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Role of Baseline Creatinine in Diagnosing Aki in Costal Rural India & It S Significance in Defining the Outcome

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ABSTRACT

Aim: The aim of the present study was to evaluate the role of baseline creatinine in diagnosing AKI in costal rural India & it's significance in defining the outcome.

Methods: This research adopted a prospective observational study design. The target sample size was 65 patients, accounting for a 10% non-response rate. Initially, 59 patients were to be included, with an additional 6 patients to cover any dropouts or nonrespondents, thus ensuring a robust sample size of 65. The study spanned a period of 18 months, allowing for comprehensive data collection and follow-up.

Results: In our analysis, 52.3% of the cases had pre-renal causes. Renal or intrinsic causes were responsible for 43.1% of AKI cases. Post-renal obstruction accounted for 4.6% of the cases in our study. In our investigation, the results of AKI differed greatly, with 43.1% of patients achieving full recovery, 33.8% experiencing partial recovery, and 23.1% unfortunately succumbing to the condition. Common symptoms among AKI patients in this study included edema (41.5%), oliguria (24.6%), and hypotension (23.1%). Symptoms such as oliguria and hypotension were significantly associated with higher mortality ($P < 0.001$). Elevated total leukocyte count (TLC) and the levels of serum creatinine were associated with greater mortality in our study which was statically significant ($P<0.01$), emphasizing the importance of these parameters in assessing the severity and prognosis of AKI.

Conclusion: In conclusion, this study shows that ambiguous definitions for baseline can have major consequences on the AKI diagnosis in patients. Incorrect definition of baseline may result in misdiagnosis of AKI patients with suboptimal decisions for treatment and medication as result. Clinicians, as well as researchers and developers of automatic diagnostic tools such as clinical decision support systems should take these considerations into account when aiming to diagnose AKI in clinical and research settings.

Keywords: *AKI registry; Community-acquired AKI; Socioeconomic status; Sepsis-associated AKI*

1. INTRODUCTION

AKI is associated with increased morbidity, mortality, and subsequent development or progression of chronic kidney disease.[1-3] According to the Kidney Disease Improving Global Outcomes (KDIGO) criteria[4], AKI is defined by one of the following: an increase in creatinine to at least 1.5 times baseline creatinine that is presumed to have occurred within 7 days, an increase in creatinine by 26.5 µmol/L within 48 hours, or urine volume <0.5 ml/kg per hour for 6 hours. Thus, baseline creatinine should reflect the expected kidney function of the last 7 days if creatinine is not measured in this period. Although baseline creatinine has an important effect on the subsequent detection of AKI, baseline creatinine remains inconsistently defined and is often unavailable in studies of AKI.[5-7] Correct estimation of baseline creatinine might be important to identify community-acquired AKI because patients are admitted with elevated creatinine.

The presumption that a 1.5-fold increase happens within 7 days is often an issue because many people do not have a measured creatinine within the latest 7 days. Defining the baseline creatinine then becomes a matter of using the creatinine measurements that are available. Some studies use the first or the lowest creatinine measurement during the hospital admission as baseline or estimate baseline creatinine, assuming eGFR to be 75 ml/min per 1.73 m2 (6,8–10). Other studies use preadmission outpatient creatinine to estimate baseline creatinine, but disagreement among these studies also exists.[7,10-14] This inconsistent use of baseline creatinine definitions hampers comparability in observational AKI studies.[7,10,12–15]

Growing use of electronic health records (EHR) and machine learning have provided a possibility to study large collections of real-world data and develop early detection systems for AKI.[16] Indeed, clinical decision support systems (CDS) have emerged as tools for initial assessment and identification of AKI patients in different settings.[17] These CDS make recommendations and risk stratifications based on the existing guidelines and best practices for AKI.[18] Understanding the specific definitions of the guidelines and their implications on AKI diagnosis is thus of utmost importance in both patient care and research. In brief, the diagnostic criteria for AKI are based on a change between a current SCr and a previous SCr measurement known as 'baseline' in the preceding days or period. As kidney function of hospitalized patients is routinely monitored, SCr measurements during admission are often available to compare with the baseline value, usually defined as the first measurement during admission or at ED presentation. However, patients who visit the ED may lack SCr measurements from the pre-admission period, making the criteria less suitable for this setting. As a consequence, several studies have proposed multiple ways to define baseline using different values and time windows.[19]

The aim of the present study was to evaluate the role of baseline creatinine in diagnosing AKI in costal rural India & it's significance in defining the outcome.

