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A Study of Clinical Profile and Etiology of Renal Dysfunction in Patients at Dr. B.R. Ambedkar Medical College and Hospital

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ABSTRACT

Background; Renal dysfunction encompasses a broad spectrum of disorders including acute kidney injury (AKI), acute-on-chronic kidney disease (AoCKD), and chronic kidney disease (CKD). These conditions are associated with substantial morbidity and mortality worldwide. The increasing prevalence of hypertension, diabetes mellitus, and infectious diseases has contributed significantly to the burden of renal dysfunction, particularly in developing countries such as India.
Objectives; To evaluate the clinical profile and etiological spectrum of renal dysfunction among patients admitted to a tertiary care hospital.
Methods; A hospital-based cross-sectional observational study was conducted in the Department of General Medicine at Dr. B.R. Ambedkar Medical College and Hospital, Bengaluru, from August 2024 to August 2025. A total of 100 patients with renal dysfunction were included. Data regarding demographics, comorbidities, clinical presentation, and laboratory parameters were collected. Renal dysfunction was categorized into AKI, AoCKD, and CKD using established diagnostic criteria. Statistical analyses were performed using descriptive statistics and chi-square tests.
Results; Among 100 patients, the mean age was 54.9 ± 12 years with a slight female predominance (54%). Hypertension and type 2 diabetes mellitus were present in 47% and 59% of patients respectively. AKI was the most common presentation (46%), followed by AoCKD (34%) and CKD (20%). The most frequent causes of AKI were acute gastroenteritis (34.8%), sepsis (19.6%), and infections including urinary tract infection and lower respiratory tract infection (15.2% each). In AoCKD, urinary tract infection in patients with CKD was the leading precipitating factor (35.3%). Diabetic kidney disease accounted for 60% of CKD cases.
Conclusion; Renal dysfunction remains a significant clinical problem with multifactorial etiology. Acute infections and metabolic diseases such as diabetes and hypertension are major contributors. Early detection and targeted management strategies are essential to prevent progression to chronic kidney disease and end-stage renal disease.

Keywords*: Renal dysfunction, Acute Kidney Injury, Acute on Chronic Kidney Disease, Chronic Kidney Disease, Etiology, Clinical profile, Tertiary care hospital.*

INTRODUCTION

Renal dysfunction is one of the major global health challenges and is associated with a wide range of renal disorders from acute kidney injury to chronic kidney disease. Renal disorders can be defined as a group of conditions characterized by the inability of the kidneys to maintain fluid, electrolyte, and metabolic homeostasis. Renal dysfunction can result from several

causes, including alterations in hemodynamics, metabolic disorders, systemic disorders, infections, and drug-induced nephrotoxicity. It is very important to understand the clinical profile and causes of renal dysfunction to provide proper management to the patients suffering from renal disorders.[1]

Acute kidney injury is defined as "an abrupt loss or impairment of renal function, typically indicated by an increase in serum creatinine levels or a decrease in urine output." AKI can occur in a matter of hours or days, and it is most commonly seen in hospitalized or critically ill patients. AKI can occur by multiple pathways, such as prerenal, intrinsic, or postrenal causes. Early recognition and prompt management are crucial in AKI, as it is linked with considerable morbidity, mortality, and financial burden.[2,3]

The incidence of AKI worldwide is on the rise, especially in developing countries where infections, dehydration, and lack of access to healthcare contribute to the late diagnosis and management of the condition. According to epidemiological studies in Southeast Asia, AKI is commonly encountered in the hospital setting, and the leading causes are infections, sepsis, and dehydration.[4] In the critically ill population, sepsis has emerged as a major cause of AKI in the intensive care setting and accounts for a significant number of cases in the intensive care unit. It has been observed that sepsis-induced AKI is associated with increased mortality and prolonged hospital stay because of the complex pathophysiology involved.[5]

The mechanisms in the pathogenesis of AKI include ischemia-reperfusion injury, oxidative stress, inflammatory cytokine response, and endothelial dysfunction. All these mechanisms culminate in tubular damage, decreased glomerular filtration rate, and decreased perfusion through the kidneys.[6] While some patients can make a complete recovery from AKI, others can develop CKD or suffer from complications in the long term. Longitudinal studies have shown that long-term survivors of AKI remain at a higher risk for developing CKD, CVD, and death, making prevention strategies crucial in AKI management.[7]

