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An Observational Study on Prescribing Pattern of Antibiotics in the Nephrology Department of a Tertiary Care Teaching Hospital in South India

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ABSTRACT

Background: Irrational prescribing of antibiotics is a widespread public health issue that leads to antibiotic resistance. To combat illogical antibiotic prescriptions, it's critical to understand the prescribing trend of antibiotics. The present study was carried out to evaluate the antimicrobial drug utilization pattern. **Methods:** The retrospective study was carried out by collecting 312 prescriptions containing antimicrobial agents from the Inpatients admitted to the wards of the nephrology department of Lourdes Hospital, Ernakulam. The data was collected by using a case record form specially prepared for the study. **Results:** Most of the patients were treated empirically at initial, and the frequently prescribed IV antibiotic was Cefoperazone sulbactam which was given to 160 (50%) patients, followed by Meropenem for 59 (18.91%) patients. A total number of 291 [93.26%] patients got clinically better and discharged, 21 (6.73%) were not clinically improved during the hospital stay. The overall mortality was 14 [4.48%] among the 312 patients enrolled in the study population. The duration of hospital stay for most of the patients was 1 to 5 days, about 145 patients [46.47%] were discharged after 1 to 5 days of hospitalization. About 156 patients [50%] showed improvement in their lab parameters and 63 patients [20.19%] lab values didn't show any noticeable positive changes. **Conclusion:** The health system in Lourdhes hospital is integrated with a clear policy regarding the rational use of antibiotics and their prescriptions pattern was largely consistent with international patterns. However minor improvements should be considered regarding wide uses of broad-spectrum antibiotics such as cefoperazone sulbactum; also the frequent prescription of meropenem to the admitted patients should be addressed with consideration. Direct implementation of the role of clinical pharmacists will further improve appropriate antibiotic prescribing and prevent drug interactions.

INTRODUCTION

Antibiotics are widely used as antimicrobial agents and have saved the lives of many people from serious bacterial infections. It is one of the commonly prescribed drugs in hospital practice. Despite their effectiveness in treating bacterial infections, too much threatening bacterial resistance is emerging, largely attributed to the irrational use of antibiotics [1, 2]. As stated in various studies conducted in developing countries, irrational use of antibiotics is a worldwide problem and approximately 75% of antibiotics are prescribed inappropriately, resulting in treatment failure and the emergence of antibacterial resistance [3, 4].

The worldwide increases in antimicrobial resistance are measured as one of the serious public health concerns that represent an international health threat [5]. Appropriate antibiotic selection requires a comprehensive knowledge of a variety of conditions, including the possible pathogens causing infection (taking into account individual host factors), the susceptible patterns of these pathogens (which may change over time), the pharmacokinetic and pharmacodynamic properties of the antibiotics involved, possible drug interactions, hypersensitivity and side effects [6]. Physicians are responsible for developing good prescribing habits that will help reduce the intensity of the issue. Drug utilization evaluation is required to improve the rationality in prescribing i.e. it helps in monitoring the drug efficacy, cost constraints and other factors related to patient safety [7]. It also plays a key role in minimizing adverse drug effects [8].

It becomes difficult to explain to patients that antibiotics probably have no role in their return to health; they took antibiotics multiple times, especially for non-bacterial infections, and felt better after a few days. Infectious diseases are the commonest causes of morbidity and mortality in developing countries of the world [9]. The problem of misuse of antibiotics is a global phenomenon. In India, the prevalence of use of antibiotics varies from 24% to 67%. According to the recent study, the 75% of antimicrobial prescriptions each year and is the most frequent reason for seeking medical attention [10]. In 1945 under the current D and C act the H_1 schedule has been introduced in India by the regulatory bodies to control the irrational antibiotic prescription [11]. Various drug prescription errors have been identified in the health sectors, especially in developing countries. This includes unnecessary poly-pharmacy and high use of unproven drugs [12], irrational use of antibiotics can lead to increased healthcare use, morbidity, mortality, adverse drug events, and drug resistance. [13]. Evaluation of antibiotic prescribing patterns is an important indicator of the quality of clinical

practice. Regular review of antibiotic prescribing patterns represents an effective monitoring study and promotes the rational use of antibiotics [14].

Despite advances in the control of drug regulations and the availability of drugs, irrational drug prescribing is still a worldwide concern. Given the emerging worldwide threat of bacterial resistance, there is a growing need to identify determinants and patterns of antimicrobial prescribing to determine where clinical practice can be improved. [15].

