

Catheter Related Antimicrobial Resistance Pattern in Intensive Care Unit Patients: A Single Centre Study

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Author's Contribution

² Conception of study

^{1,3} Experimentation/Study conduction

^{1,3} Analysis/Interpretation/Discussion

⁵ Manuscript Writing

⁴ Critical Review

⁶ Facilitation and Material analysis

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Article Processing

Received: 24/08/2021

Accepted: 08/12/2021

Cite this Article: Bibi, R., Ullah, R., Izhar, M., Rehman, S., Sheikh, K., Bhattani, K.E. Catheter Related Antimicrobial Resistance Pattern in Intensive Care Unit Patients: A Single Centre Study. *Journal of Rawalpindi Medical College*. 31 Dec. 2021; 25(4): 531-534.

DOI: <https://doi.org/10.37939/jrmmc.v25i4.1764>

Conflict of Interest: Nil

Funding Source: Nil

Access Online:



Abstract

Introduction: Urinary catheter is the most common cause of urinary tract infection (UTI) which has been associated with a three-fold increase in risk in mortality. The primary aim of the study is to know the strain of pathogens; its drugs sensitivity and resistance in intensive care unit (ICU) patients which help the physician in proper management and reduce the mortality and morbidity in urinary catheter-related complications.

Materials and Methods: This study was conducted in Intensive care unit patients of Hayatabad medical complex Peshawar Pakistan over a period of 1 year from 1st January to 31st December 2019. Medical charts were reviewed and 100 patients were selected based on inclusion criteria and their urine culture and sensitivity reports were noted to know about the most common pathogens, its drugs sensitivity, and resistance in these patients. Clinical and Laboratory Standards Institute (CLSI) was used for uropathogen by culture and Disc diffusion method to determine antimicrobial susceptibility pattern.

Results: The mean age (standard deviation) of patients was 51.60+26.59 years (Median age 58.50 years). Of the total, 64 were female and the remaining were male patients. It was found that the most common pathogens in urine samples were E. coli. Maximum pathogens were sensitive to intravenous meropenem (65%) and fosfomycin (55%). Chi-square test is used for correlation of sensitivity of meropenem and fosfomycin with the type of organism shows p-value=0.004 and 0.002.

Conclusion: It is concluded that resistance patterns of uropathogens change which results in treatment failure. Further, based on clinical practice, meropenem, fosfomycin, and cefepime had high sensitivity profiles against catheter-related infection in ICU.

Keywords: Antimicrobial resistance, catheters, urinary tract infections (UTIs).

Introduction

The common presenting symptoms of Urinary tract infections (UTIs) are fever, dysuria, and pain hypogastrum however some cases may be asymptomatic. Common predisposing factors are urinary catheters, instrumentation, urolithiasis, and anatomic anomalies. Urinary tract infections account for about 30 to 40% of all nosocomial infections. A high level of resistance was noted among the admitted patients for cephalosporins.¹ Urinary catheter is the most common cause of UTI as 17.5% shown by the study done in 66 European hospitals suffered from catheter-related infection. Nosocomial UTIs have been associated with a three-fold increase in the risk of mortality.² In a study conducted in Iran, 30.9% of intensive care patients with nosocomial infections developed urinary tract infections.³ Pattern of bacterial resistance changes with antibiotics use.⁴ As study showed 28 (9.2%) patients among 306 admitted patients at ICU were suffered from nosocomial UTI. Indiscriminate use of antibiotics is responsible for the development of drug-resistant strains of urinary tract bacteria.⁵ The present study focus for the first time on the strain of pathogens, its drugs sensitivity, and resistance in one of the largest public tertiary care set up from Peshawar.

Materials and Methods

This descriptive study was conducted in Intensive care unit patients of Hayatabad Medical Complex (HMC) Peshawar Pakistan over a period of 1 year from 1st January to 31st December 2019. 100 patients' urine samples were taken from urine bags in CS bottles of ICU patients having the urinary catheter is placed. Urine culture and sensitivity reports were traced to know about the most common pathogens, its drugs sensitivity, and their resistance. Only ICU patients were included with comorbid conditions like diabetes, cardiac disease, chronic renal disease, immunocompromised patients.

Results

A total of 100 samples were obtained from 100 intensive care patients with a urinary catheter. The mean ages (standard deviation) of patients were 51.60±26.59 years (Median age 58.50 years). Of the total, 64 were female and the remaining were male patients. . It was found that the most common

pathogens in urine samples were E. coli (cephalosporinase producer 23%), followed by Klebsiella pneumonia Sp. (17.1%), Pseudomonas aeruginosa 14(6.83%), Enterococcus 12 (5.85%), candida species (1%). Most of the pathogens were sensitive to intravenous meropenem (65%) and oral Fosfomycin (55%). Chi-square test is used for correlation of sensitivity of meropenem and fosfomycin with the type of organism shows p-value=0.004 and 0.002. Data were analyzed using SPSS version 20. The frequency along with percentage was calculated for each organism isolated from culture and the pathogens sensitivity and resistance for Augmentin, Meropenem, and Fosfomycin as shown in the table below.

