region-specific data focusing exclusively on adult populations. [2,3]

"Globally, acute otitis media remains a common infectious disease with an estimated annual incidence of approximately 10.85%, accounting for nearly 709 million cases each year, with the highest burden occurring in children. Adult-specific epidemiological data are limited. [2]

Complications of AOM, although less common in the antibiotic era, remain clinically important, particularly in adults. These include mastoiditis, facial nerve palsy, labyrinthitis, and intracranial complications such as meningitis or brain abscess. Early identification and appropriate management are crucial in preventing such adverse outcomes. [4]

Given the limited literature on adult AOM, especially in the Indian context, there is a clear need for systematic evaluation of its clinical presentation, microbiological characteristics, and treatment outcomes. Such data will help in guiding evidence-based management, optimizing antibiotic use, and reducing complications. [4]

Aim: To study the clinical presentation, microbiological profile, and antibiotic sensitivity pattern of Acute Otitis Media (AOM) in adult patients attending the ENT outpatient department of a tertiary care teaching hospital.

Objectives: Primary Objectives

1. To identify the microbiological organisms responsible for Acute Otitis Media in adults.
2. To determine the antibiotic sensitivity patterns of the isolated microorganisms.

Secondary Objectives

1. To evaluate the demographic and clinical characteristics of adult patients diagnosed with Acute Otitis Media
2. To assess the association between demographic factors (age, gender, residence, smoking status) and clinical presentation of AOM.

Methods

This study was conducted as a hospital-based cross-sectional study in the Department of Otorhinolaryngology. The study included adult patients presenting to the ENT outpatient department with clinical features suggestive of acute otitis media.

Inclusion Criteria: All patients aged above 14 years presenting in ENT OPD with symptoms such as acute onset ear pain, fever, hearing loss, aural fullness, or ear discharge was evaluated.

Exclusion Criteria: patients below the age of 14 years, CSOM patient, otitis externa, not willing to give consent.

A diagnosis of acute otitis media will be made based on clinical findings, including congestion or bulging of the tympanic membrane, reduced mobility on pneumatic otoscopy (where feasible), or presence of middle ear effusion with signs of acute inflammation. Patients who provide informed written consent will be enrolled in the study. [4]

Data collection: After obtaining consent, the patient was enrolled, a detailed clinical history will be obtained, including duration and severity of symptoms, history of upper respiratory tract infection, prior antibiotic use, smoking status, and associated comorbidities such as diabetes mellitus or allergic conditions. A thorough ENT examination will be performed, with particular emphasis on otoscopic findings such as tympanic membrane hyperemia, bulging, perforation, or presence of discharge. Tuning fork tests will be conducted in all patients, and pure tone audiometry will be performed where feasible to assess the degree and type of hearing loss. According to the socio-demographic profile patient was divided to upper, middle and lower status.

In cases where tympanic membrane perforation is present and ear discharge is available, a sterile sample of middle ear discharge will be collected using a sterile swab under aseptic precautions.

Sample Collection: The ear discharge from the middle ear was collected by sterile swabs under aseptic conditions with the help of an aural speculum and sent to the department of Microbiology for bacterial culture. The swab should be replaced in its tube with care not to soil the rim and transported immediately to the laboratory.

The swab was sub-cultured primarily on Blood Agar, Mac Conkey's agar and Chocolate agar and Thioglycolate broth; and incubated at 37°C for an overnight. Subculture from Thioglycholate broth was done if the primary inoculation was sterile.

The organisms were identified by morphology, cultural characteristics, pigment production, and biochemical reaction, followed by an antibiotic sensitivity test. [5]

Antimicrobial Susceptibility Testing: Following isolation and definitive identification of the organisms, antimicrobial susceptibility testing was carried out using the Kirby–Bauer disk diffusion method.

