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Original Research Article

BACTERIAL OTITIS MEDIA IN ALL AGE GROUP OF PATIENTS IN TERTIARY CARE HOSPITAL

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ABSTRACT

Background: Otitis media poses a more significant chronic health challenge in low and middle-income nations compared to their high-income counterparts, with Sub-Saharan Africa and South Asia reporting the highest incidence rates.

Materials and Methods: This study was conducted in Department of Microbiology in Hind Institute of Medical Sciences, Ataria, Sitapur. The duration of study was over a period of two year. The study population comprised 382 individuals diagnosed with otitis media.

Results: This study found that 49.7% of the participants belonged to the age group under 15 years, while the remaining participants were in the age group over 15 years. Among these groups, acute otitis media (AOM) was observed in 65.5% of those under 15 years compared to those over 15 years. The predominant isolates of otitis media were Proteus spp. (86), Pseudomonas spp (62), and S. aureus (78), followed by E. coli, Klebsiella spp., Providencia spp, Serratia spp, Citrobacter spp, and Enterobacter spp.

Conclusion: This study concludes that over diagnosis of COM is believed to be common, resulting in inappropriate antibiotic use, which in turn contributes to the development of antibiotic resistance and increases the risk of adverse effects. In cases where observation is chosen as the primary intervention, ongoing management decisions should be made in collaboration with the child's parent or guardian.

Keywords: Acute otitis media, Chronic otitis media, Antibiotics, Isolates.

INTRODUCTION

Otitis media refers to inflammation affecting the tympanic membrane and middle ear, encompassing various forms such as acute otitis media, otitis media with effusion, and chronic suppurative otitis media.[1,2]This condition commonly arises as a result of acute upper respiratory tract infections but can also be triggered by factors such as allergies or anatomical and functional alterations in the middle ear or Eustachian tube.[3] Approximately 1.23 billion individuals worldwide grapple with otitis media, making it the fifth highest global burden of disease and the second leading cause of hearing impairment.[2,4]Among those affected, children are particularly vulnerable, with otitis media being one of the most prevalent ailments necessitating antibiotic treatment in this demographic region.[4,5,6] Notably, otitis media poses a more significant chronic health challenge in low and middle-income nations compared to their high-income counterparts, with Sub-Saharan Africa and South Asia reporting the highest incidence rates.[4,5,6,7,8]

Otitis media, particularly when chronic or recurrent, is linked to complications including hearing impairment, reduced learning capacity, and lower educational attainment.[9] Each year, approximately 20,000 individuals, primarily children under the age of 5 year, succumb to associated complications.[7]

Commonly pathogenic bacteria such as non-typable Haemophilus influenzae, Streptococcus pneumoniae, Staphylococcus aureus, Streptococcus pyogenes, Pseudomonas aeruginosa, Proteus mirabilis, Escherichia coli, and Moraxella catarrhalisare the primary causative agents of otitis media,[10,11,12,13,14,15] although viruses and fungi are also

implicated.[14,15,16]The incidence of otitis media is directly linked to the colonization rate of bacteria in the nasopharynx.[12]Viral upper respiratory tract infections (URTI) disrupt the mucociliary system, compromising the host's primary mechanical defense against bacterial invasion and predisposing children to acute otitis media (AOM).[12,13,14,15]This study aims to quantitatively assess the bacterial isolation rate from patients with otitis media (OM), identify the main isolates, and evaluate their resistance to commonly used antibacterial agents.

The World Health Organization (WHO) has noted a substantial increase in the global number of individuals with disabling hearing impairment, rising from 42 million in 1985 to 250 million in 2001, with three-quarters of these cases manifesting adult-onset hearing loss.[16]Chronic otitis media (COM) stands as a significant established infectious cause of deafness and hearing impairment worldwide,[17] responsible for over 90% of all infectious causes and contributing to 18.8% of the overall burden of hearing loss attributed to infection. This burden predominantly affects the developing world, with the greatest impact observed in the South East Asian region, followed by the Western Pacific and African regions, where COM accounts for 34.5%, 23.7%, and 16.4% of the total burden of hearing loss, respectively.[18]In addition to chronic forms of otitis media, early-onset OM, occurring in infancy (typically below one year old), is significantly associated with factors such as low socioeconomic status, allergies, and crowded living conditions, serving as a notable risk factor for hearing loss development.[19]