With this background, the present study was designed to evaluate the practice of rational prescription in patients (cases) admitted in various wards of The Nephrology Department of Lourdhes Hospital, Ernakulam. The prescription model will reflect the physician's understanding of the disease and the patient's health history. Data from this study will be helpful in communicating with prescribers and suggesting various observed gaps to improve prescribing practice. Therefore, it will ultimately benefit patients with a minimal increase in resistance strain of bacteria and a reduction in therapy cost and a lower incidence of side effects.

AIM

To assess the antimicrobial resistance trends and to analyse antibiotic consumption in the Nephrology department.

OBJECTIVES

1. To analyse the prescribing pattern of antibiotics and it’s outcomes in Nephrology department.

2. To evaluate the prevalence of MDR pathogens in culture prone infections in Nephrology department over 3 years.

3. To classify and analyse antibiotic consumption in Nephrology department.

METHODOLOGY

STUDY SETTINGS

The study has been conducted in the Nephrology department and Microbiology department of Lourdes hospital, Kochi which is a tertiary care teaching hospital. It is a 600 bedded

multispeciality tertiary care referral teaching hospital with wide range of amenities. The institution is equipped with seven super specialty departments and 22 other departments with facilities comprising twelve operation theaters, ten intensive care units and computerized Lourdes Mediware System Clinical laboratories are with ISO standards. It is one of the top most hospitals in Kerala.

STUDY DURATION

This is a cross-sectional study done from records of adult patients who have come to the Nephrology department during 2018-2020.

INCLUSION CRITERIA

1) Patients from Nephrology Department.

2) Patients taking at least one Antibiotic.

EXCLUSION CRITERIA

1) Age group less than 18 yrs.

STUDY DESIGN

The study was conducted after obtaining the approval of the Institutional ethics committee. A retrospective chart review was conducted from a random sample of patients admitted to the nephrology department of a tertiary care academic teaching hospital. The patients were selected based on inclusion and exclusion criteria.

SAMPLE SIZE

Sample size was calculated with the help of a statistician, a total of 312 patients were included in the study (the minimum sample size required was found to be 240).

DATA COLLECTION TOOL

A specially designed data collection form. Patient data were extracted from medical records and the LOURDES MEDIWARE information system.

DATA COLLECTION

Patient data were gathered retrospectively which comprised the demographics of the patient (age, sex, allergy, height, and weight), chief complaints on admission, past medical and medication history, lab parameters, and drug therapy during the hospital stay, the transition of care, and pertinent lab parameters including sputum culture and sensitivity test, and prescription pattern were extracted from drug information center, medical records department, and Mediware software (hospital data software) were used.

STATISTICAL ANALYSIS

The collected data were compiled using Microsoft Excel and SPSS and presented using tables and graphs. Calculations of mean and SD were done by using statistical software and SPSS. The significance of the study results (<0.05) was assessed using the chi-square test.

RESULTS

A total of 312 patients admitted in the nephrology department were randomly selected during the study period, out of which 197(63.1%)were males and115 (36.8%)females.

Table 1: Demographic details of study population

AGE GROUP	MALE n=197	FEMALE n=115	POOLED n=312
18-27	11	4	15
28-37	9	8	17
38-47	24	10	34
48-57	39	24	63
58-67	55	34	89
68-77	38	27	65
MORE THAN 78	21	8	29

The infection in the department was broadly divided into five. UTI and bacteremia were more prominent. Among 312 patients, 359 cultures were done and no organisms isolated with 113.other infections mentioned in graph include respiratory tract infections, cases with symptoms of infections and showing lab abnormalities (ESR, TC, CRP).