The assay was performed on Mueller–Hinton agar employing commercially prepared antibiotic discs. A preselected panel of antimicrobial discs, comprising ampicillin, gentamicin, cotrimoxazole, ciprofloxacin, cefotaxime, amikacin, according to CLSI guideline 2022. [6]

All patients will receive treatment as per standard institutional protocol. Empiric antibiotic therapy will be initiated in accordance with current clinical guidelines, along with supportive treatment, including analgesics, antipyretics, and nasal decongestants. The choice of antibiotic may be modified later based on culture and sensitivity reports, where available. [7]

All relevant data, including demographic details, clinical findings, microbiological results, treatment given, and outcomes, will be systematically recorded in a predesigned data collection proforma. The collected data will be entered into Microsoft Excel and analyzed using appropriate statistical software such as SPSS. Descriptive statistics will be used to summarize the data in terms of mean, standard deviation, frequencies, and percentages. Inferential statistical tests such as the Chi-square test will be applied to assess associations between variables, and a p-value of less than 0.05 will be considered statistically significant.

Ethical approval will be obtained from the Institutional Ethics Committee before commencement of the study. Written informed consent will be taken from all participants, and confidentiality of patient information will be strictly maintained throughout the study

Sample Size Calculation: The sample size for this study is calculated using the standard formula for estimating a proportion in a population: prevalence 10 % (4)

$$N = Z^2PQ$$

$$D^2$$

Calculated sample size ≈ 138 patients

After adjusting for possible dropouts/non-response (~5–10%):

Final sample size = 150 patients

Result

A total of 150 adult patients with acute otitis media were studied. The majority belonged to the 31–40 years age group (25.3%), with males constituting 68% of cases. Otalgia was the most common symptom (94.7%), followed by hearing loss (73.3%), aural fullness (69.3%), and fever (64%). Tympanic membrane congestion was observed in 80% of patients, while perforation was present in 45.3%.

Culture was performed in 68 patients with ear discharge. Staphylococcus aureus (26.4%) and Pseudomonas spp. (20.5%) were the predominant isolates. Piperacillin-tazobactam, amikacin, and imipenem showed the highest antimicrobial susceptibility.

Table 1: Sociodemographic Characteristics of the study population

Age group	Category	Frequency	percentage
	18-30	32	21.3
	31-40	38	25.3
	41-50	34	22.7
	51-60	26	17.3
	Than 60	20	13.3
Gender	Male	102	68
	Female	48	32
Residence	Urban	88	58.7
	Rural	62	41
Socioeconomic status	Lower	54	36
	Middle	72	48
	Upper	24	16
Smoking status	Smoker	64	42.7
	Non smoker	86	57.3

Table 2: Distribution of patients according to Clinical Profile

Variable	Category	Frequency	Percentage
Symptoms	Otalgia	142	94.7
	Fever	96	64
	Hearing loss	110	73.3
	Ear discharge	68	45.3
	Aural fullness	104	69.3
Otoscopic finding	Congested TM	120	80
	Bulging TM	78	52
	Perforation	68	45.3
Side involvement	Unilateral		
	Bilateral	18	12

Table 3: Microbiological Profile of culture positive isolates n=68

Organism isolated	Frequency	Percentage
Streptococci sp	5	7.3
Staphylococcus aureus	18	26.4
Pseudomonas sp	14	20.5
Klebsiella	9	13.2
Escherichia coli	8	11.7
Proteus sp	4	5.8
Candida	8	11.7
Aspergillus sp	2	2.9

Table 4: Antibiotic sensitivity pattern of Gram positive cocci

	Staphylococcus aureus N=18	Streptococcus sp N=5
Amoxicillin-clavulanate	7 (38.8%)	5(100%)
Azithromycin	5(27.7%)	4(80%)
Erythromycin	5(27.7%)	4(80%)
Clindamycin	6(33.3%)	5(100%)
Ceftriaxone	12(66.6%)	5(100%)
Gentamycin	9(50%)	4(80%)
Ciprofloxacin	9(50%)	4(80%)

Table 5: Antibiotic sensitivity pattern of Gram Negative Bacilli

Antibiotic	Pseudomonas14	Escherichia coli 8	Klebsiella 9	Proteus sp4
Amoxicillin-clavulanate	6(42%)	4(50%)	7(77.7%)	3(75%)
Gentamycin	8(57%)	7(87%)	7(77.7%)	3(75%)
Amikacin	10(71.4%)	8(100%)	9(100%)	4(100%)
Ceftriaxone	8(57%)	8(100%)	6(66.6%)	3(75%)
Ciprofloxacin	11(78%)	6(75%)	8(88.8%)	4(100%)
Piperacillin tazobactam	14(100%)	8(100%)	9(100%)	4(100%)
Imipenem	13(92%)	8(100%)	9(100%)	3(75%)

