



A study of Bacterial profile and Antimicrobial susceptibility patterns of patients with ear infection in a tertiary care hospital in Northern India

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Introduction

Otitis media (OM), an inflammation of the middle ear cleft, is a common problem worldwide. Globally, about 65–330 million people suffer from ear infection and 60 % of them had significant hearing impairment.¹ It is a prevalent problem for both children and adults especially in developing countries. Due to the low socio-economic status, overcrowding, poor hygiene, inadequate health care, and recurrent upper respiratory tract infection, the burden is high in low and middle income countries.² Clinically, it is classified as acute, sub-acute and chronic depending on duration. Acute otitis media incidence rate is 10.85 % while chronic suppurative otitis media incidence rate is 4.76 %.³

Infection can be spread from middle-ear to vital structures such as mastoid, facial nerve, labyrinth,

lateral sinus, meninges and brain leading to mastoid abscess, facial nerve paralysis, deafness, lateral sinus thrombosis, meningitis and intracranial abscess.⁴ Moreover normal flora of the skin such as *Pseudomonas aeruginosa*, *Staphylococcus aureus*, *Proteus mirabilis*, *Klebsiella pneumonia* and *Escherichia coli* that can easily enter through perforated ear have been reported as the main agents of otitis media.⁵ Empiric treatment of ear infection is not always appropriate since drug susceptibility patterns change overtime and empiric antibiotic therapy may not be effective at times and could contribute to development of antimicrobial resistance in the long run.⁶ Early, prompt and effective treatment of ear infection will significantly reduce both short and long term complications. Hence our study aims at determining the bacterial profile and

antimicrobial susceptibility pattern of ear infections among patients in a tertiary care hospital in India.

Material and Methods

Study area and period: The study was conducted in the department of Microbiology of a tertiary care institute, Srinagar (Jammu & Kashmir) over a period of three years i.e. from January 2015 to December 2018.

Study population: All the patients attending the OPD with complaints of ear discharge during the period of three years were taken for the study purpose.

Culture and identification: After thorough clinical examination clinician collected discharge material with clean sterile swab stick. Whenever possible, two samples were collected. First sample of ear swab was for gram staining and second for culture. Each material was inoculated on to, bacterial blood agar, chocolate agar, and MacConkey agar. The MacConkey and blood agar plates were incubated in aerobic condition, whereas chocolate agar plate was kept in a candle jar, which was able to generate about 5–10% CO₂. After overnight incubation species isolated were identified by morphology, growth characteristics and bio-chemical reactions according to the standard conventional techniques.

Antimicrobial susceptibility testing: After identifying the isolate, their antibiotic sensitivity test was done on Mueller Hinton Agar by Kirby Bauer disc diffusion method according to CLSI recommendations.⁷

Inclusion criteria: Patients from age group of 0 to 70 years and of either sex, who complained of ear discharge, were included in the study. Informed consent was taken from all patients before recruiting in the study.

Data analysis: Data was entered in Microsoft excel office and the results were expressed in the form of tables, bars and proportions.

Results

The study was conducted in the Department of Microbiology of a tertiary care institute, Srinagar and Kashmir. The sample ie ear discharge received from patients attending the OPD from January 2015 to December 2018 was processed for isolation and identification of bacterial pathogens according to the standard microbiological techniques.

A total of 145 samples were obtained for a period of 3 years comprising of 85 (58.6%) females and 60 (41.3%) males. Most common age group involved was 20-40 yrs (55.1%) followed by 0-20 yrs (24.1%) whereas less number of isolates were found in elderly age groups i.e. 40-60yrs (10.1%) and >60 yrs (16.3%) respectively.(Table-1).

The most predominant bacterial isolates was *Staphylococcus aureus* 60 (40%) followed by *Pseudomonas spp* 40 (26.6%), Coagulase negative *Staphylococcus* 20 (13.33%), *Enterococcus spp.*10 (6.66%), whereas less number of isolates 5 each (3.3%) were from *Klebisella*, *E. coli*, *Moraxella and candida* respectively (Table-2, Figure-1).

A single growth of organism was found in 115(79.3%), mixed growth was observed in 20(13.9%) cases, however no growth was seen in 10 (6.89%) (Figure-2).

Occurrence of gram positive organisms was higher than gram negative cases. With gram positive isolation rate was 90(60%) and for gram negative organisms it was 55(36.66%).

