

A Prospective Observational Study On Antimicrobial Resistance Of E.Coli And Klebsiella Pneumoniae In Renal Failure Patients And Impact Of Treatment

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Abstract

Renal failure is defined as the kidney's inability to execute excretory activities, resulting in the retention of nitrogenous wastes in the blood. Renal insufficiency patients are more susceptible to infections because the host's immune system is compromised. As a result, CKD patients are more likely to develop an infection that leads to bacteremia and sepsis. This study involved 130 CKD patients with infections who participated in a prospective observational study. E.Coli and Klebsiella pneumoniae were the most common microbes found in the study, followed by Pseudomonas aeruginosa, Coagulase negative staphylococci, Acinetobacter baumannii, Nonfermenting Bacilli, Streptococci, and Enterococcus faecalis. E.Coli and Klebsiella pneumoniae were the bacteria with the highest incidence of causing infections in CKD patients. Resistance to Levofloxacin, Doxycycline, and Cefpodoxime Proxetil was identified in E.Coli. Resistance to Piperacillin with Tazobactam, Levofloxacin, Doxycycline, and Cefpodoxime Proxetil were also found in Klebsiella pneumoniae. To resolve the condition, proper diagnosis and therapy are required. This is an issue that all health care practitioners, particularly clinical pharmacists, should pay more attention towards.

Keywords: E.Coli, Klebsiella pneumoniae, Antimicrobial resistance, Culture sensitivity test, Clinical Pharmacist.

INTRODUCTION

Renal failure can be defined as the kidney's inability to conduct excretory activities, resulting in the retention of nitrogenous wastes in the blood. Acute Renal Failure (ARF) and Chronic Kidney Failure (CRF) or chronic kidney disease (CKD) are the two kinds of kidney failure. A persistent impairment of kidney function, excessively increased serum creatinine for more than 3 months or an estimated glomerular filtration rate (GFR) less than 60 ml per minute/1.73m², is referred to as CKD. It involves a gradual loss of kidney function that leads to dialysis or renal replacement therapy.^[1] Renal insufficiency patients are more susceptible to infections. Cardiovascular disorders cause an increased risk of morbidity and mortality in CKD patients. Infections in CKD patients are the second cause of morbidity and mortality. Infections are frequent in CKD patients at all stages of their disease. Infections develop because the host's immune system is compromised. As a result, CKD patients are more likely to develop an infection that leads to bacteremia and sepsis. Another cause is haemodialysis catheters, which, over time, can cause infections such as urinary tract infections (UTI).^[2-12] The primary goal of this study is to discover distinct gram negative microorganisms that cause infection in CKD patients, particularly Escherichia Coli (E.Coli) and Klebsiella Pneumoniae, as well as this study focus on drugs used to treat the infection and antimicrobial resistance (AMR) in microorganisms.

METHODOLOGY

Study design

A prospective observational study was used in this study. The information was gathered from the patients' follow-up till they were discharged.

Study site

The study was conducted at the Nephrology Department of Santhiram Medical College and General Hospital, which has a 1000-bed capacity hospital and has all of the necessary equipment to treat renal disease patients.

Study duration

The study was done during a six-month period, from September 2021 to February 2022, after getting approval from the institutional ethical committee.

Study criteria

Patients with chronic kidney disease in stages one to four and those undergoing various dialysis methods were eligible for inclusion. Participants who did not give their consent to participate in the study were excluded from the study. The pregnant women's and who were age was less than 12 years also excluded from the study.

Sample size

There were 130 patients in the study. These samples were collected based on the study's inclusion and exclusion criteria.

Study materials

For data collection and processing, this study employs a variety of materials. A specially designed proforma was used for each and every patient to collect data. A consent form was developed and employed to gain consent from participants, and a culture sensitivity test was used as a parameter to validate antibiotic resistance.

Ethical approval

The institutional ethics committee of Santhiram Medical College, Nandyal gave their clearance to conduct the study in Nephrology Department of Santhiram Medical College and General Hospital.

Study procedure

After the patients were admitted to the hospital, the researchers requested for their consent to participate by explaining the significance of the study. If the patient gave their consent, the study criteria for the patient were checked. If the patient's requirements were met, all data needed for the study was acquired from the patient's case sheet. The data was rewritten into the proforma once again. The proforma contains information such as demographic details of the patient, chief complaints, history of present illness, vitals, culture sensitivity information, and treatment chart.

