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"Microbiological Profile and Antimicrobial Sensitivity of Otitis Media with Ear Discharge"

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KEYWORDS

Otitis media, Chronic suppurative otitis media, Antimicrobial susceptibility testing.

ABSTRACT:

In underdeveloped nations, ear infections pose a risk to public health since they are associated with hearing loss, severe disability and even death. This study is aimed at determining aerobic bacterial agents and their antimicrobial susceptibility patterns among patients. Pus swabs samples from ear discharge were collected and processed for aerobic bacterial culture and susceptibility testing. Out of 100 pus swabs samples processed, 71 swabs (71%) were culture positive. Out of these 71 samples, 20 were polymicrobial and 51 were monomicrobial. The proportion of ear infection was higher in males (58 %) than females (42 %). The frequency of ear infection was more among the patients in the age group of 5 to 18 (49%) and 18 to 60 years (31%). The predominant isolate was Pseudomonas aeruginosa (40.84%), followed by Staphylococcus aureus (36.61%) and Coagulase-negative staphylococcus aureus (16.90%). Most aminoglycosides and cephalosporins were effective against majority of the bacteria. High degree of resistance was noted against macrolides. Therefore, treatment of otitis media in the study area needs to be guided by antibiotic susceptibility testing of isolates.

INTRODUCTION

The term "otitis media" is used to refer to a variety of inflammatory conditions that affect the middle ear. Otitis media can be classified as acute, chronic, or recurrent. An illness called acute otitis media manifests itself quickly and hurts the ears. CSOM is a type of middle ear inflammation that causes a perforated tympanic membrane and ear discharge lasting more than six weeks. The bacterial causes of otitis media can be aerobic or anaerobic, mainly Gram negative organisms such *Pseudomonas aeruginosa*, *Escherichia coli*, *Proteus mirabilis*, *Klebsiella* species, *Haemophilus* influenza, Gram Positive organisms such as, *Streptococcus pyogenes*, *Staphylococcus aureus, Streptococcus pneumoniae* or anaerobic organisms such *Bacteroides* species, *Fusobacteria* species, Gram-positive cocci.

The eustachian tube serves as a drain and connects the middle ear to the back of the nose or throat. The bacteria enter the ear canal via the eustachian tube. The eustachian tube's interior may expand as a result of irritation to the nasal passages. The eustachian tube is blocked by swelling, making it impossible for fluid to drain from it. More fluid is produced, and as it does, more of it gets trapped in the middle ear. The environment created by the retained fluid is ideal for bacteria to flourish and cause an ear infection. The eustachian tube is also used to maintain

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the air pressure inside the inner ear. The pressure inside the ear increases when the eustachian tube constricts due to fluid. This pressure could cause the middle ear's eardrum to rupture. The fluid may leak out of the ear if the eustachian tube is unable to drain it. Due to more awareness, the incidence is declining in developed countries like the United States of America and Europe, but it is rising in under developed countries.[1] Worldwide each year, acute otitis media affects about 11% of the population. Men are more likely to be impacted than women in half of the cases, which include children under the age of five. Otitis media is one of the most typical causes of deafness in India.[2]

It has been reported that pneumococcal and influenza vaccinations, breastfeeding, and avoiding cigarette smoking are all effective ways to reduce the incidence of otitis media.[3] It is critical to utilise pain medications for AOM [3] such as Paracetamol (Acetaminophen), Ibuprofen, Benzocaine ear drops, and opioids.[3] Pain relievers, both oral and topical, are beneficial in treating otitis media pain. Antibiotics may help with AOM healing, but they can also cause negative effects.

Antibiotics are only recommended in patients who have not improved after two or three days. Amoxicillin is usually used as an antibiotic of choice. Tympanostomy tubes may help those with recurrent infections. Antibiotics for effusion in children with otitis media may speed up the cure of symptoms, but they can also cause diarrhoea, vomiting, and a rash. Hence selection of antibiotic is a major concern in treatment of CSOM.

With this background, we decided to study the aerobic pathogenic bacterial profile of Otitis media and study their antimicrobial susceptibility pattern.