Antibiotic sensitivity and resistant pattern of *Staphylococcus aureus* shows that 80 *Staphylococcus spp* 20 (13.33%) were CoNS. Among coagulase positive *Staphylococcus* 15(25%) were MRSA. 100% sensitivity was observed for Vancomycin, Teicoplanin and Linezolid.83.33% resistance was seen with Ciprofloxacin,75% with Cotrimoxazole, 66.66% with Erythromycin.41.66% with Clindamycin, 75% with Gentamicin, 33.33% with Azithromycin (Figure-3).

Pseudomonas showed 100% sensitivity to Colistin and Polymyxin B. Susceptibility pattern showed 62.5% sensitivity with Amikacin, 75% with

Ciprofloxacin. Most commonly used drug against *Pseudomonas* Ceftazidime showed sensitivity of 45% (Figure-4).

Coagulase negative *Staphylococcus* isolates showed 100% sensitivity to Vancomycin, Linezolid, 30% to Trimethoprim-Sulfamethoxazole and 70% to Oxacillin (Figure-5).

Among Enterococcal isolates 100% sensitivity was seen for Vancomycin Linezolid and Erythromycin. However all the isolates were 100% resistant to Ampicillin and Ciprofloxacin (Figure-6).

With regard to *Klebisella spp* isolate, 44% were sensitive to Ceftriaxone and 77.8% sensitive to Trimethoprim-Sulfamethoxazole, 16.7% were sensitive to Ciprofloxacin and 38.9% sensitive to Gentamycin. It showed high frequency of resistance to Ampicillin. Among other gram negative bacteria like *E.coli* 66%, 16.7% and 11% of the isolates were sensitive to Ceftriaxone,

Gentamycin and Ciprofloxacin respectively (Table-3).

Table 1: Age and gender distribution of patients (n=145)

Characteristics	No.	%	
Age groups	0-20	35	24.1
	20-40	80	55.1
	40-60	15	10.1
	>60	15	16.3
Gender	Male	60	41.3
	Female	85	58.6

Table 2: Bacterial isolates of the ear discharge (n=145)

Bacterial Isolates	No.	%
Staphylococcus aureus	40	27.6
Pseudomonas	40	26.6
Coagulase negative	20	13.3
Enterococcus	10	6.6
Klebisella	5	3.3
E.coli	5	3.3
Morxella	5	3.3
Candida	5	3.3

Figure 1: Bacterial isolates of the ear discharge (n=145)

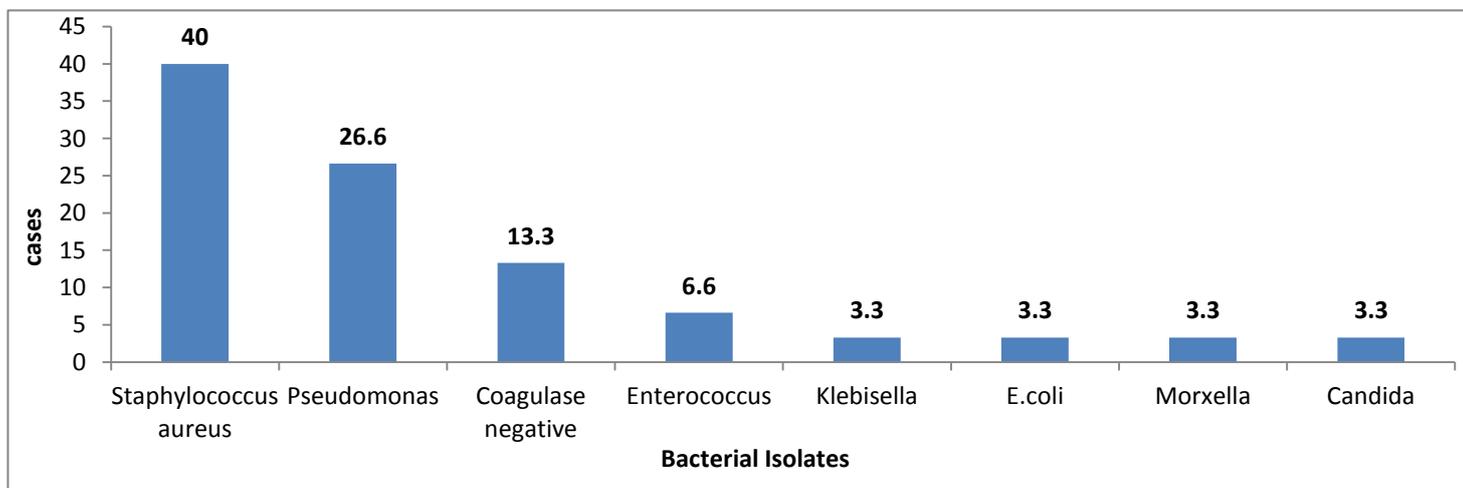


Figure 2: Type of growth seen in ear discharge of cases (n=145)