Some studies conducted in hospital settings have assessed the clinical characteristics and etiologic distribution of AKI in various populations. These studies have shown that the etiologic distribution of AKI varies with geographical distribution, population characteristics, and healthcare facilities. In the developing world, infectious diseases like gastroenteritis, urinary tract infections, and septicemia are common causes of AKI, whereas in the developed world, surgical diseases, drug toxicity, and cardiovascular diseases are more common causes of AKI.[8] In a review of the patterns of renal impairment, it has been shown that community-acquired cases of AKI are often associated with dehydration, infectious diseases, and toxin exposures, whereas hospital-acquired cases of AKI are often associated with sepsis, hypotension, and multi-organ failure syndromes.[1]

The burden of kidney diseases in India is on the rise due to rapid urbanization, increasing lifespan, and a rise in non-communicable diseases like diabetes mellitus and hypertension. National statistics indicate that a considerable proportion of the adult population in India suffers from decreased kidney function, which is a major public health challenge in India.[9] In tertiary care facilities, AKI is a critical cause for hospitalization and a major contributor to medical patient morbidity and mortality. Research in tertiary care facilities has revealed that infections, cardiovascular diseases, and drug-induced nephrotoxicity are some of the major causes for AKI in hospitalized patients.[10]

Cardiovascular diseases have an important association with renal dysfunction through intricate pathophysiological mechanisms that have been termed the cardiorenal syndrome. Cardiogenic shock and heart failure can cause renal hypoperfusion and acute renal failure.[11] In the same way, chronic liver diseases and cirrhosis can cause renal dysfunction through hemodynamic changes, systemic inflammation, and the appearance of hepatorenal syndrome.[12] These associations indicate the complex pathophysiological mechanisms underlying renal dysfunction and the necessity to conduct an extensive clinical assessment in such patients.

Chronic kidney disease is a progressive and irreversible deterioration in kidney function over months and years. CKD has been linked to cardiovascular disease, hospitalization, and premature death.[13] The combination of CKD and other chronic health problems such as heart failure has been shown to result in poor outcomes for the patient.[14] CKD is a significant health problem in Asia because of the rapid epidemiological changes and lack of access to preventive healthcare services.[15]

The spectrum of CKD aetiologies differs significantly from region to region. In developing countries, diabetes mellitus and hypertension are the main causes of CKD, followed by chronic glomerulonephritis, obstructive uropathy, and genetic diseases.[16] Furthermore, studies conducted on younger populations indicate that CKD can be caused by congenital abnormalities, autoimmune diseases, and chronic infections, highlighting the diversity in CKD aetiologies.[17]

In clinical studies conducted to identify the demographic and clinical features of CKD patients, it has been observed that CKD is often found in association with multiple comorbidities, such as diabetes, hypertension, and cardiovascular

diseases.[18] In addition, several factors, such as poor glycemic control, hypertension, recurrent infections, and nephrotoxic drug use, have also been found to influence CKD progression significantly.[19]

In addition to the above-listed chronic health problems, severe infections in the kidney can result in serious health complications. To illustrate this point, emphysematous pyelonephritis is a severe necrotizing infection of the renal parenchyma that predominantly affects diabetic patients and can result in acute renal failure if not treated in time.[20]

However, there is limited information available on the clinical profile and etiologic patterns of renal dysfunction in many parts of India. Hospital-based studies are particularly important in identifying the common risk factors and demographic characteristics and disease patterns in patients who present with renal dysfunction. This would be extremely useful in the prevention and management strategies for patients with renal dysfunction.

Therefore, the present study has been conducted with the aim of evaluating the clinical profile and etiological spectrum of renal dysfunction among patients admitted to a tertiary care facility. Through the analysis of demographic characteristics, co-morbid conditions, and etiological factors of renal dysfunction, the present study aims to make a significant contribution to the understanding of the epidemiology of renal dysfunction in the population under study.

OBJECTIVES

Primary Objective

To study the clinical profile and etiology of renal dysfunction in patients admitted to a tertiary care hospital.

Secondary Objectives

- To categorize patients based on the type of renal dysfunction.
- To evaluate the association between comorbidities and renal dysfunction.

MATERIALS AND METHODS

Study Design

This study was a hospital-based cross-sectional observational study conducted in the Department of General Medicine at Dr. B.R. Ambedkar Medical College and Hospital, Bengaluru.

Study Period

The study was conducted over a period of twelve months from August 2024 to August 2025.

Study Population

All eligible patients admitted to the Department of General Medicine with evidence of renal dysfunction during the study period were included.

