

Original Research Article

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## Bacterial Aetiology and their Antibiotic Susceptibility Pattern of Otitis Media in Paediatric Age Group

Mohammad Khalid Farooqui<sup>1</sup>, Prakriti Vohra<sup>2\*</sup>, Ruby Naz<sup>2</sup>, Anil Goel<sup>3</sup>,  
Akil Hussain<sup>4</sup>, Sameena Khan<sup>2</sup> and A.K. Malik<sup>2</sup>

<sup>1</sup>Department of ENT, SHKM, GMC, Mewat, India

<sup>2</sup>Department of Microbiology, SHKM, GMC, Mewat, India

<sup>3</sup>Department of Paediatrics, SHKM, GMC, Mewat, India

<sup>4</sup>NIMS, Medical College, Jaipur, India

\*Corresponding author

### ABSTRACT

Otitis media is the most common reason for children to visit a medical practitioner and it is an important cause of preventable hearing loss. 564 patients of paediatric age group with symptoms of otitis media were studied from ENT and paediatrics department in microbiology department at SHKM, GMC, Mewat from June 2015 to May 2016. Isolates were identified by conventional methods and the antibiotic susceptibility profiles were determined by the standard disk diffusion method. Most common bacterial isolates included *Pseudomonas aeruginosa* (41.76%), *Staphylococcus aureus* (33.3%). The Gram positive bacteria antibiogram revealed high sensitivity to ciprofloxacin, ceftazidime, netilmycin, piperacillin tazobactam and gentamycin. While Gram negative bacteria antibiogram reveals sensitivity to ciprofloxacin, ceftazidime, netilmycin, piperacillin tazobactam and gentamycin. Low levels of resistance were found among most clinical isolates in general to the commonly used antibiotics however, an increased frequency of MRSA was detected.

### Keywords

Antibiotic susceptibility,  
Bacterial aetiology,  
Otitis media,  
Paediatric age.

### Article Info

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### Introduction

Otitis media is an inflammatory disease of the mucosal lining of the middle ear, which includes a variety of medical conditions with different signs and symptoms.

Otitis media is most commonly caused by the build up of fluid behind the ear drum, as a result of a blockage to the Eustachian tube. Otitis media is more common in children, as their Eustachian tube is shorter and more horizontal than adults and is made up of

more flaccid cartilage, which can impair its opening (Biradar, 2015). Infection can spread from the middle ear to involve the mastoid, facial nerve, labyrinth, lateral sinus, meninges and brain leading to mastoid abscesses, facial nerve paralysis, deafness, lateral sinus thrombosis, meningitis and intracranial abscesses (Abdel raouf *et al.*, 2014).

The risk of prevalence of the diseases become higher in people with low

socioeconomic status, Poor living conditions, overcrowding, substandard hygiene, and malnutrition and under resource health care (Farooqui *et al.*, 2016).

It is the commonest childhood infectious disease worldwide starting early in life but in our environment; presentation may be in adult life it can be managed at the primary health care level thereby preventing the development of deafness and even fatal complications. Otitis media is more common in children, as their Eustachian tube is shorter and more horizontal than adults and is made up of more flaccid cartilage, which can impair its opening (Kumar *et al.*, 2012).

The common causes of infection are nasopharyngeal disease and in children this usually means adenoids. These causes may be in the nose or sinuses or in the oropharynx and tonsils. Bacterial infections of the middle ear normally originate from the upper respiratory tract, with the bacteria entering the ear through the auditory (Eustachian) tube, the principal portal of entry to the ear (Basak *et al.*, 2014).

Common aerobic bacteria causes otitis media are *Staphylococcus aureus*, *Pseudomonas aeruginosa*, *Escherichia coli*, *Streptococcus pyogenes*, *Proteus mirabilis*, *Klebsiella species*, *Haemophilus influenzae*, *Streptococcus pneumoniae*.

The present study was aimed at gaining knowledge about the type of pathogens responsible for infection in this region and their resistance patterns which will help the clinicians to choose the right empirical treatment. Antibiotic resistance pattern are varied according to geographical region, and very few studies are published about this especially from Haryana.

### **Material and Methods**

To study bacterial etiologic agents and their antibiotic susceptibility patterns of otitis

media in paediatric age group in collaboration of Paediatrics and ENT department of SHKM GMC Nalhar, Mewat.

**Ethical concern:** Permission from institutional ethical committee was taken for conducting this study.

**Sample size calculation:** sample size is calculated from prevalence (6%) of otitis media in children (Rupa *et al.*, 1999) with help of formula  $PQ/r^2$

P; prevalence,  $Q = 1 - P$ ,  $r = .02$

We studied 564 patients of one to 14 years age group (Paediatric) who were attend OPD with symptoms of otitis media. They were enrolled for study and written consent had been taken. Patient of otitis media presented with complain of purulent or muco-purulent ear discharge with or without fever and otalgia (Park, 2002).

