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Research Article

Assessing And Identifying The Most Commonly Occuring Infections And Antibiotics Prescribed In Renal Impairment Patients In A Tertiary Care Hospital: A Retrospective Study

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ABSTRACT

The aim of this study was to assess the commonly occurring infection and commonly prescribed antibiotics in patients with renal impairment. This abstract aims to underscore the importance of tailored antibiotic management in renal patients, considering the unique challenges posed by impaired renal function. Strategies for infection prevention, early detection, and appropriate antibiotic stewardship are crucial elements in safeguarding renal health while effectively addressing infectious threats. Through a comprehensive exploration of infections and antibiotics in renal patients, this abstract seeks to contribute to a deeper understanding of the nuances involved in managing infectious complications in this   vulnerable population. A retrospective study was conducted by screening the medical records of 100 patients who fulfilled the inclusion criteria. Most commonly occurring infections, antibiotic utilization was analysed using Microsoft Excel. The mean age of the study participant 59.8 years with 67% male and 33% female. Majority of the patients were diagnosed with CKD (56%). Most commonly occurring infections were found to be Sepsis (29.09%), RTI (29.09%), UTI (23.63%). Commonly utilized antibiotics were Inj.meropenem (21.42%), Inj. Ceftriaxone (12.5%), Inj. piperacillin tazobactum (9.82%), T. amoxicillin clavulanate (9.82%), Inj. Cefoperazone sulbactum (7.14%). Various classes of antibiotics were utilized to patients with renal impairment. The most widely prescribed were Inj. Meropenem, Inj. Ceftriaxone, T. Amoxicillin clavulanate and Inj. Piperacillin Tazobactum. Awareness raising and monitoring system for various infectious disease and antibiotics prescribed is critical to improve the quality of care in patients with renal impairment.

INTRODUCTION

The kidney is the major route of elimination for many important classes of antibiotics; Antibiotic drugs are the most frequently prescribed medications among hospitalized patients for life-saving purposes, mainly in immune compromised

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patient, like in patient with end stage renal disease on hemodialysis (HD) or those who had documented bacterial infection[1]

Infection poses a significant and often complex challenge for individuals with renal disease, particularly those afflicted by chronic kidney disease (CKD) or grappling with end-stage renal disease (ESRD). The kidneys, integral in maintaining fluid and electrolyte balance while aiding in waste product excretion, play a pivotal role in the body's defense against infections. When renal function is compromised, the intricate interplay of immunological mechanisms may falter, rendering these patients more susceptible to a spectrum of infectious threats[2,3]

Urinary tract infections (UTIs) are a recurrent concern, often stemming from the compromised ability to effectively empty the bladder, allowing opportunistic pathogens to thrive[4]

Incidence of infection among patients with kidney disease remains high in developing countries. Progression of kidney damage could also be induced by the nephrotoxicity of few antibiotics. The ultimate negative outcome is death. Medication reviews in the management of kidney disease is the key point that should always be performed by clinical pharmacists through a structured examination of patients' medications including evaluation and analysis of antibiotic dosing to avoid adverse drug reaction, to prevent additional renal injury, to improve kidney disease management and to achieve optimal outcomes[5]

Beyond these specific considerations, the metabolic disturbances inherent in renal disease contribute to a state of immune compromise, rendering these patients susceptible to infections that may manifest during surgical procedures, injuries, or routine healthcare interventions[6]

This necessitates a comprehensive approach to infection prevention, encompassing meticulous hygiene practices, sterile medical procedures, and judicious vaccination strategies[7]

METHODOLOGY
MATERIALS AND METHODS

Study design: A retrospective observational study to assess the commonly occurring infection and antibiotics in renal impairment patient.

- **Study site**: The study was conducted in Srinivas Institute of Medical Science and Research Centre (SIMS & RC), Mangalore.
- **Study Duration**: The study was conducted for a duration of 6 months from March 2023 to August 2023.
- **Sample Size**: The sample taken for the study was 100.

Ethical Clearance: The study protocol was approved by the Institutional Ethics Committee (IEC) of Srinivas Institute of Medical Science and Research Centre (SIMS & RC), Mangalore.

Study criteria:

Inclusion Criteria:

- All the AKI, CKD patients taking antibiotics.
- Patients files containing patient age greater than 18 years.

Exclusion Criteria:

- Patients below the age of 18years.
- Pregnant or lactating category.
- All the AKI, CKD patients not taking antibiotics.

Source of data collection

Data(s) for the study were collected using data collection form from the medical record department (MRD) of Srinivas Institute of Medical Science and Research Centre (SIMS & RC), Mangalore.