Sample Size

A total of 100 patients were included in the study

Inclusion Criteria

- Patients aged between 18 and 80 years
- Patients diagnosed with acute kidney injury
- Patients diagnosed with chronic kidney disease
- Patients with hypertension or type 2 diabetes mellitus
- Patients receiving hemodialysis

Exclusion Criteria

- Patients aged below 18 years or above 80 years
- Pregnant patients

Data Collection

Detailed demographic and clinical data were obtained from patients using a structured proforma. Information collected included:

- Age and gender
- Medical history including hypertension and diabetes mellitus
- Previous renal disease
- Medication history
- Clinical examination findings
- Laboratory investigations

Relevant laboratory investigations included complete blood count, renal function tests, serum electrolytes, liver function tests, urine routine examination, ultrasound abdomen, and other investigations as clinically indicated

Classification of Renal Dysfunction
Patients were classified into the following categories:
• Acute Kidney Injury (AKI)
• Acute on Chronic Kidney Disease (AoCKD)
• Chronic Kidney Disease (CKD)

Statistical Analysis
Data were analyzed using descriptive statistical methods. Continuous variables were expressed as mean ± standard deviation, while categorical variables were presented as frequencies and percentages. Associations between variables were evaluated using chi-square tests and odds ratios. Statistical significance was considered at $p < 0.05$.

RESULTS

Baseline Characteristics
A total of 100 patients were included in the study. The mean age of the patients was 54.9 ± 12 years, with a median age of 55.5 years. Females constituted 54% of the study population while males accounted for 46%

Hypertension was present in 47% of patients, while type 2 diabetes mellitus was present in 59%. Both hypertension and diabetes were present in 27% of patients

Table; 1 Baseline Characteristics

	Value
Total patients	100
Age, mean ± SD (years)	54.9 ± 12.0
Age, median (IQR) (years)	55.5 (44.8-65.0)
Male	46 (46.0%)
Female	54 (54.0%)
Hypertension	47 (47.0%)
Type 2 diabetes mellitus	59 (59.0%)
Both HTN and T2DM	27 (27.0%)

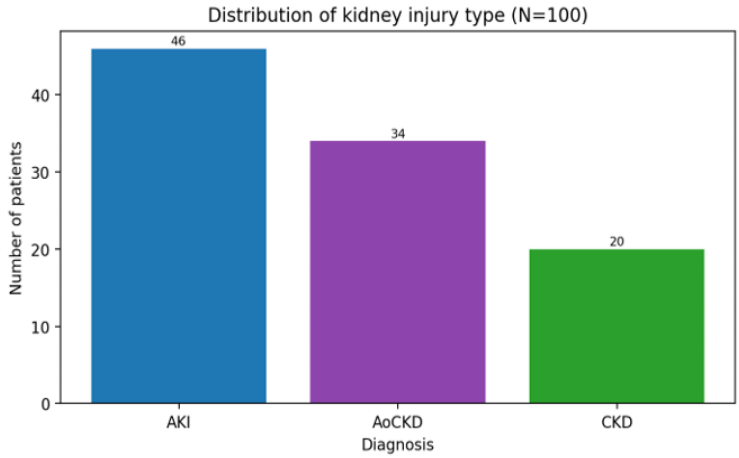

Figure 1: Distribution of kidney injury types (bar chart). Color coding: AKI (blue), AoCKD (purple), CKD (green).

Distribution of Renal Dysfunction among the study population:
AKI – 46%
AoCKD – 34%
CKD – 20%

AKI was the most common type of renal dysfunction observed in the study population.

Age Stratification
Renal dysfunction was analyzed across three age groups.

Table 2. Kidney injury type by age group (row %)

	AKI	AoCKD	CKD
<40	7 (38.9%)	6 (33.3%)	5 (27.8%)
40-59	21 (48.8%)	14 (32.6%)	8 (18.6%)
≥60	18 (46.2%)	14 (35.9%)	7 (17.9%)

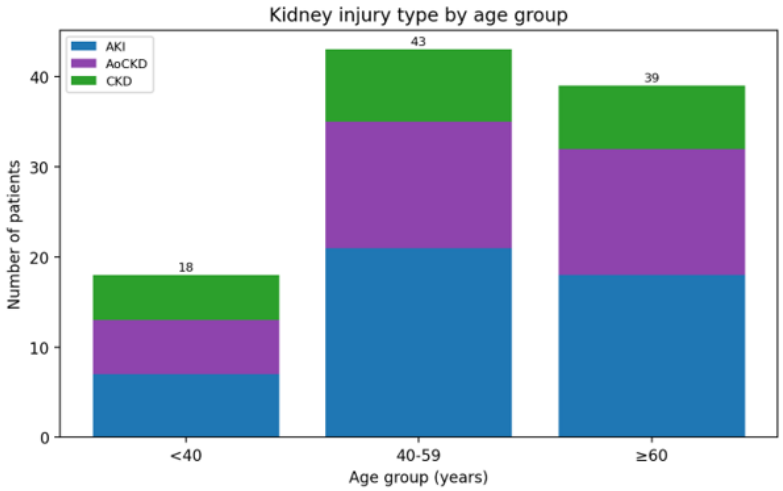

Figure 2: Stacked bar chart of kidney injury types across age groups.