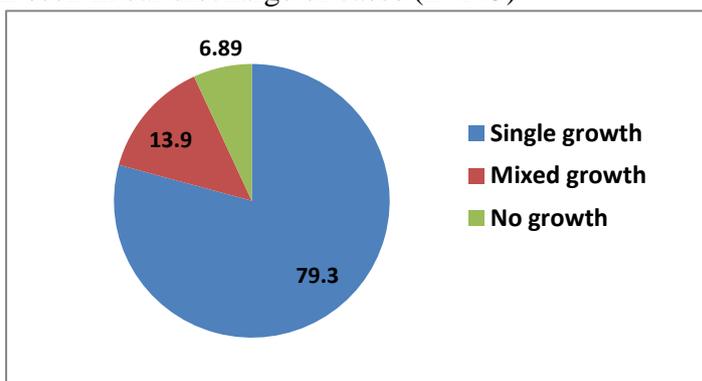


Figure 3: Antibiotic Sensitivity and Resistant pattern of *Staphylococcus aureus* (n= 60)

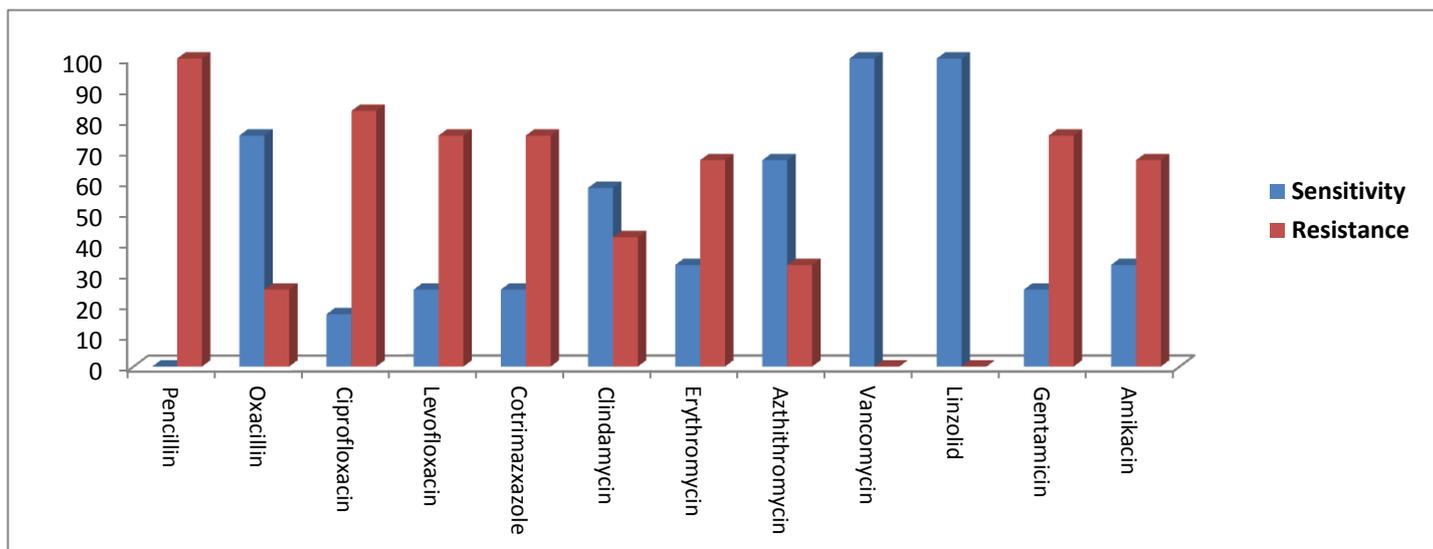


Figure 4: Antibiotic Sensitivity and Resistant pattern of *Pseudomonas* (n= 40)