Study method

The study period will be divided into 3 phases;
PHASE 1:

Preparation for the study:

1) Preparation of Patient's Data Collection form:
   - Data collection form include the patient's demographic details and antibiotic prescribed.
2) Institutional Ethics committee approval: Ethical Clearance will be(was) obtained from the

Institutional Ethics committee (IEC) of Srinivas Institute of Medical Science and Research Centre (SIMS & RC), Mangalore.

PHASE 2:

1. Selection of case files: The case files for the study **will be(was)** selected based on the inclusion and exclusion criteria.
2. Collection of data from selected case files- Data(s) were collected using data collection form with the aid of medical records from MRD of Srinivas Institute of Medical Science and Research Centre (SIMS & RC), Mangalore.

Commonly occurring infection, commonly prescribed antibiotic in renal impairment was also determined.

PHASE 3:

Analysis of data: The collected data will be analysed using Microsoft Excel.

STATISTICAL ANALYSIS

Statistical analysis involves collecting and scrutinizing every data sample in a set of items from which samples can be drawn and a suitable statistical test will be applied to analyse the data. The collected data will be analysed using Microsoft Excel.

RESULT

DEMOGRAPHIC AND CLINICAL CHARACTERISTICS

We assessed 153 case files of patients with renal impairment of which 100 fulfilled the inclusion criteria. The mean age of the patients was 59.8. The study showed majority of the patients were diagnosed with CKD (56%), AKI was seen in 34% of patients and 10% AKI on CKD. Majority of the participants were of 51-70 age group (59%), 21% were of age group above 71 years, 19% were of age group 31-50, 18-30 (1%). Among 100 patients 67 were male (67%) and 33 were female (33%). Patient's mean serum creatinine was 4.27 and the mean CrCl was 21.85.

Table 1: Demographic and clinical data of patients with renal impairment

Demographic and clinical data	Number
Number of patients with renal impairment	100
Male	67
Female	33
Age (Mean)	59.8
CrCl (Mean)	21.85
Type of renal impairmentAKI AKI on CKDCKD	34 10 56
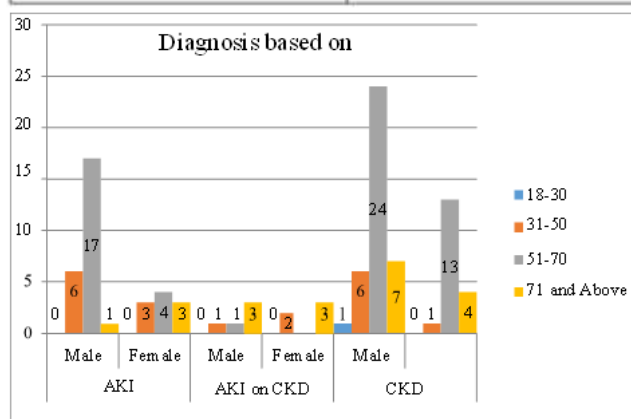
Figure 1: Co-relation between age, gender, diagnosis

CO-MORBIDITIES AND INFECTIONS AMONG STUDY PARTICIPANTS

Majority of the patients had ≤5 co-morbidities. The top 5 co-morbid conditions were HTN, infection, DM, anemia, heart disease. Hypertension was the most common co-morbidity (29.04%) and infection was the second (26.19%), followed by DM (24.76%), Anemia (10.47%), Heart disease (4.28%), CVA (2.38%), Pulmonary edema (1.9%), Hepatic disease (0.95%) Looking over the association between co- morbid diseases and the occurance of kidney diseases it was found that kidney diseases were significantly associated with hypertension and diabetes mellitus.
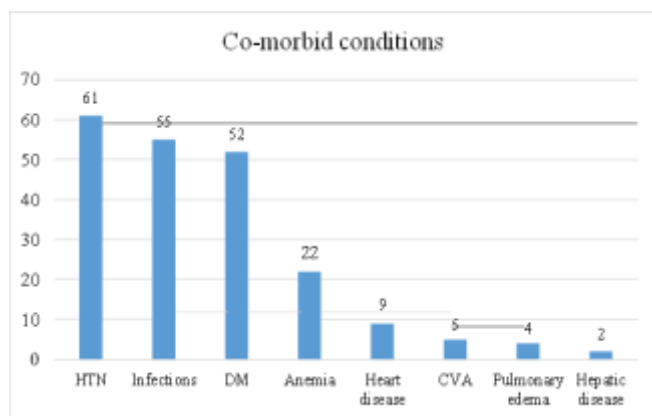
**Figure 2: Common co-morbidities seen in renal impairment**

Table 2: Common co-morbidities seen in renal impairment

Co-morbidity	Number
HTN	61
Infection	55
DM	52
Anemia	22
Heart disease	9
CVA	5
Pulmonary edema	4
Hepatic disease	2

Increasing age, diabetes, infection, anemia, cardiovascular disease are the most important co-existing conditions that predict worse outcomes for patients with renal impairment.