The majority of patients were between 40–59 years of age.

Sex Distribution

AKI was slightly more common among females (48.1%) compared with males (43.5%). AoCKD was observed in 33.3% of females and 34.8% of males. CKD distribution was similar in both sexes

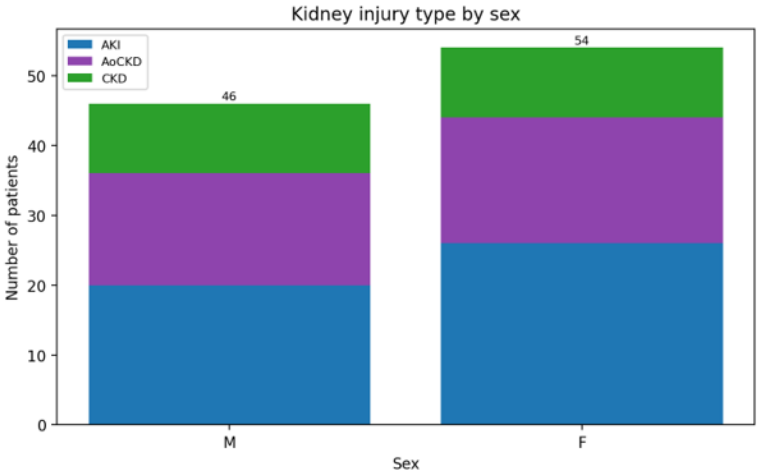

Figure 3: Stacked bar chart of kidney injury types by sex.

Etiology of Acute Kidney Injury

The most common cause of AKI was acute gastroenteritis (34.8%). Other causes included:
Sepsis – 19.6%
Lower respiratory tract infection – 15.2%
Urinary tract infection – 15.2%
Hepatorenal syndrome – 8.7%
Cardiorenal syndrome – 6.5%

Table 3 – AKI Etiology

	Count	Percent
Acute Gastroenteritis	16.0	34.8

Sepsis	9.0	19.6
Lower Respiratory Tract Infection	7.0	15.2
Urinary Tract Infection	7.0	15.2
Hepatorenal Syndrome	4.0	8.7
Cardiorenal Syndrome	3.0	6.5

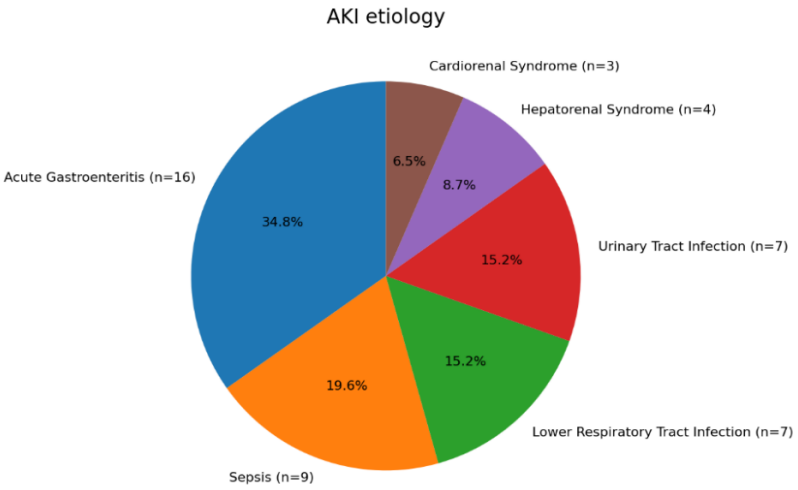

Figure 4 – AKI Etiology in form of a pie chart.

Etiology of Acute on Chronic Kidney Disease

In patients with AoCKD, the most common precipitating factor was infection.

UTI in CKD – 35.3%

Sepsis in CKD – 26.5%

LRTI in CKD – 20.6%

Volume overload – 11.8%

Drug nephrotoxicity – 5.9%

Table 4 – Acute on Chronic Kidney Disease Etiology.

