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Antibiotic Susceptibility Pattern of Various Isolates in Urine Specimen at a Tertiary Care Hospital of Islamabad

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Authors' contributions

This work was carried out in collaboration between all authors. Author HZ planned and summarized the entire research. Author NKL summarized the results and analyzed the data. Author KT wrote the discussion section and collected the data. Author MZ wrote the introduction section and collected the data. Author AK collected and analyzed the data. Authors AU and AA collected the data and managed the data entry on SPSS. All authors read and approved the final manuscript.

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ABSTRACT

Background: The updated guidelines by CDC (center for disease control) narrated the importance of using the dataprovided by hospital antibiogram for initial prescription of managing the infections. Therefore the current study had been planned to formulate the antibiogram in a tertiary care hospital of Islamabad.
Objectives: To identify the local antibiotic susceptibility pattern against various isolates of urine pathogens.

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Materials and Methods: A descriptive cross sectional study was conducted at the Pathology department of Al Nafees Medical College & Hospital, Islamabad, Pakistan. The duration of study was 04 months i.e between1st June to 1st Oct. 2015. Total 336 suspected urinary tract infection, urine specimens (indoor and outdoor) received for culture and sensitivity were included in the study. Recommended clean catch method was advised for urine sample collection. The specimen processing was done by following the three days recommended protocols for urine cultures by Clinical and laboratory standard institutes (CLSI). Frequencies and percentages were the numerical variables extracted by using the SPSS version 16.

Results: Out of total 336 samples, 9.8% (n=33*)* urine cultures were positive. *Escherichia coli (E. coli)* was present in (60.6%), *Klebsiella pneumoniae* in (12.1%), *Pseudomonas aeruginosa* in (9.09%), *Proteus mirabilis* in (6.06%), *Morganella morganii* in (6.06%) and S*taphylococcus saprophyticus* in (6.06%). The drugs of choice for *E. coli* are quinolones and aminoglycosides by showing the sensitivity of about (75%) each. For *Klebsiella pneumoniae*, the ideal antibiotics are aminoglycosides (85.1%) and 2nd generation cephalosporins (85%). For *Pseudomonas aeruginosa,* extended spectrum penicillin, quinolones, 2nd and 3rd generation cephalosporins are the most suitable ones showing the sensitivity of (100%) each.

Conclusion: Quinolones, aminoglycosides, 2nd and 3rd generation cephalosporins are the drugs of choices for thetreatment of urine infections.

Keywords: Urine cultures; antibiotic sensitivity; quinolones; aminoglycosides; 2nd and 3rd generation cephalosporins.

1. INTRODUCTION

The CLSI (Clinical and Laboratory Standards Institute) defines antibiogram as the antimicrobial susceptibility patterns against microbes [1]. Acquiring knowledge about the prevalence of various pathogens can be helpful for empirical managements at institutional level [2,3].

Antibiogram or *In vitro* sensitivity pattern of bacteria to various antibiotic groups is an essential workup in any clinical setup. It not only reflects upon the ability of the bacteria to resist various drugs in due course of time but also the antibiotic prescription trends of the clinicians. With the help of well formulated antibiogram we can frame the future use of the antibiotics in a more effective way and develop the empirical treatment for infections in various organs/sites with more confidence. The data also portrays the infection pattern encountered in the setup. An up to date antibiotic policy requires that the antibiogram should be regularly updated. The data should be based on patients' first isolate [4].

The clinicians and members of infection control committee use the data of antibiogram for monitoring the drug resistance pattern, outbreaks, and establishing the policies/ measures for infection control [5-7]. It can also be used for the assurance of quality measures by the Microbiologist and laboratory personnel as reference for Joint Commission on Accreditation of Healthcare Organizations [8].

The data should be analyzed on the basis of patient location and the site of infection from which the specimen is collected. In this study we present the antibiogram pattern in Al Nafees Medical College Hospital, Islamabad, Paksitan.