Out of the 112 prescribed antibiotics, 55 % of the antibiotics were prescribed for infection and 45 % were prescribed for prophylaxis (55.5% antibiotics were prescribed for HD, 44.4% antibiotics were prescribed for surgical prophylaxis).

Most commonly occurring infection in renal impairment were found to be Sepsis (29.09%), Respiratory tract infection (29.09%), (Pneumonia, Bronchitis, Tonsillitis), Urinary tract infection (23.63%), Cellulitis (9.09%), Bacterial meningitis (5.45%), Tuberculosis (3.63%).
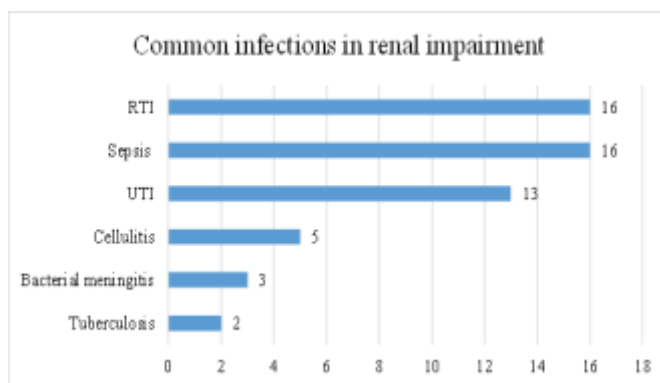
Figure 3: Commonly occurring infections in renal impairment

MOST COMMONLY PRESCRIBED ANTIBIOTICS

Totally 112 antibiotics were prescribed. In the study conducted eight largest utilized antibiotics for the treatment of infection in patients with renal impairment in decreasing order were Meropenem injection (21.42%), Ceftriaxone injection (12.5%), Piperacillin+Tazobactam injection (9.82%), Amoxicillin+Clavulanic acid tablet (9.82%), Cefoperazone+Sulbactam injection (7.14%), Clindamycin injection (5.35%), Levofloxacin tablet (4.46%), Amoxicillin+Clavulanic acid injection (3.57%) While, the least utilized antibiotics were Amikacin injection (0.89%), Fluconazole injection (0.89%), Chloramphenicol injection (0.89%), Doxycycline tablet (0.89%), Clindamycin tablet (0.89%), Ceftazidime+Sulbactam injection (0.89%), Ceftriaxone+Sulbactam injection (0.89%),Cefuroxime injection (0.89%), Linezolid injection (0.89%), Cefepime tablet (0.89%),Ciprofloxacin tablet (0.89%).
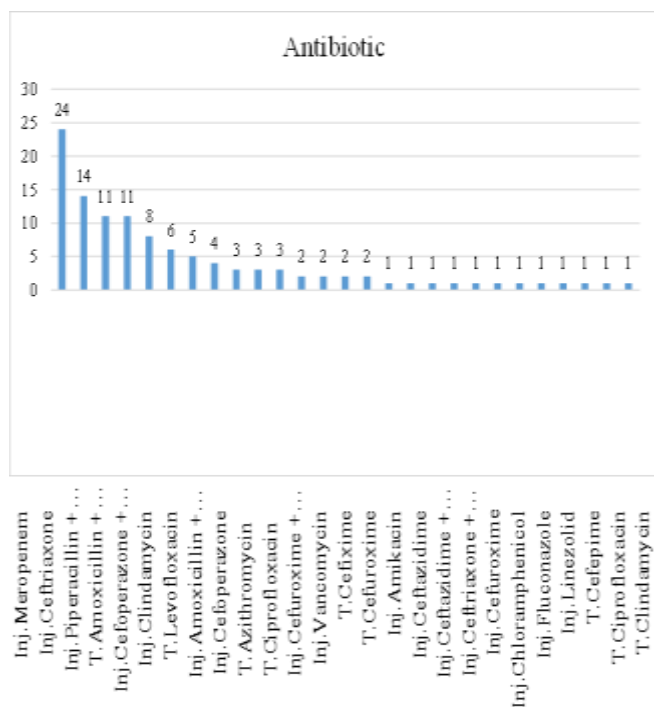
Figure 4: Overall antibiotic utilization in patients with renal impairment