Among Gram-positive isolates, Staphylococcus aureus (n=18) showed the highest sensitivity to ceftriaxone (66.6%), while Streptococcus spp. (n=5) demonstrated 100% sensitivity to amoxicillin-clavulanate, clindamycin, and ceftriaxone. Among Gram-negative isolates, Pseudomonas, Escherichia coli, Klebsiella, and Proteus showed maximum sensitivity to piperacillin-tazobactam (100%), with excellent susceptibility also observed to amikacin and imipenem

Discussion

The present study evaluated the clinical profile, microbiological spectrum, and treatment outcomes of acute otitis media (AOM) in adults in a tertiary care setting. Although AOM is predominantly considered a pediatric disease, its occurrence in adults is clinically significant due to atypical presentation, delayed diagnosis, and the potential for complications. The findings of this study provide important insights into adult AOM within the Indian context and are broadly comparable with available literature, while also highlighting certain region-specific trends. In the present study, the majority of patients belonged to the 31–40 years age group (25.3%), followed closely by the 41–50

years group (22.7%). A relatively lower proportion was observed in elderly patients (>60 years). This distribution is consistent with hospital-based studies that suggest AOM in adults is more commonly encountered in young and middle-aged populations, likely due to increased exposure to environmental risk factors such as smoking, occupational exposure, and upper respiratory tract infections. Studies by Schilder et al. and Monasta et al., although largely pediatric-focused, have suggested that adult cases are often underrepresented but tend to cluster in active, working-age groups. [1,2] A clear male predominance (68%) was observed in this study. Similar findings have been reported in several Indian studies on otitis media, where males constituted approximately 60–70% of cases. This may be attributed to higher exposure to outdoor pollutants, smoking, and health-seeking behaviour differences. Smoking was present in 42.7% of patients in the present study, which aligns with evidence suggesting that smoking impairs mucociliary clearance and predisposes to Eustachian tube dysfunction, thereby increasing susceptibility to middle ear infections. [8,9]

Clinically, otalgia was the most common presenting symptom (94.7%), followed by hearing loss (73.3%) and aural fullness (69.3%). Fever was present in 64% of patients, while ear discharge was noted in 45.3%. These findings are in agreement with standard clinical descriptions of AOM in adults. Similar symptom patterns have been reported in studies by Rupa et al. and other Indian researchers, where otalgia consistently emerged as the predominant symptom. The relatively high incidence of hearing loss and aural fullness reflects the presence of middle ear effusion and inflammation. [10]

On otoscopic examination, congestion of the tympanic membrane was seen in 80% of cases, while bulging was observed in 52% and perforation in 45.3%. The relatively high rate of tympanic membrane perforation in this study may be due to delayed presentation, a common issue in developing countries where patients often seek medical attention after symptom progression. Comparable findings have been reported in Indian hospital-based studies, where perforation rates tend to be higher than those reported in developed countries.

Microbiological analysis revealed that Streptococcus pneumoniae was (7%) and Staphylococcus aureus (26%). These findings are different with global literature identifying S. pneumoniae and H. influenzae as the principal pathogens in AOM. Studies by Lieberthal et al. and other international guidelines have similarly emphasized the dominance of these organisms. However, the presence of Staphylococcus aureus and Pseudomonas aeruginosa in a notable proportion of cases reflects the evolving microbiological spectrum in adults, particularly in those with perforation or prior antibiotic exposure. [3]

The present study evaluated the bacteriological profile and antibiotic susceptibility pattern among patients with otitis media. The microbiological findings revealed that Staphylococcus aureus was the most common Gram-positive isolate (n=18), followed by Streptococcus species (n=5). Among Gram-negative organisms, Pseudomonas aeruginosa (n=14) was the predominant isolate, followed by Klebsiella species (n=9), Escherichia coli (n=8), and Proteus species (n=4). These findings indicate the coexistence of both Gram-positive and Gram-negative pathogens in middle ear infections and emphasize the importance of local antimicrobial surveillance.