Statistical analysis

All of the information was entered into MS-Excel with various headings as needed. The GraphPad Prism 9.3.1 software was used to process all of the statistics. The data was subjected to descriptive statistics such as mean, standard deviation, standard error of the mean, co-efficient of variation, kurtosis, and skewness, as well as TWBC values were verified for normality. The normality test on the TWBC data failed. To acquire the P-Value for pre and post values of TWBC, a wilcoxon signed rank test of non parametric test was employed instead of a paired T test of parametric test. P values less < 0.05 were considered significant.

RESULTS

A total of 130 cases were collected, in which males were 70 (53.84%) and females were 60 (46.15%). All 130 patients had CKD and suspected for infections. Only 52 (40%) of the 130 patients were found to be infected. Table 1 summarised this information. The remaining cases were free of infections, and no growth was found in some of them. E.Coli (34.61 %) and Klebsiella pneumonia (28.84 %) were the most common microbes found in the study, followed by Pseudomonas aeruginosa, Coagulase negative staphylococci, Acinetobacter baumannii, Non fermenting Bacilli, Streptococci, and Enterococcus faecalis. E.Coli and Klebsiella pneumonia were the most common bacteria found to be causing infections in CKD patients in this study. Infectious patients with CKD were prescribed various antibiotics. Table 2 contained this information. Cefaperazone with Sulbactam was the most commonly given antibiotic among all. To treat the infections, some individuals were given multiple antibiotics. Table 2 showed the resistant pattern as well. Resistance to Levofloxacin, Doxycycline, and Cefpodoxmine Proxetil was identified in E.Coli. Resistance to Piperacillin with Tazobactam, Levofloxacin, Doxycycline, and Cefpodoxmine Proxetil were also identified in Klebsiella pneumoniae. Antibiotic treatments for infectious individuals were provided, and the treatment resulted in a significant difference in total white blood cell counts before and after treatment. This shows that infection levels in CKD patients were decreased. The difference between the TWBC mean and standard deviation is depicted in Fig 1. The paired T test was chosen to determine the significant difference, but due to the normality test failing, the P Value was determined using the wilcoxon signed rank test. The P value for the study was < 0.0001 , which was less than < 0.05 , indicating that the data demonstrated a significant difference in therapy. Table 3 contains information on descriptive statistics and statistical tests.

Table 1: Infectious Microorganisms in CKD Patients

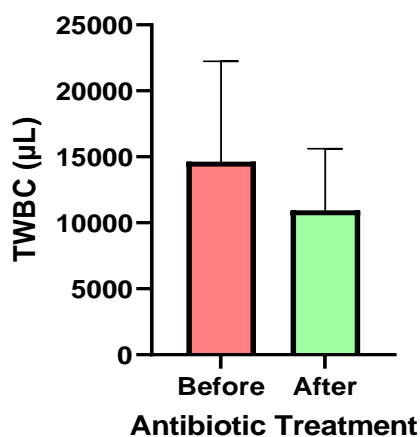
Microorganism	Type of Microorganism	No. of Cases (%)
Escherichia Coli	Gram Negative	18(34.61%)
Klebsiella pneumoniae	Gram Negative	15(28.84%)
Pseudomonas aeruginosa	Gram Negative	9(7.3%)
Coagulase negative staphylococci	Gram Positive	5(9.61%)
Acinetobacter baumannii	Gram Negative	2(3.84%)
Non fermenting bacilli	Gram Negative	1(1.92%)
Streptococci	Gram Positive	1(1.92%)
Enterococcus faecalis	Gram Positive	1(1.92%)

Table 2: Resistance and Susceptibility of E.Coli and Klebsiella Pneumoniae

Microorganism	Susceptible	Resistant
E.COLI	Cefaperazone+Sulbactam	Levofloxacin
	Piperacillin +Tazobactam	Doxycycline
	Meropenem	Cefpodoxmine Proxetil
	Colistimethate	-
Klebsiella Pneumoniae	Cefaperazone+Sulbactam	Piperacillin+Tazobactam
	Colistimethate	Doxycycline
	Meropenem	Levofloxacin
	-	Cefpodoxmine Proxetil