MATERIALS & METHODS

A prospective study was conducted at Department of Microbiology, MGM Medical college and hospital for a period of one year.

A total of 100 pus swab were collected from the patients of otitis media. They were subjected to culture and antimicrobial susceptibility testing according to standard protocols.[4]

Two ear swabs of patients with ear discharge were collected one for microscopy and one for culture and sensitivity. Samples were inoculated on Blood agar, Mannitol salt agar, Chocolate agar, and MacConkey's agar and incubated at 37° C for 24 to 48 hours. Detailed biochemical testing was performed and antimicrobial susceptibility testing was done on Muller-Hinton agar plates by Kirby Bauer's disc diffusion method using suitable antibiotics as per CLSI guidelines.[5] The sensitivity was determined by measuring the zones of inhibition around the disc.

RESULT

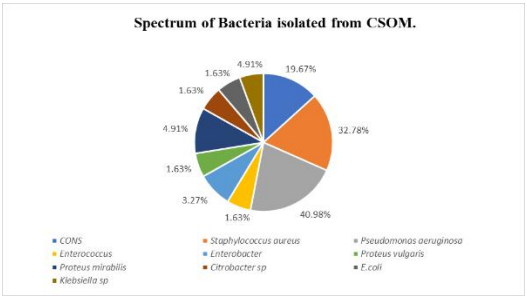
Out of 100 pus swabs of clinically suspected patients of otitis media,71 cases were enrolled for this project which yielded significant growth of single or multiple organisms.

Demographic Distribution:

Out of the 100 samples, The proportion of ear infection was higher in males (58 %) than females (42 %) In this study, The frequency of ear infection were more prevalent among the patients in the age group of 5 to 18 (49%) and 18 to 60 years (31%).

Figure 1. depicts Spectrum of Bacteria isolated from Chronic Suppurative Otitis Media (CSOM)

Figure 1. Spectrum of Bacteria isolated from Chronic Suppurative Otitis Media



A total of 100 Bacteria were isolated. They were *Pseudomonas aeruginosa* 25 (40.98%), *Staphylococcus aureus* 20(32.78%),CONS19(12.67%), *Proteus mirabilis* 3(4.91%), *Klebsiella spp*3(4.91%), *Enterobacter spp 2(3.27%), Proteus vulgaris 1(1.63%), Enterococcus spp 1(1.63%),, Citrobacter spp*1(1.63%), *E. coli* 1(1.63%). Amongst all the bacteria the predominant isolates were *Pseudomonas aeruginosa* , followed by *Staphylococcus aureus* and *Coagulase-negative staphylococcus*. Hence they were considered for further study.

FIGURE 2. Antibiotic susceptibility pattern of *Pseudomonas aeruginosa* isolated from CSOM.

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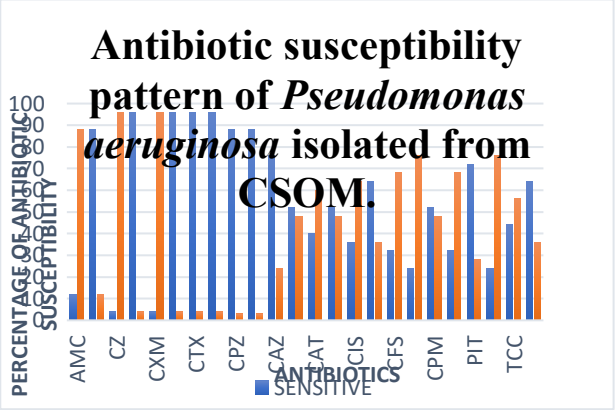
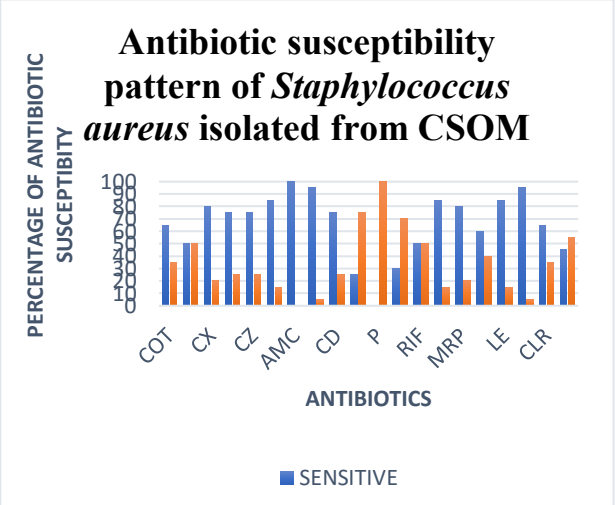