	Count	Percent
UTI in CKD	12.0	35.3
Sepsis in CKD	9.0	26.5
LRTI in CKD	7.0	20.6
Volume Overload in CKD	4.0	11.8
Drug Nephrotoxicity in CKD	2.0	5.9

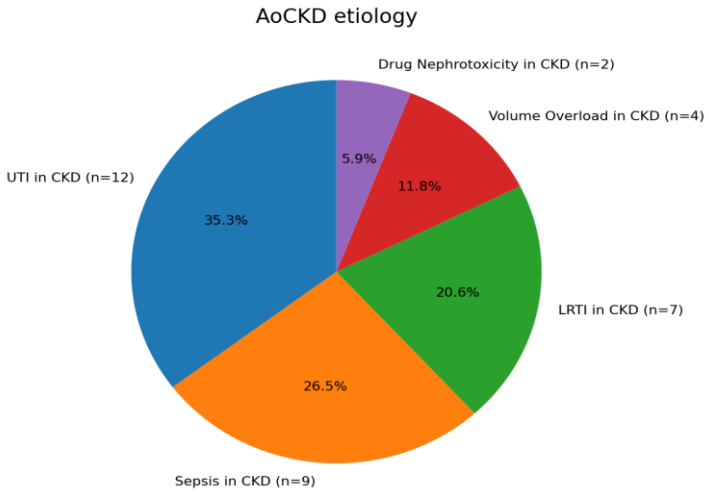

Figure 5 – Acute on Chronic Kidney Disease Etiology in form of a pie chart.

Etiology of Chronic Kidney Disease

Diabetic kidney disease was the leading cause of CKD (60%). Other causes included:
Hypertensive nephrosclerosis – 15%
NSAID nephropathy – 10%
Autosomal dominant polycystic kidney disease – 5%
Chronic glomerulonephritis – 5%
Autosomal recessive polycystic kidney disease – 5%

Table 5 – CKD Etiology

	Count	Percent
Diabetic Kidney Disease	12.0	60.0
Hypertensive Nephrosclerosis	3.0	15.0
NSAID Nephropathy	2.0	10.0
ADPKD	1.0	5.0
Chronic Glomerulonephritis	1.0	5.0
ARPKD	1.0	5.0

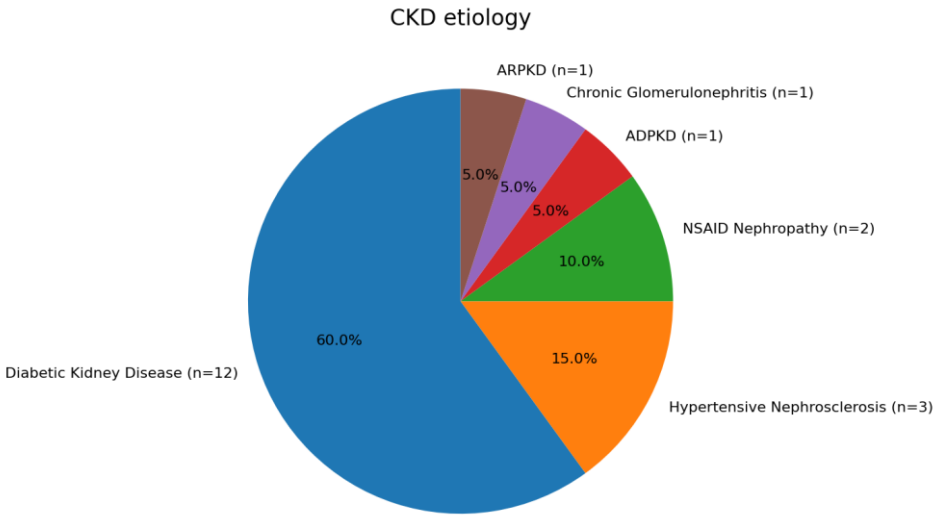

Figure 6 – Pie Chart of Etiology of CKD

Association with Comorbidities

Patients with diabetes had a higher proportion of AoCKD and CKD compared with non-diabetic patients. However, statistical analysis did not show significant association between comorbidities and renal dysfunction type ($p > 0.05$)

Table 6 – Acute on Chronic Kidney Disease Comorbidities

	Count	Percent
Hypertension (Yes)	19.0	55.9
Type 2 DM (Yes)	23.0	67.6
Both HTN+T2DM	12.0	35.3

Table 7 – CKD Comorbidity Profile

	Count	Percent
Hypertension (Yes)	8.0	40.0
Type 2 DM (Yes)	13.0	65.0
Both HTN+T2DM	4.0	20.0