2. MATERIALS AND METHODS

A descriptive cross sectional study was conducted at the Pathology department of Al Nafees Medical College & Hospital, Islamabad, Pakistan. The duration of study was 04 months between 01st June to 01st Oct. 2015. Total 336 specimens (indoor and outdoor) received for culture and sensitivity were included in the study. The samples of patients who refused to be involved in the study were excluded from the study.

Informed consent was taken prior proceeding for sample processing. The willing patients were advised to bring the urine specimen collected by clean catch method.

At first day the specimens were inoculated on CLED agar (Oxoid company). The culture plates were incubated overnight at 37ºC for 24 hours. The specimens were poured in a test tube and centrifuged at 3000rpm for 05 minutes. Direct microscopy was done from the deposits to see the number of pus cells.

On second day the presence of significant growth and colony count was correlated with the number of pus cells followed by Gram staining. The colony count of 10^5 was considered significant [8]. Biochemical tests (TSI, citrate, oxidase, catalase and coagulase) and the application of drug sensitivity on Mueller Hinton agar was also done on the same day.

For the selection of antibiotics, formal recommended protocols by CLSI[1] (clinical and laboratory standards institute) guidelines were followed. All the antibiotics used were from Oxoid company. For betalactam group, Ampicillin (10 µg), Augmentin (30 µg), Piperacilin (100 µg), and oxacillin (1 µg) discs were used. For Glycopeptides, Vancomycin disc of (30 µg) was used. For 1st generation cephalosporin, cephradine disc of (30 µg) was used. While Cefaclor (30 µg), cefoxitin (30 µg) and cefuroxime (30 µg) discs were used for second generation cephalosporins. Ceftriaxone (30 µg), cefixime (5 µg), cefotaxime (30 µg), and cefoperazone (75 µg) discs were used for 3rd generation cephalosporins. Cefipime (30 µg) disc was used for fourth generation cephalosporins.

For Aminoglycosides, gentamycin (10 µg) and amikacin (30 µg) discs were used. For Quinolones, ciprofloxacin (5 µg), ofloxacin (1 µg), levofloxacin (5 µg), norfloxacin (10 µg) and pipemidic acid (20 µg) were used. For Tetracycline, doxycycline disc of 30 µg was used. For Nucleic acid inhibitors, cotrimoxazole (25 µg) disc was used. Imipenam disc of 10 µg was used for carbapenam group. Linezolid disc of 30 µg was used for oxazolidinone group. Fosfomycin disc of 50 µg was used for phosphonic acid derivatives. Nitrofurantoin of 300 µg was used for imidazolidinedione group.

On the third day, biochemical tests and antimicrobial susceptibility were interpreted as per recommended by CLSI. Guidelines and the reports were finalized.

SPSS Version was used for statistical inference. Frequencies and percentages were the numerical variables extracted by using the SPSS version 16.

3. RESULTS

Out of the total 336 specimens, 9.8% (n=33) specimens yielded positive growth. *Escherichia coli (E. coli)* was present in (60.6%), *Klebsiella pneumoniae* in (12.1%), *Pseudomonas aeruginosa* in (9.09%), *Proteus mirabilis* in (6.06%), *Stpahylococcus saprophyticus* in (6.06%) and *Morganella morganii* in (6.06%). This is shown in Table 1.

While overall susceptibility of all the antibiotics is shown in Table 2.

The drugs of choice for *E. coli* are quinolones (75%) and aminoglycosides (75%). This is shown in Fig. 1.

For *Klebsiella pneumoniae*, the ideal antimicrobials are aminoglycosides (85.1%) and 2nd generation cephalosporins (85%). This is shown in Fig. 2.

For *Pseudomonas aeruginosa*, extended spectrum penicillin, quinolones, 2nd and 3rd generation cephalosporins are the most suitable ones showing the sensitivity of (100%) each. This is shown in Fig. 3.

The most appropriate group of antimicrobials for *Proteus species* are extended spectrum penicillins, quinolones, phosphonic acid derivatives, 2nd and 3rd generation cephalosporins by showing the sensitivity of (100%) each. This is shown in Fig. 4.

