



Research Article

## A Retrospective Study On Evaluation Of Antibiotic Utilization In Renal Impairment In A Tertiary Care Hospital In Dakshina Kannada District

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### ABSTRACT

Renal impairment is the inability of the kidneys to perform their excretory functions, which results in the retention of nitrogenous waste products in the blood. Infectious disease is recognized as an important complication among patients with renal impairment, contributing to excess morbidity and health care costs. Epidemiological research revealed that individuals with end-stage renal disease are more prone to develop infectious complications, which include urinary tract infection, pneumonia, and sepsis. These infections can be managed with the appropriate antibiotics. The objective of the study was to evaluate the utilization patterns of antibiotic in patients with renal impairment. A retrospective study was conducted by screening the medical records of 100 patients who fulfilled the inclusion criteria. 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%). Commonly utilized antibiotics were Inj. Meropenem (21.42%), Inj. Ceftriaxone (12.5%), T. Amoxicillin + Clavulanic acid (9.82%), Inj. Piperacillin + Tazobactam (9.82%). The rational use of antibiotics is critical for optimising clinical outcomes. The most commonly prescribed parenteral antibiotic was Injection Meropenem, while the most commonly prescribed oral antibiotic was Tablet Amoxicillin + Clavulanic acid.

### INTRODUCTION


Renal impairment is the inability of the kidneys to perform their excretory functions, which results in the retention of nitrogenous waste products in the blood. Renal impairment is classified as acute renal failure (ARF) or acute kidney injury (AKI)

and chronic renal failure (CRF) or chronic kidney disease (CKD).

In ARF Glomerular filtration abruptly decreases (over hours to days) but usually returns to normal. Kidney Disease Improving Global Outcomes (KDIGO) criteria state that AKI can be identified

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by any of the following: (1) A rise in creatinine of 0.3 mg/dL within 48 hours, (2) A rise in creatinine of 1.5 times baseline within the previous 7 days, or (3) A decrease in urine output of less than 0.5 mL/kg/hour for six hours.<sup>1</sup>

In CKD there is a persistent impairment of kidney function indicated by either a calculated glomerular filtration rate (GFR) less than 60 ml per minute / 1.73 m<sup>2</sup> or an excessively increased blood creatinine for more than 3 months.<sup>2</sup>

CKD classified based on stage:

- Stage 1: GFR greater than 90
- Stage 2: 60 to 89
- Stage 3: 30 to 59
- Stage 4: 15 to 29
- Stage 5: Less than 15

Kidney disease (KD) is a growing public health concern across the world. According to the Global Burden of Disease report, around 1.4 million people died from kidney disease in 2019, a 20% increase from 2010, one of the biggest increases among the major causes of mortality.<sup>3</sup>

Infectious diseases has been identified as a significant complication in individuals with end-stage renal failure, contributing to increased morbidity. Recent studies have demonstrated that even mild to severe stages of kidney disease increases the risk of infection significantly. Acute kidney injury is associated with increased short-term and long term rates of infection.<sup>4</sup> Regarding underlying mechanisms, data shows that individuals with KD have an altered immune response, including reduced function of T cells, B cells, and neutrophils. Multiple factors associated with KD, such as advanced age, diabetes, and hypertension contribute to greater susceptibility to infection.<sup>5</sup>

According to epidemiological studies patients with renal disease are more likely to experience infectious complications mainly urinary tract infection, pneumonia, and sepsis.<sup>6,7,8</sup> Patients on dialysis are vulnerable to infections. Infections are

a major source of morbidity and mortality in this population, and the second leading cause of death.<sup>9</sup> Management of Infections can be done with the use of appropriate antibiotics. Rational antibiotics provision is important to optimize the treatment outcomes.<sup>10</sup>

The aim of the study was to evaluate the utilization patterns of antibiotic in patients with renal impairment.

## METHODOLOGY

**Study design:** A retrospective observational study was carried out to evaluate the utilization patterns of antibiotic in patients with renal impairment in tertiary care hospital of Dakshina Kannada District. Data was collected from 100 case files from MRD between January-July 2022.

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

**Study method:**

The study period was 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, diagnosis, antibiotic prescribed.

2) Institutional Ethics committee approval: Ethical Clearance 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 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.

3. Filling information in data collection form- The information includes the patient's demographic details, diagnosis, antibiotic prescribed.