The treatment of recurrent acute otitis media (AOM) is typically categorized into two approaches: medical and surgical. Medical therapy primarily involves the application of topical antiseptics and the administration of topical or oral antibiotics. Surgical intervention commonly entails the insertion of a tympanostomy tube into the middle ear cavity.[20] Restoring the slightly acidic environment of the outer and middle ear cavities is crucial for resolving ear infections, and thus, reducing the pH through the application of acidic solutions can be beneficial.[21]

MATERIAL AND METHODS

Study Area: This study was conducted in Department of Microbiology in Hind Institute of Medical Sciences, Ataria, Sitapur.

Study Duration: The duration of study was over a period of two year.

Data collection: The study population comprised 382 individuals diagnosed with otitis media. Ear discharges were collected in aseptic conditions by a skilled laboratory technician using sterile swabs. For patients, particularly children, with intact tympanic membranes, no attempts were made to aspirate fluid from behind the eardrum (a procedure known as tympanocentesis), which typically requires the expertise of an Ear, Nose, and Throat (ENT) specialist. Instead, ear swabs were taken immediately after the insertion of a sterile otoscopic cone, following routine clinical examination practices. These swabs were then transported in Amie's transport media and inoculated within 2 hours of collection on MacConkey agar and Blood agar. The inoculated plates were incubated aerobically at 35–37°C for 18–24 hours. Bacterial isolation was conducted using standard microbiological methods, and antimicrobial susceptibility testing was performed according to the guidelines provided by the Clinical and Laboratory Standards Institute (CLSI).

Data Analysis: Data were evaluated by using Microsoft Excel.

RESULTS

This study was included 382 cases of otitis media. Among all cases 64 cases of acute otits media rest were from chronic otitis media. This study found that 49.7% of the participants belonged to the age group under 15 years, while the remaining participants were in the age group over 15 years. Among these groups, acute otitis media (AOM) was observed in 65.5% of those under 15 years compared to those over 15 years. The predominant isolates of otitis media were Proteus spp. (86), Pseudomonas spp. (62), and S. aureus (78), followed by E. coli, Klebsiella spp., Providencia spp., Serratia spp., Citrobacter spp., and Enterobacter spp. Antimicrobial susceptibility tests revealed that all bacterial isolates showed low resistance rates of 0%–16.7% to Gentamycin and Ciprofloxacin. Most isolates exhibited low resistance to Chloramphenicol. However, Enterobacter spp., E. coli, Citrobacter spp., and Klebsiella spp. demonstrated 100% resistance to Amoxycillin and Oxacillin. Additionally, Citrobacter spp. showed 100% resistance to Cephalothin and Erythromycin. Overall, all bacterial isolates exhibited 100% resistance to Penicillin. The antibiogram of isolates indicated that 25.6% were resistant to the five tested antimicrobial drugs, and 22.2% were resistant to all antimicrobial drugs tested. Approximately 43.3% of Pseudomonas spp. and 35.4% of Proteus spp. were resistant to all antimicrobials, while 30.8% of Providencia spp., 30.0% of E. coli, and 66.6% of Klebsiella spp. were resistant to five antimicrobials. On average, all isolates exhibited resistance to more than four of the tested antimicrobials.

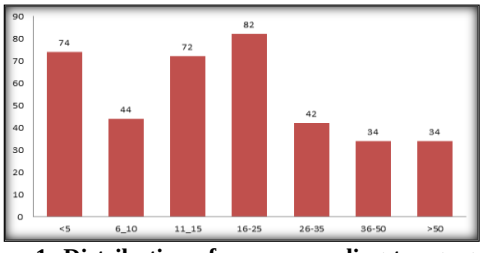

Figure 1: Distribution of cases according to age group (in year)

Table 1: Distribution of cases according to gender

Gender	Number	
Male	194	50.7%
Female	188	49.3%
Total	382	100

Table 2: Distribution of cases according to acute and chronic otitis media

	Number	
Acute Otitis Media	**64**	**16.7%**
Chronic Otitis Media	318	83.3%
Total	382	100%