Table 1. Isolates from urine specimens

Sr. no.	Organisms	Urine % (n = 33)
1.	*Escherichia coli*	60.60
2.	*Klebsiella species*	12.1
3.	*Pseudomonas species*	9.09
4.	*Proteus species*	6.06
5.	*Staphylococcus saprophyticus*	6.06
6.	*Morganella morganii*	6.06

Tetracyclines, extended spectrum penicillins, 2nd and 3rd generation cephalosporins are the most suitable antibiotics for *Staphylococcus saprophyticus*. This is shown in Fig. 5.

Penicillins, 3rd generation cephalosporins and quinolones are considered the antimicrobials of choice for *Morganella morganii by showing the sensitivity of 100 & 99.9% respectively*. This is shown in Fig. 6.

Table 2. Antibiotic susceptibility for urine specimen (N=33)

Antibiotics	Urine (S)	
	n=33	%
Extended spectrum penicillins: Piperacillin tazobactam	25	75.7
Short acting penicillins: Total (n)	11	33.3
Ampicillin	07	21.2
Augmentin	04	12.1
Oxacillin	-	
Aminoglycosides: Total (n)	11	21.2
Gentamycin	02	6.06
Amikacin	05	15.1
Flouroquinolones: Total (n)	33	100
Ciproxin	11	33.3
Norfloxacin	08	24.2
Ofloxacin	07	21.2
Levofloxacin	06	18.1
Pipemedic acid	01	3.0
Carbapenam: Imipenam	07	21.2
Phosphonic acid derivative: Fosfomycin	19	57.5
Oxazolidinone: Linezolid	13	39.3
Imidazolidinedione: Nitrofurantoin	26	78.7
Tetracycline: Doxycycline	02	6.06
2nd Generation cephalosporins: Total (n)	10	30.3
Cefaclor	01	3.0
Ceftriaxone Na	09	27.2
3rd Generation cephalosporins: Total (n)	22	66.6
Cefixime	02	6.06
Cefoperazone sulbactam	20	60.6

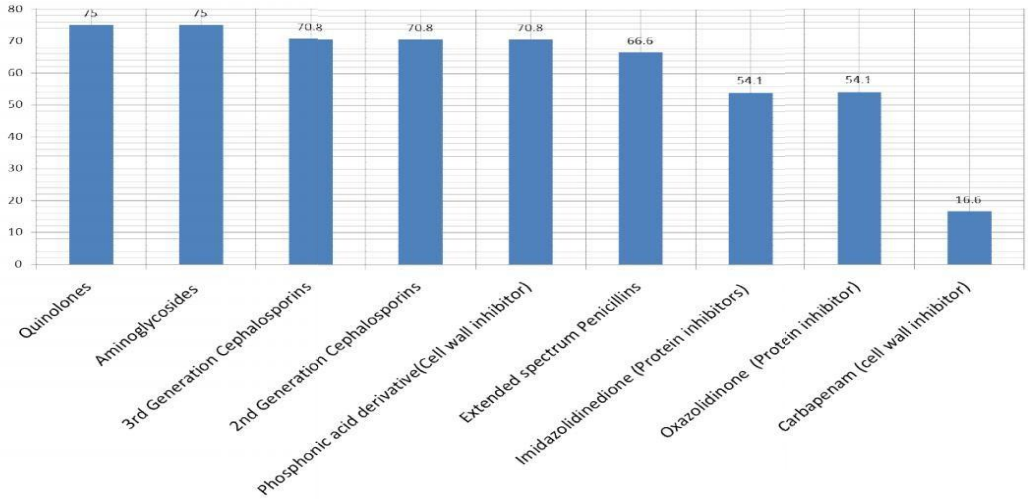

Fig. 1. Sensitivity pattern of *Escherichia coli*

4. DISCUSSION

In current era, the injudicious/ misuse of antibiotics is on the peak followed by the emergence of increased drug resistance [9]. In such situation establishment of antibiograms for specific localities will be a step forward to manage the critical infections well in time [10,11]. The latest campaign by Centre for Disease Control and prevention (CDC) suggested that the appropriate use of antibiogram is amongst the list of twelve steps used to prevent the emergence of drug resistance [12].