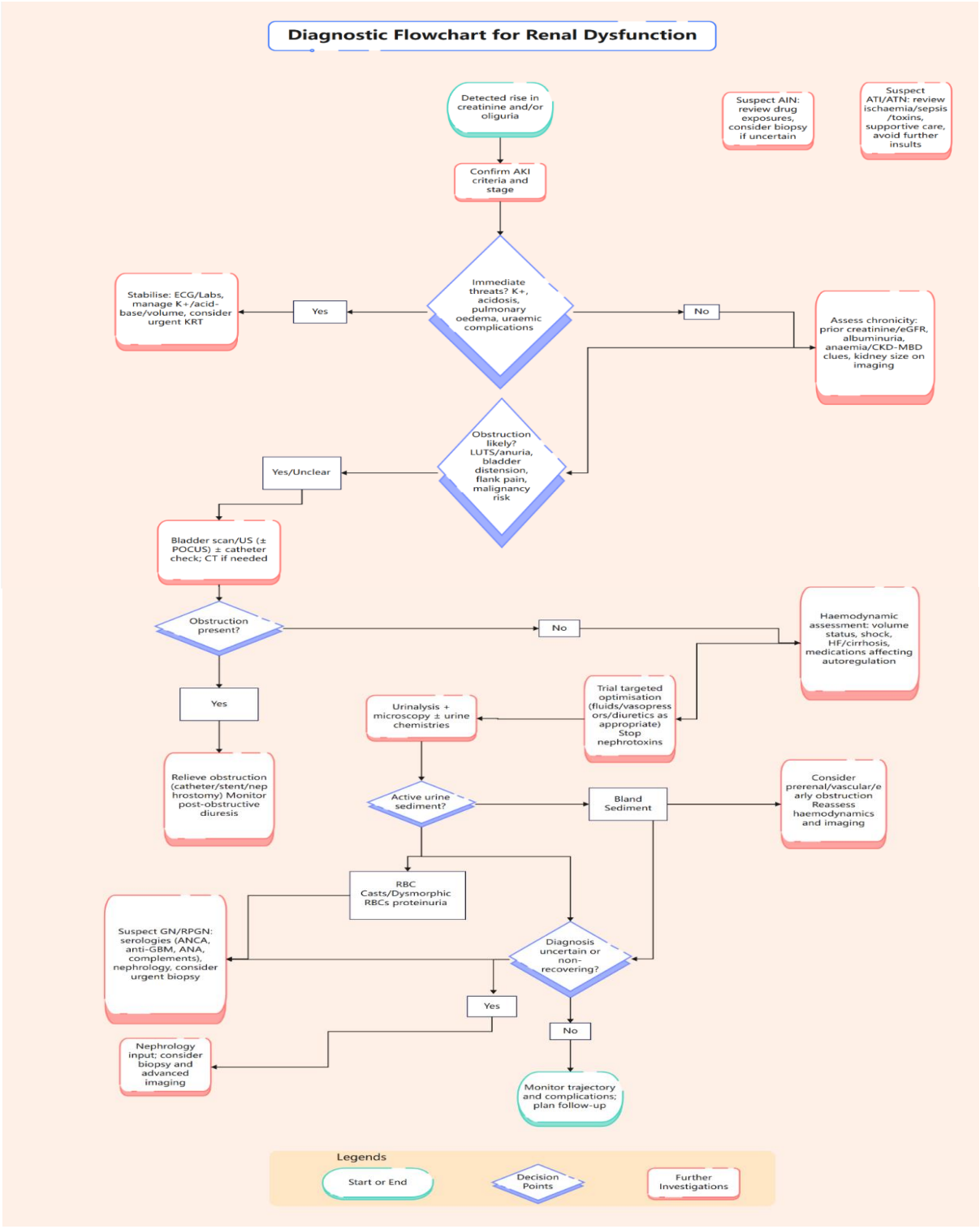

Figure – 7 – Diagnostic Algorithm for Evaluation of Renal Dysfunction in Hospitalized Patients. Adapted from KDIGO AKI guidelines and standard nephrology diagnostic approaches.

DISCUSSION

The objective of the present study was to assess the clinical profile and etiological spectrum of renal dysfunction among the patients admitted to the hospital. Renal dysfunction is a significant health challenge worldwide and encompasses the spectrum from acute kidney injury to chronic kidney disease. These disorders cause significant morbidity and mortality and have significant implications on public health.[1-3] The study offers valuable insights into the epidemiology of renal dysfunction among the hospital population from the Indian subcontinent and the need to determine the underlying etiology and co-existing conditions.

Overall Burden and Clinical Profile of Renal Dysfunction
In the present study, a total of 100 patients suffering from renal dysfunction were included in the study. The average age group of the population was found to be 54.9 ± 12.0 years. A slight female predominance was noted in the present study population, with 54% females and 46% males (Table 1).