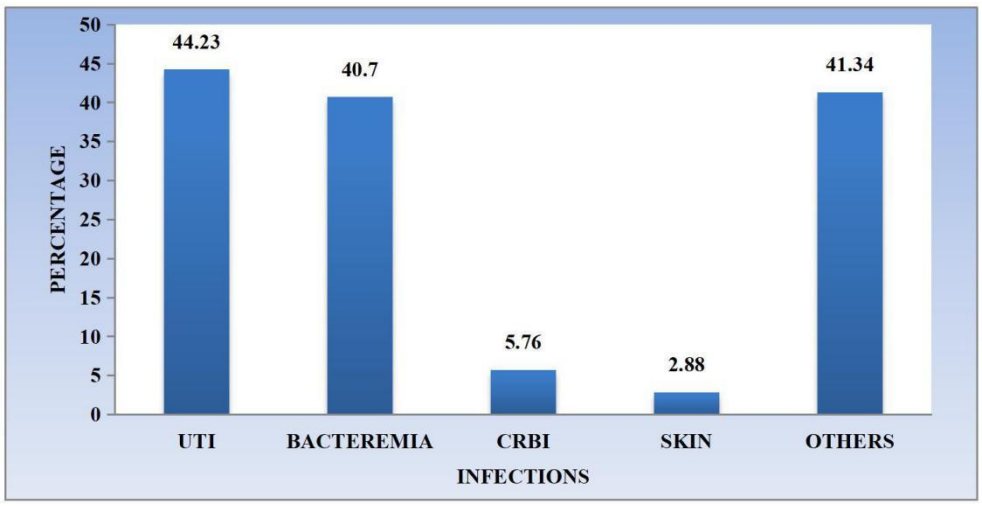


Fig 1: Type of infection with occurrence rate

ORGANISM ISOLATED

Among the organisms isolated, 188 (76.4%) were Gram-negative and 58(23.57%) were Gram-positive.

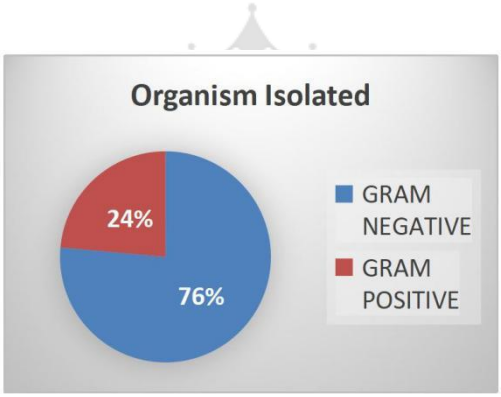


Fig 2: Type of organisms isolated

From the 312 patients, the following organisms were obtained and E.coli was commonly isolated with 21.16%, followed by Klebsiella pneumonia with 15.87%. The figure below represents the frequently isolated organisms and their frequencies. Others include pseudomonas aeruginosa, staphylococcus aureus, Staphylococcus epidermidis Staphylococcus aureus (MRSA), Enterococcus faecium, Elizabethkingia meningoseptica, Enterococcus faecalis, Burkholderia cepacia, Staphylococcus hemolytic, Streptococcus agalactiae.