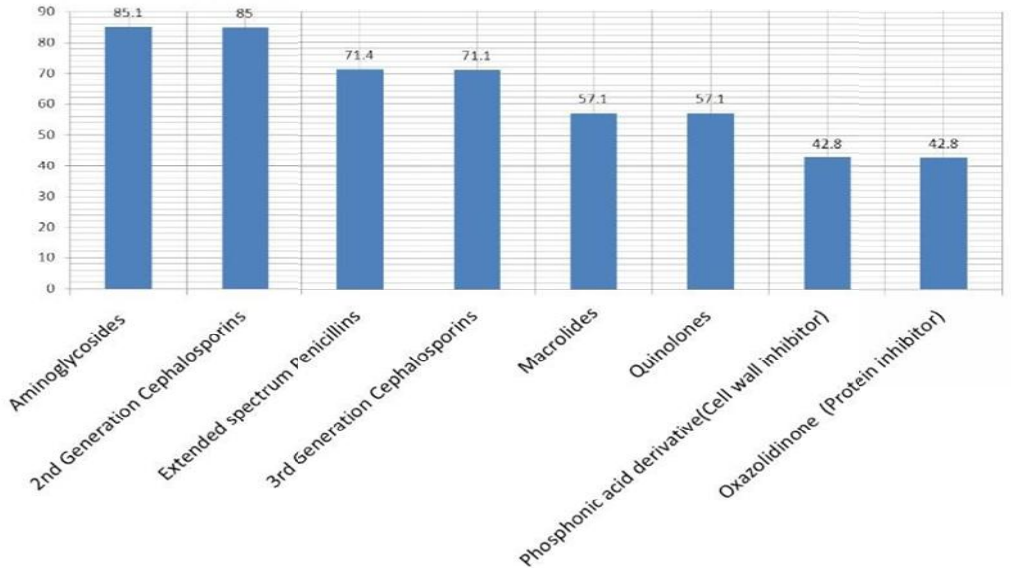

Fig. 2. Sensitivity pattern of *Klebsiella species*

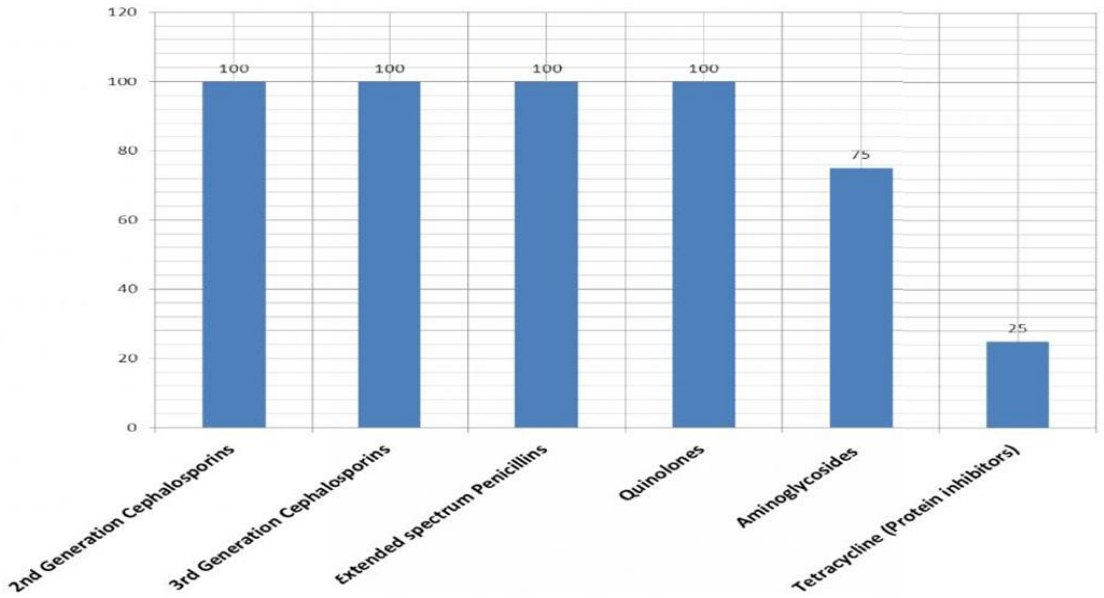

Fig. 3. Sensitivity pattern of *Pseudomonas species*

The results of current study have shown that *E. coli* (60.6%) was the most commonly prevalent bacteria isolated from urine specimen. This was followed by *Klebsiella species* (12.1%), *Pseudomonas species* (9.09%), *Proteus mirabilis* (6.06%), *Staphylococcus saprophyticus* (6.06%), and *Morganella species* (6.06%). This is in favour of study results by Joshi et al. [4] who concluded the same findings that *E. coli, Klebsiella* and *Pseudomonas aeruginosa* is a common urine pathogen [4]. Also our study results are in favour of studies by Naeem et al. [13], Akortha et al. [14] and Kumar et al. [15], who concluded that *E. coli* is the most common pathogen of urine specimen.

It was also concluded in our study that 90% of *E. coli* was found sensitive to Nitrofurantoin (oxazolidinones i.e urine sterilizer). While a high resistance pattern was seen for tetracycline,

macrolides and nalidixic acid. This finding of our study is different from the study results by Akortha et al. [14]. This all is against the results of studies that showed quinolones (75%) and aminoglycosides (75%), the drugs of choice for *E. coli* [15,16].