2. MATERIALS AND METHODS

This research adopted a prospective observational study design. The target sample size was 65 patients, accounting for a 10% non-response rate. Initially, 59 patients were to be included, with an additional 6 patients to cover any dropouts or nonrespondents, thus ensuring a robust sample size of 65. The study spanned a period of 18 months, allowing for comprehensive data collection and follow-up. An analysis was conducted on their biochemical and clinical data. We monitored the patients till their release or passing.

The study's source of data comprised inpatients at VMMCH Karaikal who were deemed eligible for inclusion and were taken consecutively until the required sample size was obtained. The investigation was conducted in the inpatient departments of Vinayaka Mission's Medical College and Hospital, which is an institution for tertiary care providing a wide range of medical services.

Inclusion and Exclusion Criteria

Patients older than eighteen years old who showed clinical and/or biochemical signs of AKI met the study's inclusion criteria. Based on certain criteria, patients with preexisting renal disease were excluded, as their condition could confound the study results, and those with obstetric AKI, as the etiology and management in these cases differ significantly from the general population.

3. METHODOLOGY

After obtaining ethical approval from the relevant committee, before any patient could be included in the trial, their informed written consent was requested. This ensured ethical compliance and patient autonomy. Patient selection was conducted by applying the specified inclusion and exclusion criteria rigorously.

Data collection focused on several key areas:

1. Demographic Data: Age, sex, and other relevant demographics were recorded.

2. Medical History:

o Detailed medical history, including comorbid conditions, medication use, and previous episodes of AKI, was documented.

3. Presenting Symptoms:

o Symptoms at the time of admission, such as oliguria, anuria, dysuria, oedema, puffy face, fever haematuria, loose stools, jaundice, dyspnoea, nausea, trauma, rashes and fatigue, were recorded.

4. Clinical and Biochemical Parameters:

Clinical examination findings and biochemical tests, including blood routine, serum urine, creatinine, electrolytes, and BUN routine, urine sodium, FENa were done to confirm AKI. The patients were monitored until their release or passing.

5. Etiology of AKI:

o The causes of AKI were documented based on clinical findings, laboratory results, and imaging studies. The etiology was categorized

1) Prerenal (e.g., dehydration, heart failure), o 2) Renal (e.g., acute tubular necrosis, glomerulonephritis), o 3) Postrenal

causes (e.g., urinary obstruction).

Outcome Assessment

Patients were monitored during their hospital stay to assess various outcomes:

1. Need for Dialysis:

The requirement for dialysis, type of dialysis (haemodialysis or peritoneal dialysis), and frequency were recorded.

2. Recovery of Kidney Function:

Improvement in renal function was tracked using serial measurements of urine production, BUN, and serum creatinine.

3. Mortality:

In-hospital mortality and its association with the etiology of AKI were documented

Statistical Analysis

The gathered information was converted into variables, coded, and then input into Microsoft Excel. SPSS-PC-25 version was used to analyse and statistically evaluate the data. The Shapiro-Wilk normality test was used to determine whether various parameters had a normal distribution. The quantitative data was presented as mean±standard deviation, and the Kruskal Wallis H test or ANNOVA test were used to examine the mean differences across many groups. The chi square test was used to examine the difference between proportions for qualitative data that were expressed as frequency and percentage. A P-value of less than 0.05 was deemed statistically noteworthy. By following this detailed and systematic approach, the study aimed to contribute valuable knowledge to the understanding of AKI, its causes, and its effects on patient outcomes, thereby informing better clinical practices and patient care strategies at VMMCH.