### **Study duration**

Duration of study was from June 2015 to May 2016, on the basis of following inclusion and exclusion criteria. Detailed clinical history regarding unique identification number, name, age and sex, duration of discharge, other associated symptoms and antibiotic therapy were noted down.

### **Inclusion criteria**

1. Clinically diagnosed cases of Otitis Media
2. Active purulent discharge at time of examination

### **Exclusion criteria**

1. Congenitally anomalies involving ear nose oral cavity and pharynx

2. Discharge with intact tympanic membrane ( to exclude otitis externa)
3. Patient took antibiotic in last 48 hour.
4. patients less than 1 year or more than 14 year of age,

### **Sample collection**

The ear discharge from the middle ear was collected by sterile swabs under aseptic conditions with help of 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 transport immediately to laboratory. The swab was sub-cultured primarily on Blood Agar, Mac Conkeys agar and Chocolate agar and Thioglycolate broth; and incubated at 37°C for an overnight. Subculture from Thioglycolate broth was done if primary inoculation was sterile. The organisms were identified by morphology, cultural characteristics, pigment production and biochemical reaction followed by antibiotic sensitivity test. All the data concerning clinical feature, supporting blood investigation and culture report was analysed and complied in prescribed format. Chi square test was used to calculate p value with help of SSPS (version 12.0) software (Daniel *et al.*, 2007).

### **Result and Discussion**

Out of 564 patients males were 49 % and females were 51%. Age of patients was ranging from 1year to 14 years. Higher infection rate was observed in age group 6-10 year followed by < 1-5 year. Out of 564 patients, 67% patients were from OPD, 46.9% had infection in right ear and 19.8% had bilateral ear discharge. Only 1.7% patients had history of fever, 48.3% children complained of ear ache and 17% patient had purulent discharge. The most common

important symptoms of ear infections are ear discharge, ear pain (78%), hearing loss (35%), vertigo and tinnitus. The clinical findings of patients with Otitis media prevalence mostly in children younger age in our study are similar to findings of previous studies done in India and other developing countries (Rawat *et al.*, 2015).

In our study 53% culture were sterile in aerobic culture. Reason behind it may be viral origin or other anaerobic bacteria. 89% growths were mono-microbial while 10.7 % were polymicrobial. Fungus was isolated in 7% cases in which *Aspergillus* spp. was most common. Maximum patients were suffered from recurrent upper respiratory infection.

The results of this present work showed that *P. aeruginosa* was the most commonly isolated pathogen (41.76%) followed by *S. aureus* (33.34%). Similar findings have been observed in Ireland, Pakistan and Greece which reported that *P. aeruginosa* and *S. aureus* are the most common organisms isolated from the cases of otitis media (Mukassabi, 2007; Arshad *et al.*, 2004; Bardanis *et al.*, 2003).

This study also provides insights into the susceptibility profile of bacteria isolated from ear infections. Our results have demonstrated that amoxicillin-clavulanic acid, ciprofloxacin, cefepime, teicoplanin, vancomycin, netilmycin, imipenem, amikacin, ofloxacin and gentamicin in general are effective against both Gram positive and negative bacteria isolated from ear infections.

Gram-positive bacteria showed that there was high frequency of sensitivity to cefotaxime, ceftazidim. While ciprofloxacin, Ceftazidim, Gentamicin, cefixeme and ceftriaxone were perfect antimicrobial agents against Gram negative bacteria.

This susceptibility profile of isolated bacteria provides an evidence for bacterial resistance to many antimicrobial agents by means of multiple drug resistance (MDR), this can be noticed clearly from the susceptibility pattern of *P. aeruginosa* and *S. aureus* and increased frequency of Cefoxitin

resistance *S. aureus* (MRSA) (5.8%) and this detection of multidrug resistant isolates may further limit therapeutic options. However, there are reports from different parts of the world with high resistance to this antimicrobial agents (Naz *et al.*, 2015; Prakash *et al.*, 2013; Habibu *et al.*, 2015)

**Table.1** Distribution of patients according to age

Age	Male	Female	Total
1-5	103 (54.5%)	86(45.5%)	189(33.5%)
6-10	96(42.5%)	130(57.5%)	226(40%)
11-14	76(51%)	73(49%)	149(26.4%)
Total	275(49%)	289(51%)	564