### PHASE 3:

Analysis of data: The collected data was analysed using Microsoft Excel. Commonly prescribed antibiotic in renal impairment was determined.

### DATA ANALYSIS:

The collected data was analysed using Microsoft Excel.

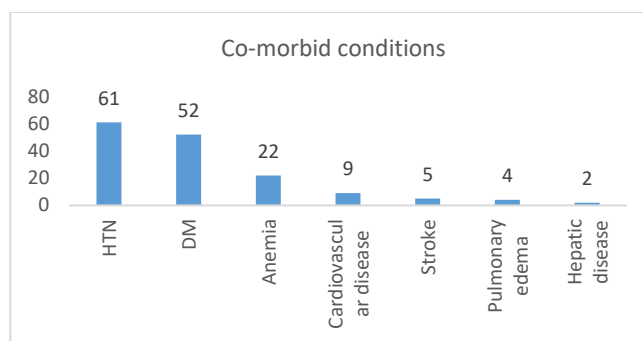
## RESULTS

### 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 study participants was 59.8. The study showed majority of the patients were diagnosed with CKD 61%, AKI was seen in 39% of patients. 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%).

**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
Type of renal impairment	
AKI	39
CKD	61



**Figure 1: Common co-morbidities seen in renal impairment**

### CO-MORBIDITIES AMONG STUDY PARTICIPANTS

Majority of the patients had  $\leq 4$  co-morbidities. The top 4 co-morbid conditions were Hypertension (HTN), Diabetes Mellitus (DM), anemia, heart disease.

Hypertension was the most common co-morbidity (61%), followed by DM (52%), Anemia (22%), Cardiovascular disease (9%), Stroke (5%), Pulmonary edema (4%), Hepatic disease (2%). Increasing age, diabetes, anemia, cardiovascular disease are the most important co-existing conditions that predict worse outcomes for patients with renal impairment.

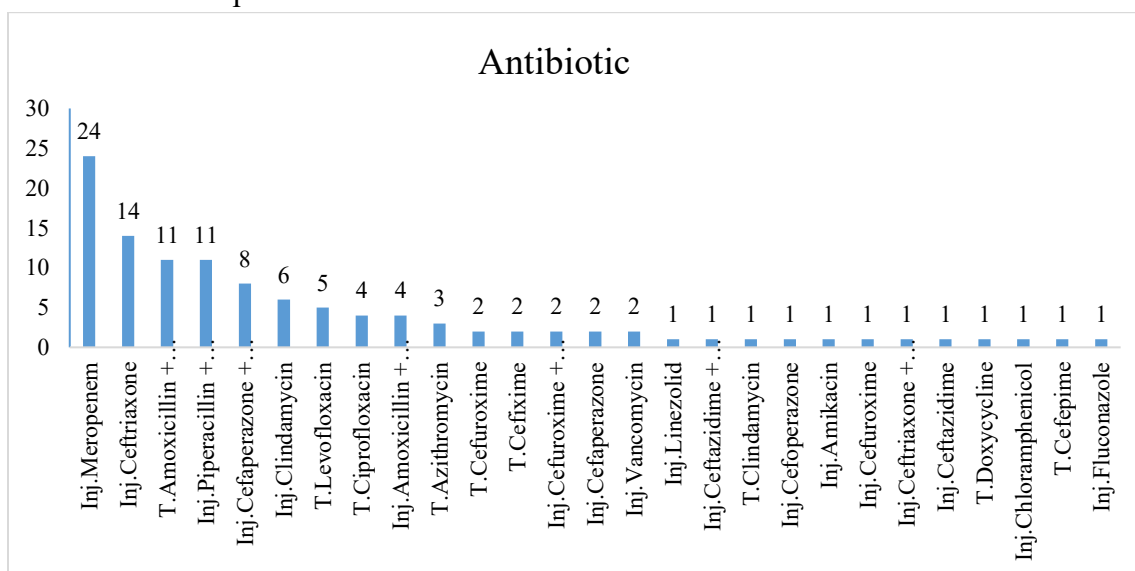
### ANTIBIOTICS UTILIZATION PATTERNS

Totally 112 antibiotics were prescribed. Overall antibiotics utilized for 100 patients are shown in fig no 2. This study found that there were 11 classes of antibiotics provided to patients with renal impairment. 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%).