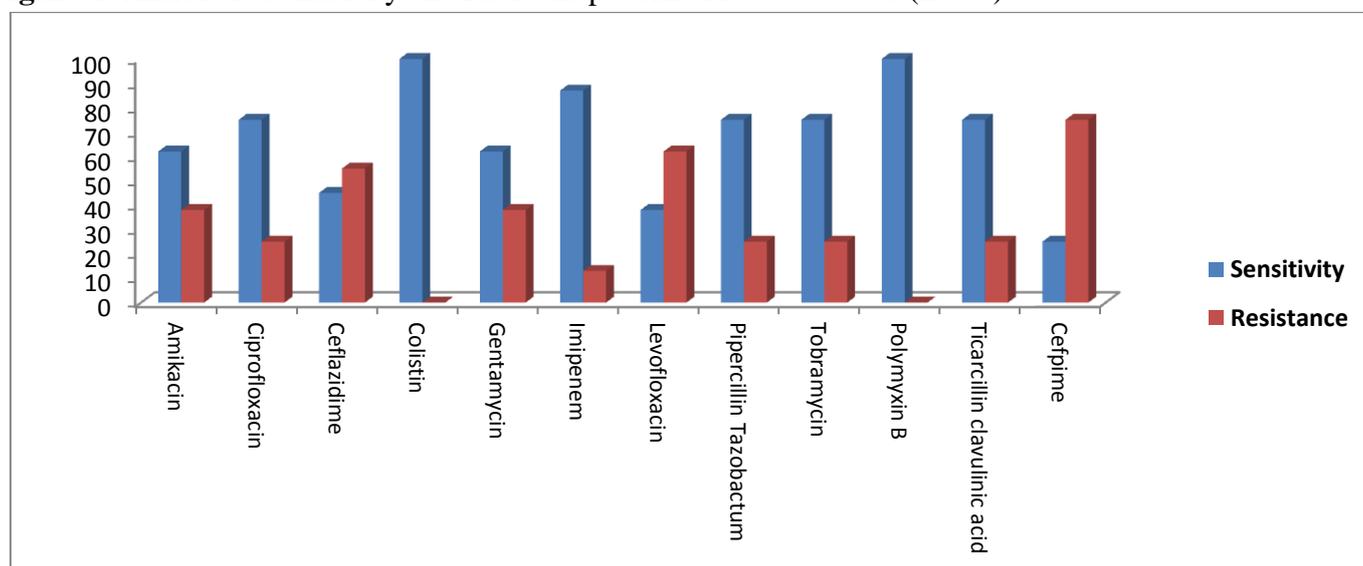


Figure 5: Antibiotic Sensitivity and Resistant pattern of *Coagulase negative* (n= 20)