In the present study, Pseudomonas aeruginosa constituted the most common Gram-negative isolate. Similar findings were reported by Vaid et al. (2024) from Maharashtra, who identified Pseudomonas aeruginosa as the predominant pathogen isolated from otitis media patients, accounting for nearly 80% of isolates. Likewise, a study from Bihar by Kumar et al. reported Pseudomonas aeruginosa (45%) as the most frequent organism, followed by Staphylococcus aureus (36%). Our findings are therefore consistent with these Indian studies, supporting the observation that Pseudomonas remains a major pathogen in middle ear infections.

The predominance of Staphylococcus aureus among Gram-positive organisms in the present study is also in agreement with findings reported by Agrawal et al. in the Indian Journal of Otology, who observed Staphylococcus aureus as one of the leading isolates in patients with otitis media. Similar observations have been reported in studies conducted across different regions of India, indicating the persistent role of S. aureus in middle ear infections. Regarding antibiotic susceptibility, Staphylococcus aureus in our study demonstrated maximum sensitivity to ceftriaxone (66.6%), while sensitivity to amoxicillin-clavulanate, azithromycin, erythromycin, and clindamycin was comparatively lower. This finding differs from the study by Kawatra et al. (2023), where Staphylococcus aureus exhibited higher sensitivity to amoxicillin-clavulanate and clindamycin. Such differences may be attributable to geographical variations, prescribing practices, and emerging antimicrobial resistance.

Among Gram-negative isolates, piperacillin-tazobactam demonstrated excellent activity, with 100% sensitivity observed in Pseudomonas, E. coli, Klebsiella, and Proteus species. Similar findings

have been reported by Vaid et al. and other Indian investigators, who documented high susceptibility of Pseudomonas aeruginosa to piperacillin-tazobactam and carbapenems. The present study also found high sensitivity to imipenem (92–100%) and amikacin (71–100%), which is in accordance with recent Indian antimicrobial surveillance data.

The sensitivity of E. coli, Klebsiella, and Proteus species to amikacin and imipenem was particularly encouraging, with 100% susceptibility observed in most isolates. Similar results were reported in a recent Indian microbiological study, where Enterobacteriaceae isolated from otitis media demonstrated excellent susceptibility to carbapenems and aminoglycosides. These findings suggest that these antibiotics remain effective therapeutic options for resistant Gram-negative infections. [11]

Overall, the findings of the present study are largely consistent with contemporary Indian literature, which identifies Pseudomonas aeruginosa and Staphylococcus aureus as the predominant pathogens in otitis media.

The high efficacy of piperacillin-tazobactam, imipenem, and amikacin observed in this study reinforces their role in the management of resistant infections. At the same time, the reduced susceptibility to commonly used antibiotics highlights the need for culture-guided therapy and periodic monitoring of antimicrobial resistance patterns. Such measures are essential to optimize treatment outcomes and prevent the emergence of multidrug-resistant organisms. [11]

In conclusion, this study contributes valuable data on adult AOM in the Indian setting. It reinforces known clinical patterns while drawing attention to evolving microbiological trends and resistance patterns. These findings can help guide clinicians in selecting appropriate empirical therapy, encourage the use of culture-based treatment when indicated, and ultimately improve patient outcomes.

Limitation

This study was a single-center hospital-based cross-sectional study with a relatively limited sample size. Microbiological evaluation was restricted to patients presenting with ear discharge, which may not represent the entire spectrum of acute otitis media. Prior antibiotic exposure could have influenced culture positivity and antimicrobial susceptibility results.

Viral and anaerobic pathogens were not investigated, and molecular diagnostic methods were not utilized. Long-term clinical outcomes and recurrence rates were not assessed. Therefore, the findings should be interpreted with caution and may not be generalizable to the broader adult population. Future multicentric studies with larger sample sizes and comprehensive microbiological evaluation are recommended.

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