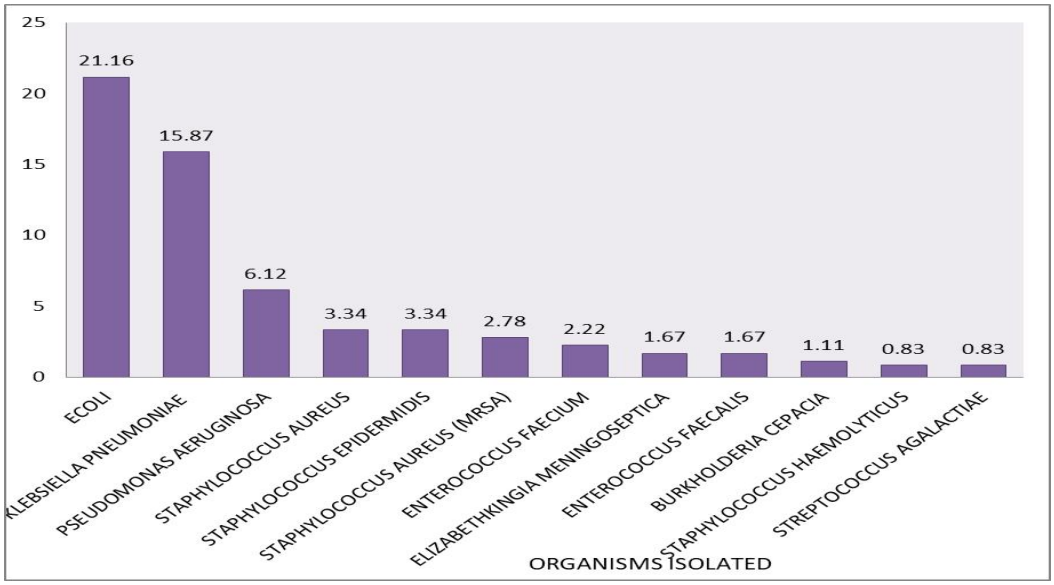


Fig 3: Classification of bacteria based on gram-positive and gram-negative

ANTIBIOTIC USAGE

Among the 312 patients,the prescribed antibiotics were considered as empirical and definitive therapy. 360 antibiotics were provided to the study population during the study period. Among them about 160 patients were empirically prescribed with cefoperazone sulbactum followed by meropenem in 59 patients. 166 patients were treated with definitive therapy by using meropenem to 32 patients, followed by cefoperazone sulbactum to 19. The frequency of empirical and definitive antibiotics are depicted in the table.

Table 2: Empirical and definitive antibiotics

ANTIBIOTIC	EMPIRICAL n-=360		DEFINITIVE n=166	
	COUNT	%	COUNT	%
CEFOPERAZONE SULBACTUM	160	51.28	19	6.08
MEROPENEM	59	18.91	32	10.25
CEFTRIAXONE	23	7.37	8	2.56
AMOXYCILLIN CLAVULANIC ACID	19	6.08	9	2.88
CEFUROXIME	13	4.16	8	2.56
CEFIXIME	10	3.20	14	4.48
CLARITHROMYCIN	10	3.20	1	0.32
METRONIDAZOLE	10	3.20	2	0.64
OFLOXACIN	9	2.88	6	1.92
CEFTAZIDIME	8	2.56	4	1.28
LEVOFLOXACIN	4	1.28	8	2.56
LINEZOLID	4	1.28	13	4.16
CEFIPIME TAZOBACTAM	3	0.96	1	0.32
CIPROFLOXACIN	3	0.96		
FAROPENEM	2	0.64	13	4.16

Among the study population, about 77.75% treatment were given as IV and 22.4% were given as oral.

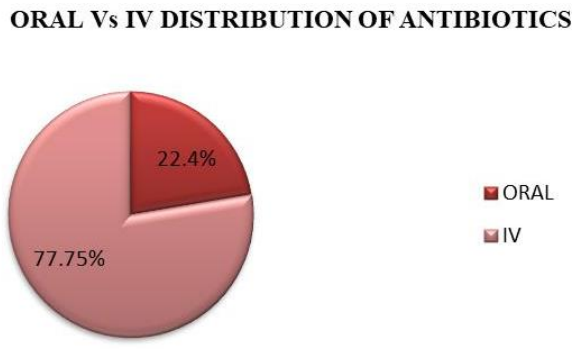


Fig 4: Route of administration of antibiotics

INFECTION-WISE ANTIBIOTICS PRESCRIBED

Table 3: Antibiotics prescribed to common infections

INFECTIONS	EMPIRICAL ANTIBIOTICS	DEFINITIVE ANTIBIOTICS
UTI	CEFOPERAZONE SULBACTAM (52.8%) MEROPENEM (21.7%)	MEROPENEM (18.8%) CEFOPERAZONE SULBACTUM (10.1%)
CRBSI	CEFOPERAZONE SULBACTUM (38.8%) LINEZOLID, MEROPENEM (16.6%)	LINEZOLID (27.7%)
SKIN	CEFOPERAZONE SULBACTUM (44.4%) AMOXICILLIN, CLAVULANICACID, PENICILLIN G(22.2%)	MEROPENEM, LINEZOLID, CEFTAZIDIME (11.1%)
BACTEREMIA	CEFOPERAZONE SULBACTUM (47.2%) MEROPENEM (23.6%)	MEROPENEM(16.5%) COLISTIN (13.3%)

Patients with UTI was empirically treated with Cefoperazone Sulbactum in 73 patients (52.8%) followed by Meropenem in 30 patients (21.7%). In case of definitive therapy, most frequently prescribed was Meropenem, followed by Cefoperazone sulbactum in 26 (18.84%) and 14 (10.14%) patients respectively.