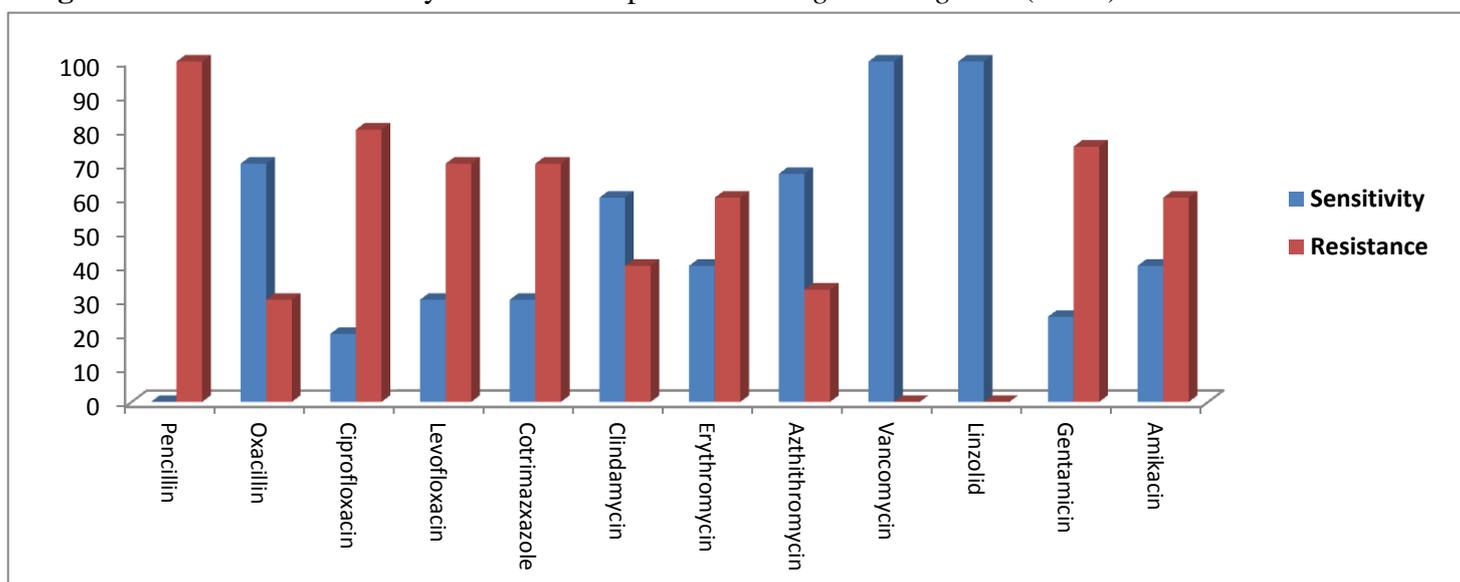


Figure 6: Antibiotic Sensitivity and Resistant pattern of *Enterococcus* (n= 10)

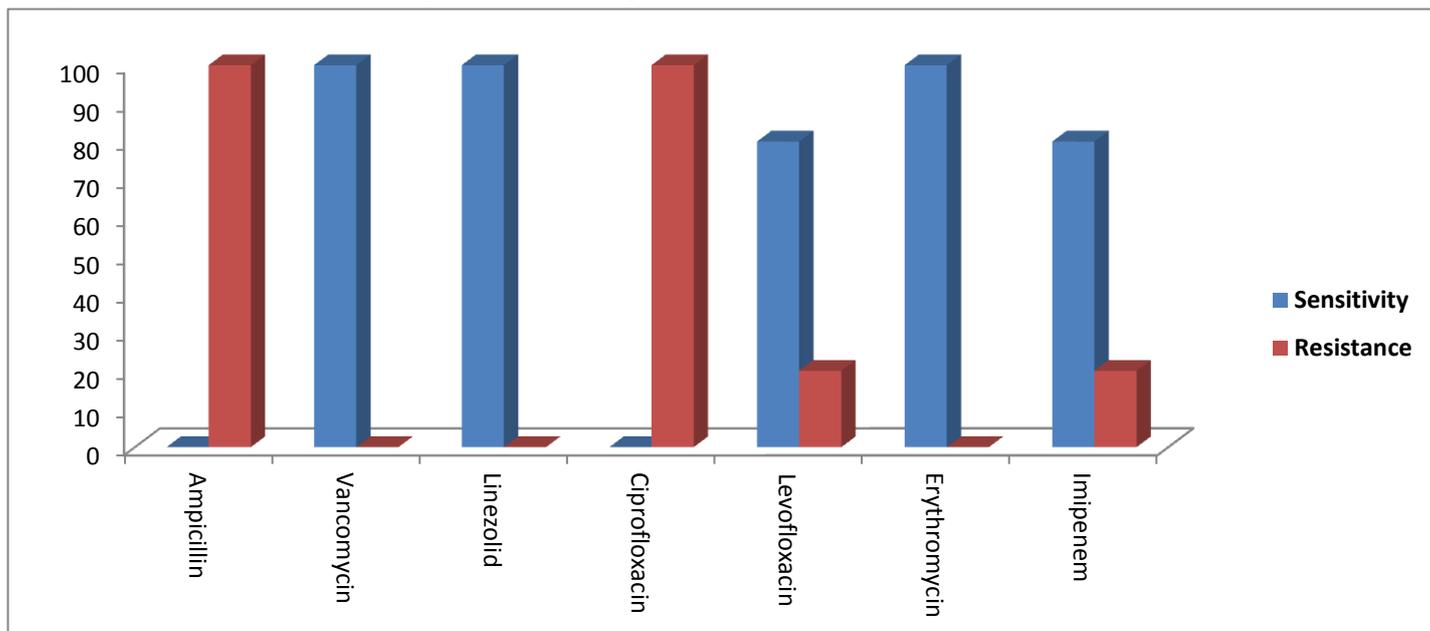


Table 3: Antimicrobial sensitivity pattern of gram negative bacilli

Drugs	E.coli	Klebisella
Ceftriaxone	66	44
Ampicillin salbactam	22.2	25
Ciprofloxacin	11	16.6
Levofloxacin	33.3	12.5
Tetracycline	50	8.9
Cotrimaxazole	66.7	77.8
Gentamycin	16.7	38.9
Amikacin	11.1	12.5
Imipenem	90	89
Ampicillin	88.9	100