Table 3: Acute otitis media and chronic otitis media in respect of age group

Age	AOM	COM	Total
<5	22	52	74
6-10	8	36	44
11-15	12	60	72
16-25	4	78	82
26-35	14	28	42
36-50	2	32	34
>50	2	32	34
Total	64	318	382

Table 4: Acute otitis media and chronic otitis media in respect of bacterial isolates

Bacterial isolates	AOM	COM	Total
Proteus spp.	15	71	86
Klebsiella spp.	5	7	12
S. aureus	10	68	78
Enterobacter spp.	9	30	39
E. coli	7	33	40
Providencia spp	7	22	29
Citrobacter spp.	0	32	32
Serratia spp.	0	4	4
Pseudomonas spp.	11	51	62
Total	64	318	382

***AOM- Acute otitis media; *COM- Chronic otitis media**

Table 5: Antibiotic resistant pattern of bacterial isolates isolated for otitis media

Isolates	GEN	Cephalothin	AMX	CIP	TE	E	P	C	OX	COT
Proteus spp.(86)	2	68	82	6	82	83	86	44	82	41
Klebsiella spp. (12)	2	6	12	2	4	12	12	0	12	6
S. aureus(78)	6	22	72	2	49	28	80	12	56	28
Enterobacter spp. (39)	0	38	39	0	22	24	38	10	39	14
E. coli(40)	4	36	40	6	32	38	40	6	40	22
Providencia spp (29)	4	22	44	0	12	18	26	8	26	12
Citrobacter spp. (32)	0	32	32	0	24	32	32	10	32	10
Serratia spp. (4)	0	2	2	0	2	2	2	2	2	0
Pseudomonas spp. (62)	2	48	48	12	8	42	50	60	32	34

DISCUSSION

Numerous studies highlight otitis media (OM) as a significant public health concern affecting individuals across all genders and age brackets. It stands as one of the most common reasons for children to seek medical attention,[22] and represents the primary cause for antibiotic prescriptions. Similarly, in this partic
ular study, 49.7% of OM patients were children under 15 years old, a proportion comparable to the 34–46% reported in other parts of the world.[23-25] Anatomical and immunological factors likely contribute to this high prevalence of OM in young children. The nasopharynx of young children is often incidence of OM in children.[25]

In our study, the majority heavily colonized with pathogens associated with middle ear infections, and their short, broad, and straight eustachian tubes provide easier access for bacteria to enter the middle ear. Additionally, young children experience a high incidence of upper respiratory infections due to their immature immune systems, which can predispose them to subsequent bacterial infections in the middle ear.[26] Poorey VK and Lyer A have also suggested that factors such as overcrowded living conditions, nutritional deficiencies, poor hygiene, and poverty contribute to the increased (83.2%) of otitis media (OM) cases were clinically diagnosed as chronic otitis media (COM), which aligns with findings from previous studies conducted in Ethiopia, where rates of 59.7%,[10] and 52.8%,[27] were reported. Crowded

living conditions, malnutrition, and low socioeconomic status, often linked to poor hygiene practices, could be contributing factors to the higher prevalence of COM cases. These factors are recognized as risk factors for the development of chronic otitis media.[26]

Furthermore, the majority of isolates identified in our study, including Pseudomonas aeruginosa, Proteus spp., and Staphylococcus aureus, are known to be biofilm-forming organisms. These organisms create biofilms as a defense mechanism, which enhances their resistance to host immune responses. Biofilms increase microbial biomass, making it difficult for phagocytosis to occur. Additionally, the extracellular polymeric substances (EPSs) produced by biofilms create a physical barrier that hinders the actions of complement, antibodies, and immune cells.[28]