The results are in concurrence with previous studies stating that the prevalence of renal dysfunction is more in the middle and elderly ages due to the natural decline in kidney function and the presence of metabolic syndrome.[1,2]

The prevalence of kidney diseases has been found to be increasing worldwide, especially in developing countries such as India. The prevalence of diabetes mellitus and hypertension has been found to be increasing in India. A survey has stated that impaired kidney function has been found in a considerable number of the adult population in India. This has been attributed to the increase in non-communicable diseases.[9] A similar increase in the prevalence of kidney disorders has also been noted in the Asian population. Rapidly increasing rates of urbanization and lifestyle changes in the Asian population have resulted in an increase in the incidence of kidney disorders.[15]

Distribution of AKI, AoCKD, and CKD
In the present cohort, acute kidney injury accounted for 46% of cases, while acute on chronic kidney disease (AoCKD) represented 34%, and chronic kidney disease accounted for 20% of patients (Figure 1).

These findings highlight the predominance of acute renal presentations in hospitalized patients.

According to the Kidney Disease Improving Global Outcomes (KDIGO) classification, AKI is described as an abrupt reduction in kidney function within hours to days and is identified based on changes in creatinine and urine output.[2,3] The high prevalence of AKI in the present study is in accordance with epidemiological studies that documented the incidence of AKI in hospitalized medical patients, which varies from 20% to 50%.[4]

The clinical implications of the presence of acute on chronic kidney disease in the present study are significant because AoCKD is a clinical scenario in which there is a population at risk due to the presence of pre-existing renal dysfunction, and acute insults occur in these patients, leading to poor clinical outcomes.[7] The significant number of patients with AoCKD in the present study highlights the importance of the management and treatment of CKD to prevent the development of AoCKD.

Age Distribution of Renal Dysfunction
In addition, it was observed that renal dysfunction occurred in all the age groups, with the highest incidence in the 40-59 years and ≥60 years groups (Table 2; Figure 2). In the 40-59 years and ≥60 years groups, AKI continued to be the most common cause of renal dysfunction, with 48.8% and 46.2% of cases, respectively.

As observed in previous studies, the present study suggests that with increasing age, the risk of renal dysfunction increases due to various structural and functional changes in the kidney, including a reduction in the number of nephrons, renal blood flow, and impaired autoregulation in the kidney.[18] In addition, with increasing age, the risk of associated diseases such as hypertension, diabetes, and cardiovascular disease is higher, which can cause renal dysfunction.

Sex Distribution
Sex-based analysis revealed that the incidence of AKI was slightly higher in females compared with males, with values of 48.1% and 43.5%, respectively, while the incidence of AoCKD and CKD remained relatively similar in both sexes (Figure 3).

Epidemiological studies have reported that renal diseases are more common in males compared with females; however, some regional studies have reported that the prevalence of renal diseases is similar or even higher in females depending on the population and the region's access to health facilities.[8]

These observations indicate that the sex of the patients may not be an important factor in the patterns of renal injuries.

Etiological Spectrum of Acute Kidney Injury
Among patients with AKI, acute gastroenteritis was the most common cause, accounting for 34.8% of cases, followed by sepsis (19.6%), lower respiratory tract infection (15.2%), and urinary tract infection (15.2%) (Table 3; Figure 4).

These results are in accordance with previous studies carried out in developing countries, in which infectious diseases and dehydration were found to be significant causes of acute renal failure.[4,8] In tropical countries such as India, acute

gastroenteritis is common and can cause severe dehydration, which can cause prerenal failure and subsequently renal tubular damage.

Another cause of acute renal failure is sepsis-induced acute renal failure, which is significant in the critically ill population.[5] The pathophysiology of sepsis-induced acute renal failure is not fully understood, but it is thought that systemic inflammation and microvascular damage occur.

Other causes identified in the present study were hepatorenal syndrome and cardiorenal syndrome, which account for 8.7% and 6.5%, respectively.[11,12]

Etiology of Acute-on-Chronic Kidney Disease

In the AoCKD subgroup, the most common precipitating factor was urinary tract infection in CKD patients (35.3%), followed by sepsis (26.5%), lower respiratory tract infection (20.6%), and volume overload (11.8%) (Table 4; Figure 5).

These results underscore the susceptibility of CKD patients to acute infections and hemodynamic stressors. CKD patients are known to be at increased risk of acute decompensation because they tend to have compromised immune responses and decreased reserve capacity.[7]

Drug-induced nephrotoxicity was less common (5.9%) but is noteworthy because many patients are exposed to nephrotoxic agents such as NSAIDs, aminoglycosides, and iodinated contrast media during hospitalization.