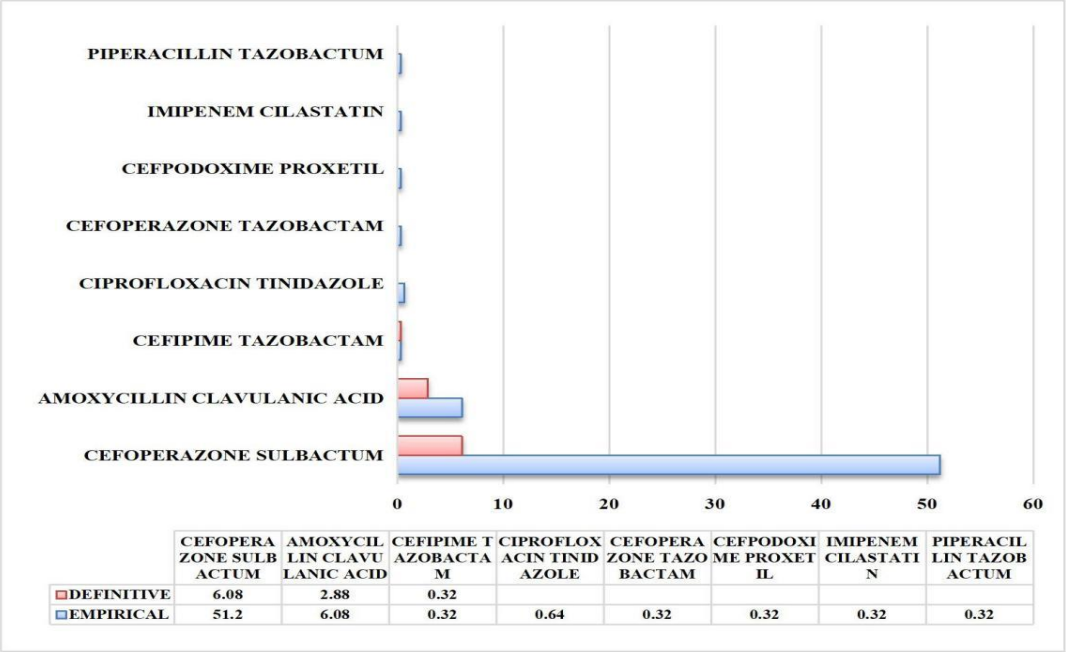
While analyzing the treatment pattern of CRBSI (n=18), the majority patients were managed empirically by Cefaperazone sulbactum, followed by Amoxicillin clavulanic acid, Linezolid and Meropenem in 38.88% and 16.66% respectively. Definitive treatment was by Linezolid in the majority cases.

Cefoperazone sulbactum was the commonly prescribed empirical antibiotic for skin infections (n=9), followed by Amoxicillin clavulanic acid in 4 (44.44%) and 2 (22.22%) patients respectively. Definitive therapy was done using Ceftazidime, Linezolid, Meropenem and Imipenem.

Majority of patients diagnosed Bacteremia (n=127) were treated empirically by using Cefoperazone sulbactum which is in 60 (47.24%) patients, followed by Meropenem in 37 (23.62%) patients. They were mostly managed with definitive therapy with Meropenem, followed by Colistin.

FIXED DOSE COMBINATIONS

41.25% antibiotics given in the department were fixed-dose combinations. The most commonly prescribed fixed-dose combination empirically was cefoperazone sulbactum(51.28%) in 160 patients, followed by amoxicillin clavaulanic acid (6.09%). In definitive therapy also the same antibiotics are used frequently about 6.08% and 2.88%.



	CEFOPERAZONE SULBACTUM	AMOXYCILLIN CLAVULANIC ACID	CEFIPIME TAZOBACTAM	CIPROFLOXACIN TINIDAZOLE	CEFOPERAZONE TAZOBACTAM	CEFPODOXIME PROXETIL	IMIPENEM CILASTATIN	PIPERACILLIN TAZOBACTUM
DEFINITIVE	6.08	2.88	0.32					
EMPIRICAL	51.2	6.08	0.32	0.64	0.32	0.32	0.32	0.32

Fig. 5: commonly used fixed-dose combination antibiotics

OUTCOME

By analyzing the outcomes of the antibiotic prescription in the department, we have obtained both clinical cure and clinical failure for the study population. The parameters used for analyzing outcomes were length of hospital stay, clinical status and mortality. The below diagram depicts that 21 were not clinically improved during the hospital stay. The overall mortality was 14 among 312 patients enrolled in study population. The duration of hospital stay was 1 to 5 days for most patients. About 145 patients were discharged after 1-5 days of hospitalization and 101 patients after 6-10days.Also 156 patients showed improvement in lab parameters and 63 patients lab values did not show any noticeable positive changes.