Table 3: Information of Descriptive Statistics and Wilcoxon Signed Rank Test

Descriptive statistics		
Statistic criteria	Before treatment	After treatment
Number of values	130	130
Mean	14628	10948
Std. Deviation	7613	4668
Std. Error of Mean	667.7	409.4
Coefficient of variation	52.05%	42.63%
Skewness	1.696	2.059
Kurtosis	4.369	6.510
Wilcoxon matched pairs signed rank test		
P value		<0.0001
Exact or appropriate p value?		Exact
Significantly different (P <0.05)?		Yes
One or two tailed P value?		Two-tailed
Sum of positive, negative ranks		1902, -6613
Sum of signed ranks (W)		-4711
Was the pairing significantly effective?		Yes

**Fig. 1:** Pre and Post Treatment Data of TWBC (µL) with Mean and Standard Deviation

DISCUSSION

Patients with CKD are more susceptible to infection, which can lead to bacteremia and sepsis. Another factor is haemodialysis catheters, which provide an infection risk over time. E.Coli, Klebsiella pneumoniae, Pseudomonas aeruginosa, Coagulase negative staphylococci, Acinetobacter baumannii, Non fermenting Bacilli, Streptococci, and Enterococcus faeculis were shown to cause infection in our study. The study Samanipour et al. also detected similar bacteria causing infections in the CKD patients, those were E.coli, Staphylococcus aureus, Enterococcus spp, Klebsiella spp, Citrobacter spp, Pseudomonas aeruginosa and Staphylococcus epidermis.^[7] E.coli, Staphylococcus aureus, Staphylococcus saprophyticus, and Klebsiella freundii were also identified by Abdul Karim Miya et al.^[10] Enterococcus spp. and Coagulase negative staphylococcus spp. were identified by Karimzadeh et al.^[8] E.Coli and Klebsiella pneumoniae were the most common bacteria causing infections in CKD patients, according to our findings. The study focused on these two microbes in particular to determine antibiotic resistance.

Antibiotics were given as a treatment for infections. Cefaperazone with Sulbactam were the most commonly given antibiotic among the all. Resistance to Levofloxacin, Doxycycline, and Cefpodoxmine Proxetil was found in E.Coli. Resistance to Piperacillin with Tazobactam, Levofloxacin, Doxycycline, and Cefpodoxmine Proxetil were also found in Klebsiella pneumoniae. The research cited above reveal that these bacteria have a similar pattern of resistance to the antibiotics. Table 2 depicted bacterial resistance, suggesting not only resistance but also the presence of a

superbug. The microorganisms here are resistant to multiple antibiotics. This is one of the most difficult aspects of treating the patient in order to reduce infection. The medicines provided, on the other hand, were very helpful in decreasing the infections.

Antibiotics not only saved many lives, but they also aided in the treatment of infectious disorders. However, due to world issues, these remedies were unable to keep the magic continuing. The primary source of the problem was antibiotics being misused or used incorrectly. The major challenges are self-medication, inaccurate prescribing, and overuse. As a result of these concerns, AMR finally emerged in the population. This means that microorganisms are no longer responding to antibiotics, making medications less efficient at killing them. It increases the length of stay in the hospital, the cost of care, morbidity, and mortality. According to a report released by the World Health Organization (WHO) in April 2014, AMR is a serious global health threat. By 2050, it is estimated that 10 million people will die each year if the AMR continues. Most of this takes place in low- and middle-income countries. Appropriate diagnostic laboratories, surveillance, regulations, and enhanced education are all necessary to stop the spread of this AMR.^[13-20] The study has the benefit of concentrating on two infective bacteria. Furthermore, this study suggests that the more research is needed to determine the association between infection and CKD. The study has certain limitations, including as a small sample size and attrition in some of the patients. Microbiological cultural sensitivity testing with a large sample size and complete information reveals the incidence and prevalence of all microorganisms.

CONCLUSION

Antibiotic resistance rates are higher in E.Coli and Klebsiella pneumonia bacteria. This microorganism's superbug activity delays the patients from returning to normal and may worsen their illness. To solve the condition, proper diagnosis and therapy are required. This is an issue that all health care practitioners, particularly clinical pharmacists, should pay more attention on the issue.

Conflict Of Interest: Authors declares that no conflict of interest

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