Etiology of Chronic Kidney Disease

Among the CKD patients, the most common cause was diabetic kidney disease, which contributed to 60% of the cases, followed by hypertensive nephrosclerosis, NSAID nephropathy, and hereditary disorders such as ADPKD and ARPKD (Table 5; Figure 6). These findings correlate with the global and regional epidemiology, which states that the most common cause of CKD is diabetes and hypertension.

It has also been observed that diabetic kidney disease is the most common cause of end-stage renal failure in the Indian subcontinent due to the increased prevalence of diabetes.[16]

Hereditary disorders such as polycystic kidney diseases were found to be less common among the CKD patients, which is an important cause of CKD in younger age groups.[17]

Chronic glomerulonephritis was found to be less common among the CKD patients, as the incidence of this cause is decreasing in many parts of the world due to the reduced incidence of infections.

Role of Comorbidities: Hypertension and Type 2 Diabetes Mellitus

Comorbid conditions have an essential role in the pathogenesis and progression of renal dysfunction. In the present study, hypertension was observed in 47% of the patients, and type 2 diabetes mellitus was observed in 59% of the patients (Table 6 and Table 7). In addition, 27% of the patients were found to be suffering from both hypertension and diabetes.

Diabetes Mellitus

Diabetes Mellitus is known to be the main cause of chronic renal dysfunction worldwide.[13] Hyperglycemia is known to cause hyperfiltration and fibrosis in the renal cortex, leading to Diabetic Nephropathy.[16] In the present study, it was observed that diabetes was particularly prevalent in AoCKD (67.6%) and CKD patients (65%).

Hypertension

Hypertension is another significant cause of renal dysfunction. Chronic hypertension is known to cause damage to the renal vasculature, leading to nephrosclerosis and renal failure.[16] In the present study, hypertension was observed in 55.9% of the patients with AoCKD, indicating the association between renal dysfunction and hypertension.

Comparison with Other Regional Studies

The patterns of disease distribution observed in this study are in line with previous studies carried out in Asia as well as other developing nations of the world. Epidemiological studies carried out in Southeast Asia reported a similar pattern of disease distribution, with infections and metabolic diseases being important aetiological agents of renal dysfunction.[4,15]

Hospital-based studies have demonstrated the common aetiology of AKI, which includes preventable causes such as dehydration, infections, and drug toxicity, highlighting the need to diagnose acute medical conditions early enough to avert permanent kidney damage.[10]

Clinical Implications
The findings of this study also have some clinical implications. Firstly, the high prevalence rate of AKI in this study emphasizes the need to develop better ways to monitor and manage AKI in hospitalized patients, and this can be achieved by implementing KDIGO guidelines for AKI monitoring.

Secondly, the association between renal dysfunction and metabolic disorders emphasizes the need to develop better preventive measures to control diabetes and hypertension.

Thirdly, the findings that infections are the most common cause of renal injury in this study emphasize the need to develop better infection control practices to reduce the burden of renal dysfunction in the patient population.

Limitations
However, this study has several limitations. First and foremost, the small sample size and the fact that this was a single-center study may limit the generalizability of the results. Moreover, the cross-sectional nature of the analysis does not allow us to assess the long-term outcomes such as the return of kidney function and the development of end-stage kidney disease.

Future Directions
More studies are needed in the future, including larger numbers of participants, to better understand the epidemiology of renal dysfunction in India. Longitudinal studies are needed to better understand the outcome of dialysis, mortality, and improvement of kidney function in the context of this disease.

Conclusion of Discussion
In conclusion, the present study has shown that renal dysfunction is a significant clinical problem among hospitalized patients, with acute kidney injury being the most common cause of renal dysfunction in the study population. Infections, dehydration, and metabolic disorders were the main aetiological factors for renal dysfunction in the study population.

CONCLUSION
Renal dysfunction is a clinical problem of great concern in hospitalized patients. In the study, acute kidney injury was found to be the most common cause of renal dysfunction, followed by acute on chronic kidney disease, and then chronic kidney disease. Infections, particularly gastrointestinal and urinary tract infections, are important causes of acute kidney injury. Diabetes mellitus was found to be the most common cause of chronic kidney disease.

The risk factors of renal dysfunction, such as diabetes mellitus, hypertension, infections, etc., need to be addressed at an early stage to reduce the burden of renal dysfunction. The newer strategies in the screening and prevention of this condition might help in the delay of progression of chronic kidney disease to end-stage renal disease.

More multicentric studies with a large sample size are required to know more about the epidemiology of this condition and its clinical course in Indian patients.

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