The primary isolates identified in acute otitis media (AOM) in our study were Staphylococcus aureus (12.8%), Proteus spp. (17.5%), and Pseudomonas spp. (17%). These findings are consistent with a study conducted in Nigeria, where S. aureusand Proteus mirabiliswere also identified as dominant isolates.[29] Similarly, our results align with findings by Diriba et al. in Ethiopia, where Proteus spp. and S. aureuswere reported as major isolates of AOM.[10]However, our findings contrast with a report from Cote D'Ivoire, where Pseudomonas aeruginosa and Streptococcus pneumoniaewere identified as the leading isolates.[30] Additionally, studies conducted in Brazil and Israel showed different dominant etiologies of AOM. In Brazil, Haemophilus influenzae, Streptococcus pneumoniae, andMoraxella catarrhaliswere reported as the dominant pathogens,[31] while in Israel, Streptococcus pneumoniae and Haemophilus influenzaewere identified as the primary isolates.[32] Our findings support the conclusion reached by Tanon-Anoh et al., which suggests that Haemophilus influenzae and Moraxella catarrhalis play a minor role in the pathogenesis of acute otitis media (AOM) in tropical regions.[30]The overall rates of bacterial isolates observed in our study, including Proteus spp. (22.5%), Staphylococcus aureus (20.4%),and Pseudomonas spp. (16.2%), in both acute and chronic otitis media (OM), are consistent with previous reports from Ethiopia,[33-35] and Sudan.[36] Our results also align with studies by Arjyal et al,[28] and Mansoor et al,[18]which identified Staphylococcus aureus, Pseudomonas aeruginosa, and Proteus spp. as prevalent isolates among chronic otitis media (COM) patients. However, the frequencies of Enterobacter spp., Citrobacter spp., Providencia spp., and Escherichia coliwere relatively high in our study compared to previous reports from Ethiopia.[33-34] This variation may be attributed to differences in the etiological distribution of otitis media based on climatic conditions and cultural practices.[29] Regarding antimicrobial susceptibility patterns, we observed considerable variability among isolates. Gentamycin and ciprofloxacin demonstrated effectiveness against over 90% of the isolates.

Similarly, chloramphenicol and co-trimoxazole exhibited effectiveness against some of the isolates. Additionally, cephalothin and erythromycin were effective against Staphylococcus aureusbut showed resistance against the other isolates. Overall, these findings are consistent with reports from Ethiopia,[33,35] Singapore,[37] Iraq,[38] India,[39] Rawalpindi ,[40] and Nigeria.[41]

The susceptibility of Staphylococcus aureusto cephalothin in our study aligns with previous work by Melaku and Lulseged, where cephalothin was found to be effective against gram-positive isolates in general.[33] Studies conducted in Ardebil,[42] Iraq,[38] Nepal,[43] India,[25] Rawalpindi,[44] and Jordan,[44] have also demonstrated the efficacy of ciprofloxacin in treating otitis media, which is consistent with our findings.

However, Jha et al. reported gentamicin and ciprofloxacin-resistant isolates, indicating a decline in the effectiveness of these antibiotics.[23] The prevalence of multidrug-resistant isolates in our study was notably high and concerning. Some isolates showed resistance to nearly all tested antimicrobial drugs. This may reflect the extent of antibiotic misuse, a global issue primarily stemming from over-the-counter purchases in local pharmacies and drug stores, as well as inappropriate prescribing habits, as noted by Ibeawuchi and Mabata.[45] Such practices can lead to treatment failures and complications of the disease.

Furthermore, the majority of isolated bacteria in our study were known biofilm formers. Bacterial biofilms are notoriously resistant to antibiotic treatment, often being 10–1000 times more resistant than genetically identical planktonic bacteria.[28] This likely contributes to the observed increase in multidrug resistance. The lack of available culture facilities and the empirical prescription of antimicrobial drugs in our study setting may also be significant contributing factors to the development of multidrug resistance among these isolates.

CONCLUSION

Chronic otitis media (COM) stands as one of the most prevalent inflammatory disorders in children, significantly impacting their well-being and often leading to antibiotic prescriptions. However, diagnosing COM can be challenging due to inconclusive symptoms and indicators, and difficulties in conducting physical examinations in young children. While a reddish tympanic membrane alone does not definitively indicate COM, the presence of a hazy, bulging membrane with pneumatic otoscopic characteristics, combined with evidence of effusion and a typical clinical history, strongly suggests the condition. Moreover, the management of COM has been a subject of debate, with various treatment approaches

proposed. However, the adoption of these principles is complicated by the diverse types of otitis media. Over diagnosis of COM is believed to be common, resulting in inappropriate antibiotic use, which in turn contributes to the development of antibiotic resistance and increases the risk of adverse effects. In cases where observation is chosen as the primary intervention, ongoing management decisions should be made in collaboration with the child's parent or guardian.

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