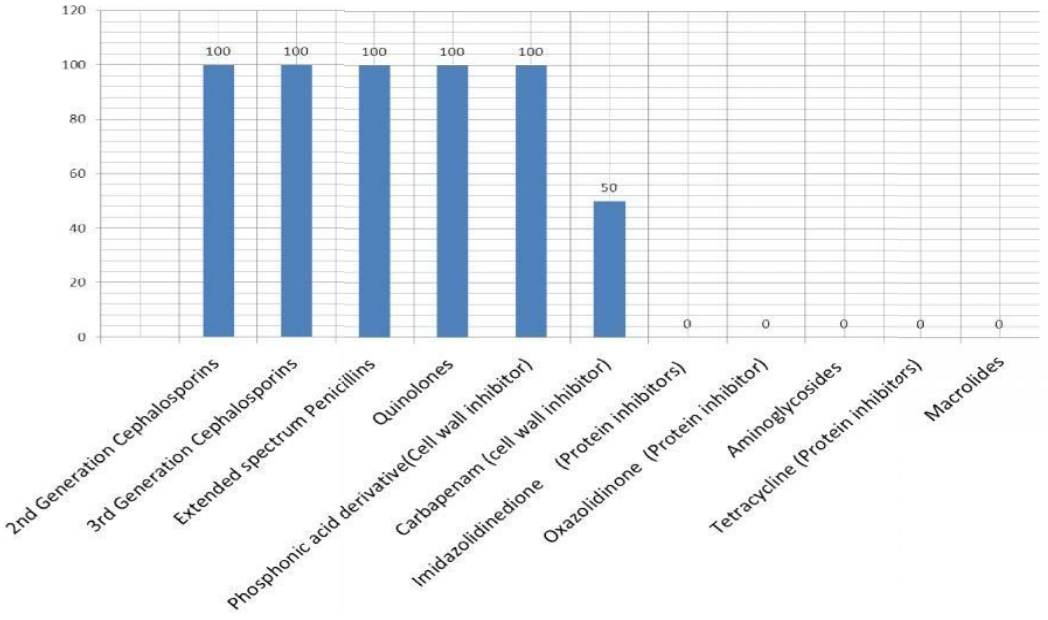

Fig. 4. Sensitivity pattern of *Proteus species*

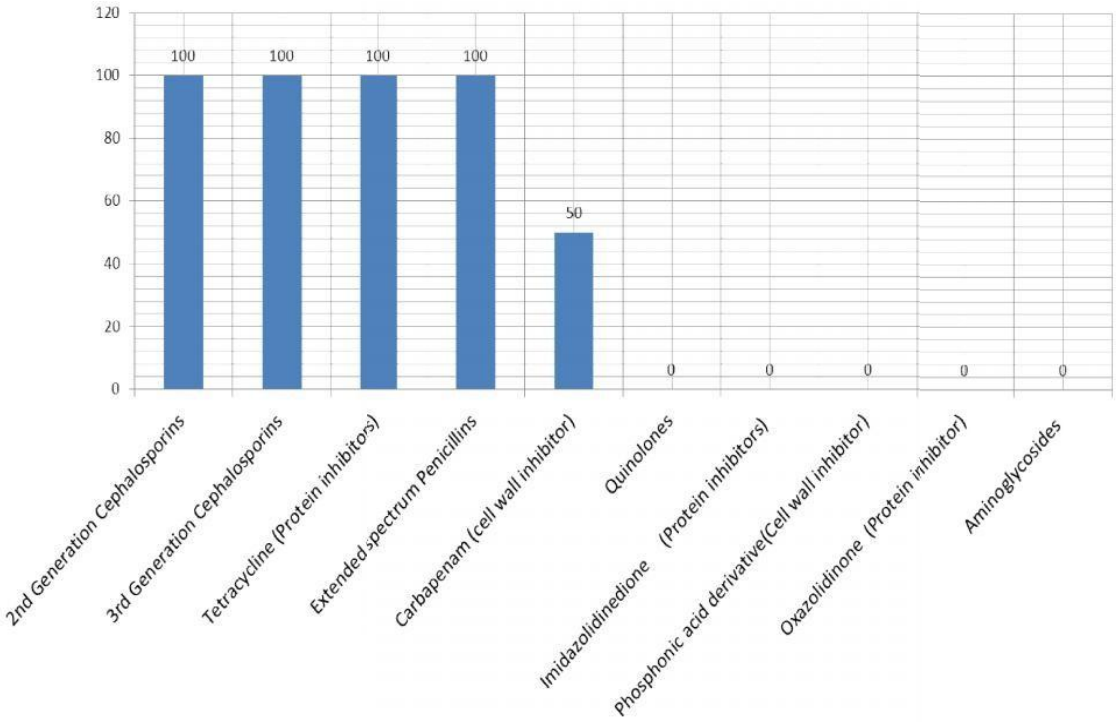

Fig. 5. Sensitivity pattern of *Staphylococcus saprophyticus*

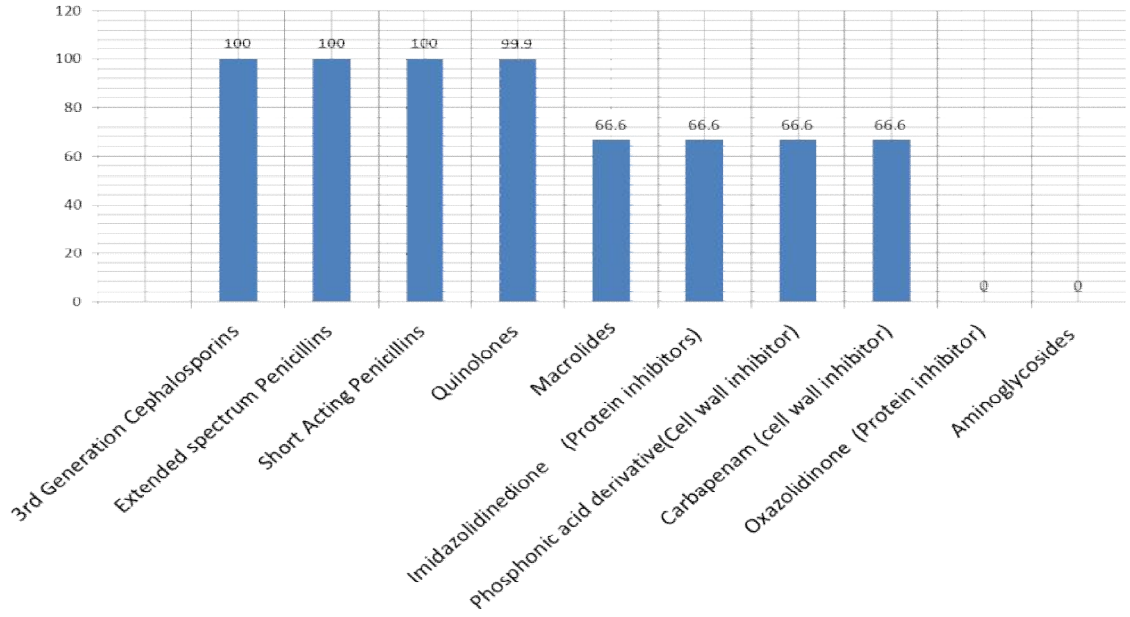

Fig. 6. Antibiotic susceptibility pattern of *Morganella morganii*

The current study results showed that aminoglycosides (85.1%) and 2nd generation cephalosporins (85%) are the ideal anti microbials for *Klebsiella species.* This is against the study results by Zapantis et al. [1] who concluded that ampicillin is the most sensitive drug for the treatment of *Klebsiella species Pseudomonas aeruginosa* was isolated from (9.09%) cases. This is in favour of study results by Joshi et al. [16] who concluded the same findings that *Pseudomonas aeruginosa* is a common urine pathogen. The results of current study favours the usage of extended spectrum penicillin, quinolones, 2nd and 3rd generation cephalosporins. This is in favour of study findings who concluded that penicillins and quinolones are the drugs of choice for *Pseudomonas aeruginosa* [17]. As per the results of current study, *Proteus* and *Staphylococcus