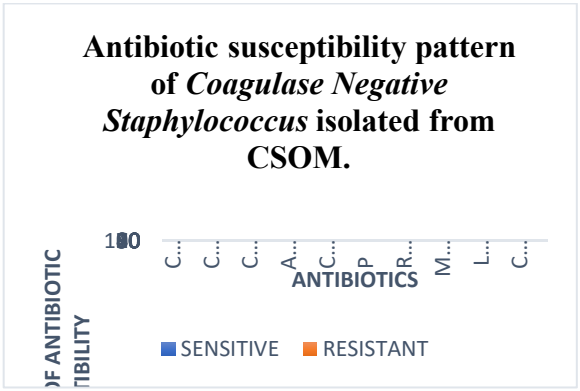
More than 75% *Pseudomonas aeruginosa* were sensitive to Gentamicin (96%), Tobramycin (90%), Amikacin (87%), Cefotaxime (93%), Ciprofloxacin (90%), Polymyxin-B (100%), Atropenem (100%) and more than 75% *Pseudomonas aeruginosa* were resistant to Cefazolin (100%), Augmentin (93%), Cefuroxime (100%)

FIGURE 3. Antibiotic susceptibility pattern of *Staphylococcus aureus* isolated from CSOM.



More than 75% of *Staphylococcus aureus* were sensitive to Augmentin (100%), Meropenem (100%), Linezolid (100%), Vancomycin (96%), Rifampicin (96%), Levofloxacin (96%), Clarithromycin (92%) and more than 75% of *Staphylococcusaureus* were resistant to Penicillin (81%), Azithromycin (75%).

FIGURE 4. Antibiotic susceptibility pattern of *Coagulase Negative Staphylococcus* isolated from CSOM.



Majority of Coagulase Negative Staphylococcus were sensitive to Cefazoline (100%), Augmentin (100%), Tetracycline (100%), Vancomycin (100%), Linezolid (100%), Ciprofloxacin (92%), Meropenem (92%), Levofloxacin (92%), Clarithromycin (92%) and majority of *Coagulase NegativeStaphylococcus* were resistant to Penicillin (75%), Azithromycin (67%), Roxithromycin (67%).

DISCUSSION

In the present study, out of 100 cases of Otitis media a total of 71% of the samples showed aerobic bacterial growth in which 20 were polymicrobial and 51 were monomicrobial. A study carried out at Jawaharlal Nehru Medical College and Hospital in Aligarh, Khatoon A *et al* reported that out of 130 samples of CSOM, 84.62% revealed bacterial growth. They have also reported out of the 95.96% of pathogenic bacteria found, 4.04% were commensal [6]. 1225 ear discharge culture results from suspected patients were evaluated from a ten year retrospective analysis done by Argaw Denboda*et al*, from Northen Ethiopia out of which 1024 (83.6 %) were positive for one or more bacterial species.[2] Nine (3.1%) of the samples in research by Hailu *et al*. had mixed bacterial growth.[7] This shows that CSOM is usually associated with one or more pathogenic bacteria.

In our study, majority of CSOM patients were in the age group of 5 to 18 (49%) followed by 18 to 60 years (31%) years. The study by Hiremath B et al. revealed that the majority of patients were under the age of 29.[8] In a study conducted by Jagannath Babu G.R. et al, CSOM was frequently observed in people between the ages of 11 and 20.[9]

In contrast to other research, we found that CSOM most frequently affects those under the age of 18. Their weak

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immune system and higher incidence of upper respiratory tract infections may be the reason for this.