**Table.2** Types of isolates

Bacterial	242	92.33%
Fungal	19	7.27%
Total	261	

**Table.3** Types of growth

Monomicrobial	233	89.27%
Polymicrobial	28	10.72%
Total	261	

**Table.4** List of isolates

Organism	No.	%percentage
<i>Pseudomonas spp</i>	109	41.76%
<i>Staphylococci aureus</i>	87	33.34%
<i>Klebsiella spp</i>	19	7.27%
<i>Streptococcus pyogenes</i>	12	4.5%
<i>CoNS</i>	11	4.2%
<i>Escherichia coli</i>	11	4.2%
<i>Enterococcus spp</i>	7	2.68%
<i>Citrobacter spp</i>	5	1.9%
Total	261	

**Table.5** Antibiotic susceptibility pattern for gram positive cocci

Antibiotics	<i>CoNS</i> (n=11)	<i>Staphylococcus aureus</i> (n=87)	<i>Streptococcus pyogenes</i> (n=12)	<i>Enterococci</i> (n= 7)
Vancomycin	11(100%)	87(100%)	(100%)	(100%)
Erythromycin	4(37%)	45(51.7%)	6(50%)	3(42.8%)
Clindamycin	3(27%)	41(47%)	8(67%)	3(42.8%)
Cefotaxime	4(37%)	66(76%)	6(50%)	-
Cefepime	4(37%)	65(74.7%)	6(50%)	-
Ciprofloxacin	8(73%)	80(92%)	12(100%)	6(85.7%)
Teicoplanin	7(64%)	81(93%)	10(83%)	7(100%)
Gentamycin	10(91%)	87(100%)	12(100%)	7(100%)
Amoxicillin-clavulenate	8(73%)	82(94%)	10(83%)	6(85.7%)
Ampicillin	3(27%)	40(46%)	4(33%)	3(42.8%)

**Table.6** Antibiotic susceptibility pattern for gram negative isolates

	<i>Pseudomonas</i> n=109	<i>Citrobacter</i> n=5	<i>Klebsiella</i> n=19	<i>E.coli</i> n=11
Ampicillin	-	3(60%)	6(31.5%)	6(55%)
Amikacin	107(98%)	2(40%)	17(89.47%)	10(91%)
Ceftazidime	69(63.3%)	3(60%)	13(68.42%)	7(64%)
Cefepime	-	3(60%)	7(36.84%)	7(64%)
Ciprofloxacin	103(94%)	4(80%)	19(100%)	10(91%)
Piperacillin-tazobactam	99(91%)	5(100%)	15(78.9%)	9(82%)
Imepenem	109(100%)	5(100%)	19(100%)	11(100%)
Gentamycin	103(94%)	5(100%)	19(100%)	11(100%)
Netilmycin	98(90%)	4(80%)	14(74%)	9(82%)
Amoxicillin-clavulenate	-	4(80%)	14(74%)	9(82%)

This difference in the susceptibility profile might be due to frequency of usage of these agents for the treatment of ear infections in different geographic locations. In this area CSOM is more prevalent. The reason behind this may be more people from low socio economic strata, mostly illiterate with poor sanitary habits. They use mainly pond water for cleaning and bathing due to lack of clean water supply.

Patient non-compliance is an important

factor responsible for the development of antibiotic resistance. As soon as symptoms subside, many patients stop taking antibiotics before completion of therapy and allow partially resistant microbes to flourish. Such practice should be condemned strongly and patients should be educated to avoid the same for the antibiotics commonly available locally as topical eardrops.

Both *Pseudomonas aeruginosa* and *Staphylococcus aureus* are constituents of

normal flora of the external auditory canal. *Pseudomonas* to be the most commonly isolated organisms may be that it can grow well in the absence of special nutrition, it proliferates at room temperature and it is highly resistant to antibiotics, making it difficult to treat. *Pseudomonas* is ubiquitous in our physical environment and has a predilection for the moist areas. It is thought to infect tissues first by adherence to epithelial cells by means of pili or fimbriae. Normal tissues usually resist such attachment, unless there is cellular injury. This phenomenon of opportunistic adherence may represent an important step in the pathogenesis of middle ear infections. Also *Pseudomonas* has been known to form bacterial biofilms because of which they can resist host defence mechanisms and extremely difficult to eradicate. The frequency of *Staphylococcus aureus* in the middle ear infections can be attributed to their ubiquitous nature and high carriage of resistant strains in the external auditory canal and upper respiratory tract (Li *et al.*, 2001; Ogbogu *et al.*, 2013).

Result of our study showed high prevalence and resistance rate of *Staphylococci* and *Pseudomonas* isolates from otitis media patients to  $\beta$ -lactam and other commonly used antimicrobials. Our study suggested that Amoxycylav, ciprofloxacin, Piperacillin-Tazobactam, Gentamycin, and Netilmycin are best choice in these cases. Therefore an appropriate knowledge of antibacterial susceptibility of microorganism may contribute to rational antibiotic use and the success of treatment for otitis media

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