Injection Meropenem (29.26%) was commonly prescribed antibiotic via parenteral route followed

by Injection Ceftriaxone (17.07%), Injection Piperacillin + Tazobactam (13.41%), Injection Cefoperazone + Sulbactam (9.75%). Tablet Amoxicillin + Clavulanic acid (36.66%) was commonly prescribed via oral route followed by Tablet Levofloxacin (16.66%). Meropenem injection was mainly indicated for sepsis and urinary tract infection. Injection Ceftriaxone was prescribed for treatment of Respiratory tract infection and Injection Piperacillin + Tazobactam was prescribed for treatment of Sepsis and Respiratory tract infection. For prophylaxis Injection Cefoperazone + Sulbactam was the main antibiotic prescribed followed by Tablet Amoxicillin + Clavulanic acid. Tablet Levofloxacin was indicated for Respiratory tract infection.



**Figure 2: Overall antibiotic utilization in patients with renal impairment**

## DISCUSSION

The current study found out that the top comorbidities in the study population were hypertension followed by diabetes mellitus. Uncontrolled blood pressure and blood sugar levels can damage, stiffen, or constrict the arteries that surround the kidneys.<sup>11</sup> 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.<sup>12</sup>

Pyelonephritis results from the direct invasion of different bacteria into the renal tissue, either through ascending infection (Urinary tract infection) or hematogenous spread (sepsis), which causes persistent inflammation or direct injury from bacterial toxins.<sup>13</sup> 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.<sup>14</sup> Haemodialysis patients with central venous catheters had a considerably increased risk of bacteraemia and those with temporary catheters have been reported to have higher risk of septicaemia.<sup>15</sup> Management of Infections can be done with the use of appropriate antibiotics

This study is primarily focused on identifying most frequently prescribed antibiotics in patients with renal impairment. 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 tazobactam, Inj.Cefoperazone-sulbactam, Inj.Clindamycin, T. Levofloxacin. In a similar study conducted by *Kumar A et al* most widely used antibiotic medication was Piperacillin+Tazobactam followed by Meropenem, Amoxicillin+Clavulanate, Ciprofloxacin, Ceftriaxone.<sup>16</sup>

In the current study the most utilized antibiotic was Inj. Meropenem. The same antibiotic was the commonest among parenteral antibiotics. However Amoxicillin + Clavulanic acid was the commonly prescribed antibiotic via oral route. In a study conducted by Hui et al the most commonly prescribed IV antibiotics were Vancomycin, Piperacillin + Tazobactam, Cefazolin and Ceftriaxone. Amoxicillin + Clavulanic acid was the most common oral antibiotic prescribed.<sup>9</sup>

Injection Meropenem was the most commonly prescribed antibiotic indicated for sepsis and Urinary tract infection. Injection Ceftriaxone was prescribed for treatment of Respiratory tract infection and Injection Piperacillin + Tazobactam was prescribed for treatment of Sepsis and Respiratory tract infection. In a study conducted

by Hui et al Vancomycin and Cephazolin were most commonly prescribed for Blood stream infection, Skin and soft-tissue infection; Piperacillin + Tazobactam for Skin and soft-tissue infection and Ceftriaxone for Respiratory tract infection.<sup>9</sup>

For prophylaxis Injection Cefoperazone + Sulbactam was the main antibiotic prescribed followed by Tablet Amoxicillin + Clavulanic acid. In a study conducted by Najwa Al Himali et al Cefazolin was the commonly utilized antibiotic for prophylaxis.<sup>17</sup>

The most common oral antibiotics prescribed were Tablet Amoxicillin + Clavulanic acid for prophylaxis and Tablet Levofloxacin for Respiratory tract infection. In a study conducted by Hui et al Amoxicillin + Clavulanic acid was the most common oral antibiotic prescribed for Respiratory tract infection and Skin and soft-tissue infection.<sup>9</sup> 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.

## CONCLUSION

The current study provides summary of commonly prescribed antibiotics. Various classes of antibiotics were prescribed to patients with renal impairment. The most widely provided parenteral antibiotics were Injection Meropenem, Injection Ceftriaxone, Injection Piperacillin + Tazobactam and The most widely provided oral antibiotics were Tablet Amoxicillin + Cavulanic acid, Tablet Levofloxacin. The rational use of antibiotics is critical for optimising clinical outcomes.

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