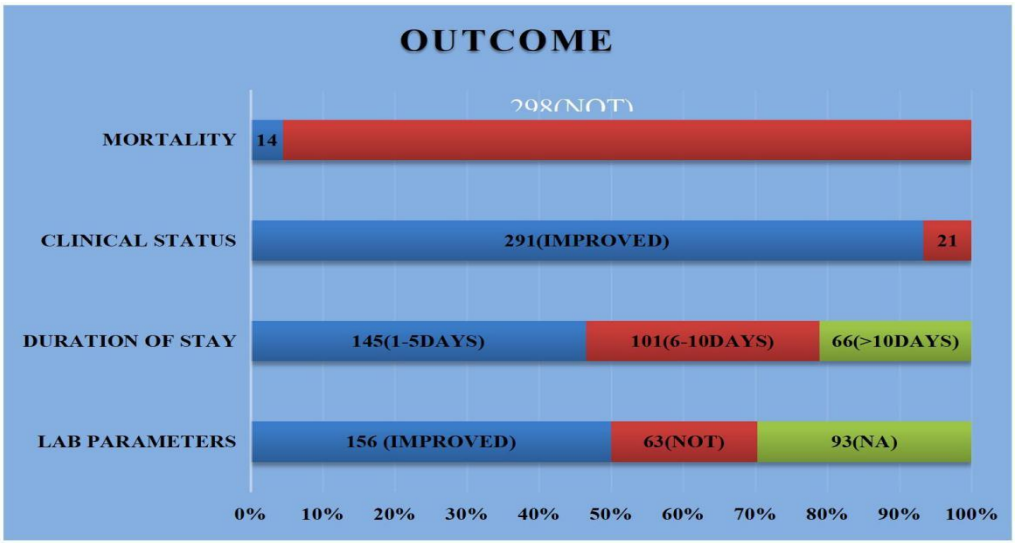


Fig 6: Outcomes of therapy

DISCUSSION

A retrospective cross-sectional study was carried out in nephrology department and microbiology department to assess the prescription pattern of antibiotics. During the study period 312 patients who were treated with atleast one antibiotic was taken into consideration. Most of the patients admitted to nephrology department were older than 57 years, which agrees with the common factors like serious illness, age related issues, and changes in immune response.

Complicated UTI and Bacteremia were the most frequent infections for which an antibiotic was prescribed. These results correlate with study done by Das AK et al[16].The antibiotics most frequently prescribed empirically are Cefoperazone sulbactum and Meropenem. Srishyla Mvetal conducted similar study that cefoperazone sulbactum followed by meropenem and ceftriaxone were the most frequently prescribed antibiotics in an Indian hospital setting.[17].

In our study 77.1% of the patients were prescribed antibiotics by the parenteral route. In a study reported by Raveh D et al, 64% of antibiotics were prescribed by the parenteral route [18]. About 145 patients, duration of hospital stay was 1 to 5 days. Similar findings were obtained from another study conducted by Xiaoxi Zeng et al[19].

LIMITATION OF THE STUDY

1) The retrospective data collection is typically constructed using existing databases from healthcare records, hence there is no interaction with patients.

2) The pandemic consequences associated with COVID 19 affected our study.

3) Our study is based on a single health care department thereby limiting the generalizability of results.

CONCLUSION

The present study delved the prescribing pattern and the selection of antibiotics in 312 cases admitted for different infectious disease in the Nephrology department. Antibiotics were used both as empirical and definitive remedy. Cefoperazone Sulbactum followed by meropenem were used as empirical therapy, however Meropenem followed by Cefoperazone sulbactum was specified as definitive therapy. The high rate of prescription of parenteral antibiotics is a matter of concern. Hence, abating the prescribing of parenteral antibiotics and early switch to oral antibiotics will significantly reduce the expenditure incurred. Complicated UTI and bacteremia were more prominent in the study population and utmost constantly prescribed antibiotics was Cefoperazone sulbactum followed by Meropenem. Therefore, regular monitoring of microbial resistance helps in proper selection of antibiotics. Our study demonstrated an increased rate of clinical cure and lower mortality rate when compared with other studies. Thus, rational use of antibiotics is decisive to control antibiotic resistance. The development of renal dosing guidelines in CKD patients can improve the pattern of prescribing in renal failure population. This signifies that clinical pharmacists in association with physicians enhance proper antibiotic prescription.

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