DISCUSSION

This study is primarily focused on identifying the most prevalent infections in patients with renal impairment and figuring out the most frequently prescribed antibiotics in patients with renal impairment. This present study reveals that males were more affected by renal impairment than females. Similar observation was made by Alhabadri SM et al., who conducted a study on patients having moderate to severe renal impairment, where also majority of renal impairment patients were men. Other related research studies indicated that high testosterone levels in men which cause kidney function to decline, unhealthy living styles such as alcohol consumption and smoking, excess protein supplement intake for gym workouts as put men at increased risk for renal impairment. Estrogen, which is more abundant in women, and also having protective effect on kidney may protect the female kidney until menopause. [12] The type and severity of infections may vary across different stages of renal impairment. Patients with advanced

CKD or ESRD, especially those on dialysis, are prone to unique infections such as dialysis access site infections or peritonitis in peritoneal dialysis.[8] The current study found out that the top three co-morbidities in the study population were hypertension - followed by infectious diseases and diabetes mellitus. Uncontrolled blood pressure and blood sugar levels can damage, stiffen, or constrict the arteries that surround the kidneys. Because these damaged arteries are unable to supply adequate blood to the renal tissue, the kidneys gradually lose their capacity to filter blood, which may eventually result in chronic kidney disease. Pyelonephritis results from the direct invasion of different bacteria into the renal tissue, either through ascending infection (UTI) or haematogenous spread (SEPSIS), which causes persistent inflammation or direct injury from bacterial toxins. Among the infectious diseases sepsis accounted for the majority of infections followed by UTI, RTI. In a study conducted by Sridhara S et al., UTI were seen in most of the patients, followed by systemic, bloodstream infections and respiratory infections. Haemodialysis patients, during the normal course of treatment, are exposed to several infectious risks, and the majority of patients require at least 1 hospitalization every year for treatment of infections. The type of vascular access in use plays an important role in the subsequent development of bloodstream infections. Haemodialysis patients with central venous catheters had a considerably increased risk of bacteraemia and those with temporary c atheters have been reported to have higher risk of septicaemia.[9,11]

This current study found that the seven most utilized antibiotics for the treatment of renal patients in decreasing order were Inj.Meropenem, Inj.Ceftriaxone, T. Amoxicillin clavulanate, Inj.Piperacillin tazobactum, Inj.Cefoperazone-sulbactum, Inj.Clindamycin, T. Levofloxacin. In a similar study conducted by *Kumar et al* most

widely used antibiotic medication was Piperacillin+Tazobactam followed by Meropenem, Amoxicillin+Clavulanate, Ciprofloxacin, Ceftriaxone. These differences resulted from many possible reasons including the wide range of complications suffered by the patients, appropriateness of therapy, and difference in severity of infection suffered by the renal impairment patients, knowledge and expertise of physician, popularity and cost of antibiotic etc. Other determinant of the choice of antibiotics was their susceptibility based on assessment of culture and sensitivity test performed in this hospital.[10,13] Given the heightened vulnerability of renal patients to infections, a proactive approach to infection prevention is paramount. This includes meticulous hygiene practices, vaccination strategies, and regular surveillance for potential sources of infection, particularly in dialysis settings.[14,15] In conclusion, managing infections in renal impairment patients requires a nuancede understanding of antibiotic pharmacokinetics, consideration of nephrotoxicity risks, and tailoring treatment strategies to the specific challenges posed by renal dysfunction. Antibiotic stewardship and infection prevention efforts are integral components in optimizing outcomes for this vulnerable population.[16.17] Thus Clinical pharmacists must evaluate the antibiotics given to CKD patients and analyse their pharmacological logic in order to increase therapy effectiveness.

CONCLUSION

From the retrospective study conducted that most commonly occurring infection in renal impairment was UTI, LRTI, Sepsis, Pneumonia, Cellulitis. Most commonly prescribed antibiotic was Meropenem, amoxicillin Clavulanic acid, Ceftriaxone, Cefoperazone+Sulbactam, Piperacillin+Tazobactam. This study which is representative of commonly occurring infections showcases the burden of various infectious disease in renal impairment patient. Also showcases the patterns of antimicrobial used in renal impairment patients. In conclusion, the intricate relationship between antibiotics and infections in renal patients underscores the critical importance of a tailored and vigilant approach to medical management. Patients with renal impairment, whether due to chronic kidney disease (CKD) or end-stage renal disease (ESRD), face an elevated risk of infections that necessitates a careful balance between effective antimicrobial therapy and the preservation of renal function. Thus Clinical pharmacists must evaluate the antibiotics given to CKD patients and analyse their pharmacological logic in order to minimize inappropriate use and promote rational prescribing of antimicrobial therapy in renally impaired patients by completely adhering to standard dosing guidelines available by co-operating with other medical professionals.

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