Out of the 100 samples included in our study, 58 patients were males and 42 patients were females. In a study conducted in the ENT division of the secondary care hospital in North India, by Singh A *et al*. out of the 85 patients, 67.05% were males and 32.94% were females [10]

In our study, *Pseudomonas aeruginosa* was the most predominant pathogen followed by *Staphylococcus aureus* and *Coagulase negative Staphylococcus.* Various other studies done by Yadav K *et.al* [11], Hailu D *et. al* [7]and Shetty A. K. *et. al* [12] also showed that the most isolated pathogens from CSOM were *Pseudomonas aeruginosa* and *Staphylococcus aureus*. A study by Mittal *et.al* [13] shows that *Pseudomonas aeruginosa* (22-44%) and *Staphylococcus aureus* (17-37%) were the most common aerobic pathogenic organism. In a study done by Argaw Denboda*et al* [2]the predominant isolates were Proteus species and, in another study, done by Afolabi OA *et al* [14] *Pseudomonas aeruginosa* and *Klebsiella* species were the most isolated organisms. Etiological agents of CSOM may vary from one set up to another, however *Pseudomonas spp* and *Staphylococci* have been reported to be the most common cause of otitis media as per the reports of majority of studies.

All the pathogens were subjected to antibiotic susceptibility pattern using a standard procedure. We found that the most effective antibiotics against *Pseudomonas aeruginosa* were Aztreonam, Cefepime, Gentamicin and Amikacin. Least effective antibiotics were Cefazolin and Cefuroxime and Augmentin. A study done by J. Madana *et. al* at Jawaharlal institute of Postgraduate Medical Education and Research, Pondicherry also showed similar result as 105 of *Pseudomonas* isolates were susceptible to Amikacin.[15] Studies done by Pampi Majumder *et. al* [16], also, shows that Amikacin, Polymyxin-B were highly effective against *Pseudomonas*.

In our study *Staphylococcus aureus* were susceptible to Augmentin, Meropenem and Linezolid and highly resistant to Penicillin, Azithromycin, Roxithromycin. Augmentin, Cefazolin, Tetracycline were highly effective against *Coagulase Negative Staphylococcus* and they were found to be resistant to Penicillin, Azithromycin, Roxithromycin. In a study done by J. Madana *et. al* Vancomycin resistance was found in all of the *Staphylococcus* isolates.[15]

Gram positive bacteria showed high resistance to Penicillin but were sensitive to Augmentin. Whereas Pseudomonas was resistant to Augmentin. The empirical treatment for CSOM in India is usually Augmentin. Here, it is necessary to note that Augmentin will not be of much help if the causative organism is *Pseudomonas aeruginosa* as it is intrinsically resistant to Augmentin. Hence it is essential to know the aetiological agent of Otitis media before starting the antibiotic treatment. It was observed that most aminoglycosides and cephalosporins were effective against the majority of the bacteria that were isolated from CSOM.

Topical antibiotics with or without steroids and occasionally oral antibiotics are used in the treatment of CSOM. However, it has been found that topical therapy usually helps CSOM patients. Additionally, if oral antibiotics are used, the middle ear may not receive the necessary antibiotic concentration. Therefore, oral antibiotics are started only if the patient does not improve after receiving topical therapy. Studies have advised individuals who are not responding to topical treatment to use oral and intravenous antibiotics.

In a study carried out by Head K et.al [17], aural toilet aids help in alleviating the discomfort as well.Numerous research has recommended various types of combinations. Topical antibiotics with aural toileting,oral and intravenous antibiotics,topical and systemic antibioticscan be effectively used in effective treatment of patients.

We recommend culture and sensitivity testing of pus swabs collected from CSOM to start the appropriate antibiotic treatment along with the above treatments.

CONCLUSION

Otitis Media, especially CSOM is the main factor contributing to hearing loss. Over time, it degrades a person's quality of life and negatively affects their employability. For a successful treatment, it is advised to identify the etiological agent and assess its antibiotic susceptibility pattern. Additionally, it is necessary to periodically review the antibiotic policy and evaluate the microbiological pattern, which may help in empiric treatment of CSOM. However, we suggest use of culture and sensitivity guided therapy instead of the traditional

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empiric therapy method. This will reduce the difficulties brought on by drug resistance.

Declaration by Authors

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