Discussion

Otitis media is commonest disease to come across in day to day practice. Although, a non- fatal disease which could lead to hearing loss, facial paralysis and many neurological complications. The reason being low socio economic status of people with poor affordability, neglecting the discharging ear which leads to inadequate and improper treatment. Hence, early diagnosis and effective treatment is necessary to avoid complications. Antibiotics are usually started on the basis of its efficacy, resistance pattern, cost and side effects. Therefore, it is very important to

know its antibiotic sensitivity for effective treatment.

In our study, a total of 145 samples were obtained comprising of 85 (58.6%) females and 60 (41.3%) males. Most common age group involved was 20-40 yrs (55.1%) followed by 0-20 yrs (24.1%). Similar results were found in a study by Panchal PD et al³, Akter S et al⁸ who in their respective studies found that common age group involved was 21-30 years with female predominance (62% &64.35%) respectively. However in a study by Wasihun AG et al⁹ it was seen that the paediatric age group (6-10 yrs) was most commonly involved with male predominance (64.8 %).

Our study revealed that the most predominant bacterial isolates were *Staphylococcus aureus* (40%) followed by *pseudomonas* (26.6%) and coagulase negative (13.33%). Similar results were observed in a study by Agarwal A et al¹⁰, Wasihun AG et al⁹ and Akter S et al⁸ who in their studies found that *Staphylococcus spp* was the most predominant organism (37.6%, 28.4% & 24.42%), followed by *Pseudomonas aeruginosa* (32.8%, 16.7% & 23.26%) respectively. However in a study Panchal PD et al³, it was found that the most common isolate was *Pseudomonas aeruginosa* (25.88%) followed by *Staphylococcus aureus* (21.17%).

Our study revealed that single growth of organism was found in 79.3% followed by mixed growth in 13.9% cases. Similar results were found in a study by Agarwal A et al¹⁰ who also found monomicrobial bacterial isolate was 80% of cases while 8% had mixed growth. In a study by Panchal PD et al³ majority (96.6%) samples had single organism isolated on culture study, while (3.40%) had mixed growth. In studies by Akter S et al⁸ and Wasihun AG et al⁹, it was found that 81.40% and 60.5% had single bacterial infection while 18.60% and 39.5% had mixed bacterial infections respectively.

While looking for Antibiotic sensitivity *Staphylococcus spp.* showed sensitivity of 16.66% with Ciprofloxacin. In some of the studies sensitivity was higher (83-95%). Vancomycin, linezolid, Teicoplanin showed 100% sensitivity thus making these agents drug of choice. *Pseudomonas* showed higher sensitivity to Imipenem, Colistin, Polymyxin B and Piperacillin-Tazobactam. Sensitivity with Amikacin (62.5%) was in concordance with study by Madana J et al¹¹ and Tahir M et al¹². Sensitivity with quinolones was 75 and 37.5% respectively for Ciprofloxacin and Levofloxacin. These observations are in contrast to the other studies showing higher sensitivity of 90 -92%.¹³ The declining sensitivity trend with quinolones may be due to a number of factors including injudicious use, inappropriate dosage, and easy accessibility.

Conclusion and Recommendations

Monomicrobial etiology, especially *Staphylococcus spp* and *Pseudomonas aeruginosa*, was found to be the most common in our study. *Staphylococcus* species are highly resistant to ampicillin and ciprofloxacin. *Pseudomonas aeruginosa* is becoming less sensitive against commonly used antimicrobials, viz. ciprofloxacin, ofloxacin, cephalosporins, and gentamicin. Therefore, evaluation of microbiological pattern and their antibiotic sensitivity pattern is becoming helpful in prescribing empirical antibiotics for successful

treatment, thus minimizing the risk of complications and emergence of resistant strains. Hence we recommend antimicrobial surveillance to make the right recommendation of antibiotics along with strict adherence to antibiotic use policy to reduce the spread of drug-resistant microbes and associated complications. Further researches are needed to identify high resistance strains using molecular techniques.

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Conflict of interest:-None declared.

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