Table 1:

Age of patient	
Mean	51.60
Median	58.50
Std. Deviation	26.598

Table 2:

Frequency	Percent
Proteus vulgaris (cephalosporinase producer)	2 2.0
E.coli(ESBL Producer)	12 12.0
Providencia alcalifaciens(cephalosporinase producers)	2 2.0
klebsiella pneumoniae(ESBL producers)	3 3.0
enterococcus species	7 7.0
E.Coli (cephalosporinase producer)	23 23.0
klebsiella pneumoniae (cephalosporinase producer)	3 3.0
candida species	15 15.0
Klebsiella oxytoca (cephalosporinase producers)	8 8.0
pseudomonas aeruginosa	4 4.0
mixed skin organisms	12 12.0
Morganella morganii (cephalosporinase producers)	1 1.0
proteus mirabilis	2 2.0
staphylococcus saprophyticus	1 1.0
providencia sturtaii (cephalosporinase producer)	1 1.0
Serratia species (ESBL producer)	1 1.0
Actinobacter baumannii	1 1.0
E.coli	1 1.0
Enterobacter species (cephalosporinase producer)	1 1.0
Total	100 100.0

Maximum pathogens were resistant to Augmentin.

Table 3:

	Frequency	Percent
sensitive	5	5.0
resistant	63	63.0
not tested	32	32.0
Total	100	100.0

Least number of pathogens resistant to Meropenem (IV)

Table 4:

	Frequency	Percent
sensitive	65	65.0
resistant	1	1.0
not tested	34	34.0
Total	100	100.0

Least number of pathogens was resistant to Fosfomycin

Table 5:

	Frequency	Percent
sensitive	55	55.0
resistant	8	8.0
not tested	37	37.0
Total	100	100.0

Discussion

The present study focused on ICU patients suffering from urinary tract infections having a urinary catheter is placed that were present in the ICU of HMC. This study showed the most common urinary pathogen is E. coli cephalosporinase producer) (23%), E. Coli (ESBL producer) (12%), Candida species (15%), mixed skin organism (12%).^{1,2} Out of these pathogen majorities were resistant to Co-amoxiclav (Augmentin) (63%). A maximum number of pathogens were sensitive to intravenous meropenem (65%) given in table 4 and oral foscin (55%).^{5,8}

The spectrum of urinary tract pathogens isolated from urine samples in this study is similar to the findings of Nicolle LE et al.⁴ A study conducted in North India reported 76% resistance to ampicillin.⁵ Such a high level of ampicillin resistance has been documented in different studies conducted in different parts of India. A study in northern India reported 76% resistance to ampicillin.⁵ The first international surveillance program to determine the susceptibility of major

urinary tract pathogens in 16 countries in Europe and Canada was 2525. E.coli isolates were cultured from 4734 women.⁶ Another study conducted in West Bengal by Saha et al, (2008-2013) India, reported that Escherichia coli was the primary uropathogen (67.1%) isolated, followed by Klebsiella, (22%), and Pseudomonas spp (6%).⁷ While a study from Rajasthan reported 94.63%, 77.88%, and 74.75% resistance in E.coli to nalidixic acid, norfloxacin, and ciprofloxacin respectively.⁸ Urinary tract infection is considered the most common infectious disease because it has reached a global incidence of 18/1000 persons per year in the general population.^{9,10} It has been previously reported that in 80% of acute and recurrent urinary tract infections in women, E. coli is the primary organism, followed by S. saprophyticus (10-15%). Other less common urinary tract pathogens that can cause UTI include Klebsiella, Enterobacter, Serratia, Proteus, Pseudomonas, and Enterococcus.¹¹ Resistance to the antimicrobial agents occurs due to widespread use of antibiotics and the resistance pattern may change from time to time and even in the same region.^{12,13} Some antibiotics which are used for treating UTIs such as trimethoprim may cause acute kidney insult.¹⁴ So the antibiotics may be carefully selected and so as the emergence of antimicrobial resistance may be monitored which will help to administer the proper drug.^{15,16,17} However, extended-spectrum beta-lactamase-positive organisms are sensitive to drugs like imipenem, polymixin, and nitrofurantoin; therefore these can be the drug of choice for such highly resistant bacteria.¹⁸

Most bacteria colonize the indwelling catheter in the form of biofilm. Microbial agents which grow in the biofilm are resistant to antibiotics mostly which may lead to sepsis.¹⁹ Irrational use of drugs by practitioners has further worsened the situation, which in turn resulted in increased drug resistance.²⁰

Further studies are suggested to find out more common urinary pathogens in ICU patients time by time due to higher resistance of pathogens to the drugs.

The first worth limitation of this study is the small sample size and not taking the history of nephrolithiasis, bladder disorder, and other comorbid conditions. The second limitation includes the sampling technique and study design. Thirdly patients were not followed up. Fourthly urine C/s technique was not observed.

Conclusion

It is concluded that resistance patterns of uropathogens change which result in treatment failure. Furthermore, based on observations, carbapenem and cefepime are the drugs of choice for empirical antibiotic treatment of catheter-related infections in intensive care units.

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