saprophyticus* are also the true urine pathogens in 06% of cases for each. This finding is different from the study results of Kumar et al. [15] who described that *E. coli* is the responsible uropathogen in >90% of cases.

The most appropriate group of antibiotics for *Proteus species* are extended spectrum penicillins, quinolones, phosphonic acid derivatives, 2nd and 3rd generation cephalosporins by showing the sensitivity of 100% each. While tetracyclines, extended spectrum penicillins, 2nd and 3rd generation cephalosporins are the most suitable antibiotics for *Staphylococcus saprophyticus*. This all is in favour of study results by Mumtaz et al. [18].

Morganella morganii has shown the highest sensitivity to third generation cephalosporins, penicillins and quinolones. This is different from the study results by Zahid et al. who concluded that the aztreonam, aminoglycosides and quinolones are the ideal management options for *Morganella morganii* [19-21].

The proper knowledge about the uropathogens and their susceptibility patterns will aid the clinicains to identify the approach for empirical therapy. Literature review had highlighted that the variations in regional pathogenic flora.

Therefore, antibiograms must be formulated for specific hospitals. The acceptance and adoption of guidelines provided regional or local antibiogram will be a step forward to reduce the rate of hospital acquired infections.

5. CONCLUSION AND RECOMMENDA-TIONS

Quinolones, aminoglycosides, 2nd and 3rd generation cephalosporins are the drugs of choices for the treatment of urine infections. Acquiring knowledge about the sensitivity and resistant pattern of specific drugs for urine

isolates will reduce the emergence of extended spectrum beta lactamases. Hospital infection rate is towards a lower side because of proper antibiogram usage.

Therefore, Antibiogrrams should be formulated separately for different hospitals, keeping in mind the variations in pathogenic flora. So Antibiogram of one hospital should not be used for another hospital.

ETHICAL APPROVAL

All ethical concerns were taken in account for the study proceedings starting from institutional approval uptil patient's considerations.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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