Reporting

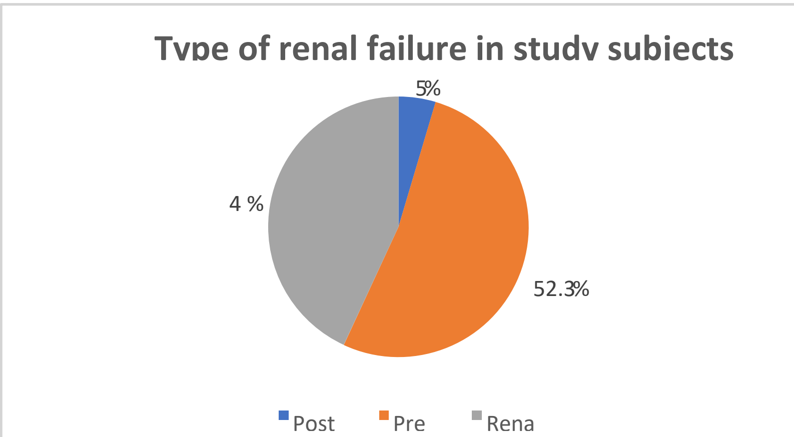
A detailed report of the study findings was prepared, including statistical analyses, tables, and figures to summarize the data. The report discussed the implications of the findings, compared them with existing literature, and suggested potential areas for further research. By adhering to this methodology, the study aimed to provide a comprehensive assessment of the prevalence, causes and consequences of AKI in patients who are hospitalized at Vinayaka Mission's Medical College & Hospital.

4. RESULTS

Table 1: Renal failure type in research participants

Type of renal failure	No.	%
Pre renal	34	52.3
Renal	28	43.1
Post Renal	3	4.6

Graph 1: Renal failure type in research participants

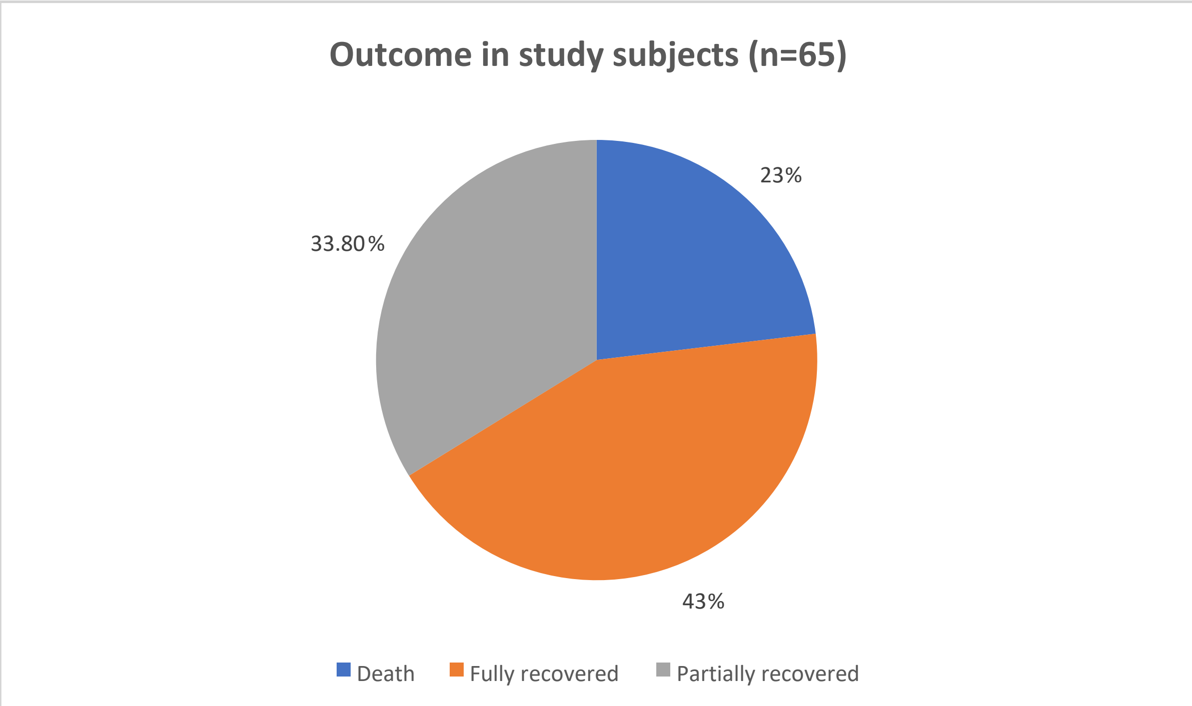


In our analysis, 52.3% of the cases had pre-renal causes. Renal or intrinsic causes were responsible for 43.1% of AKI cases. Post-renal obstruction accounted for 4.6% of the cases in our study.

Table 2: Outcome in study subjects

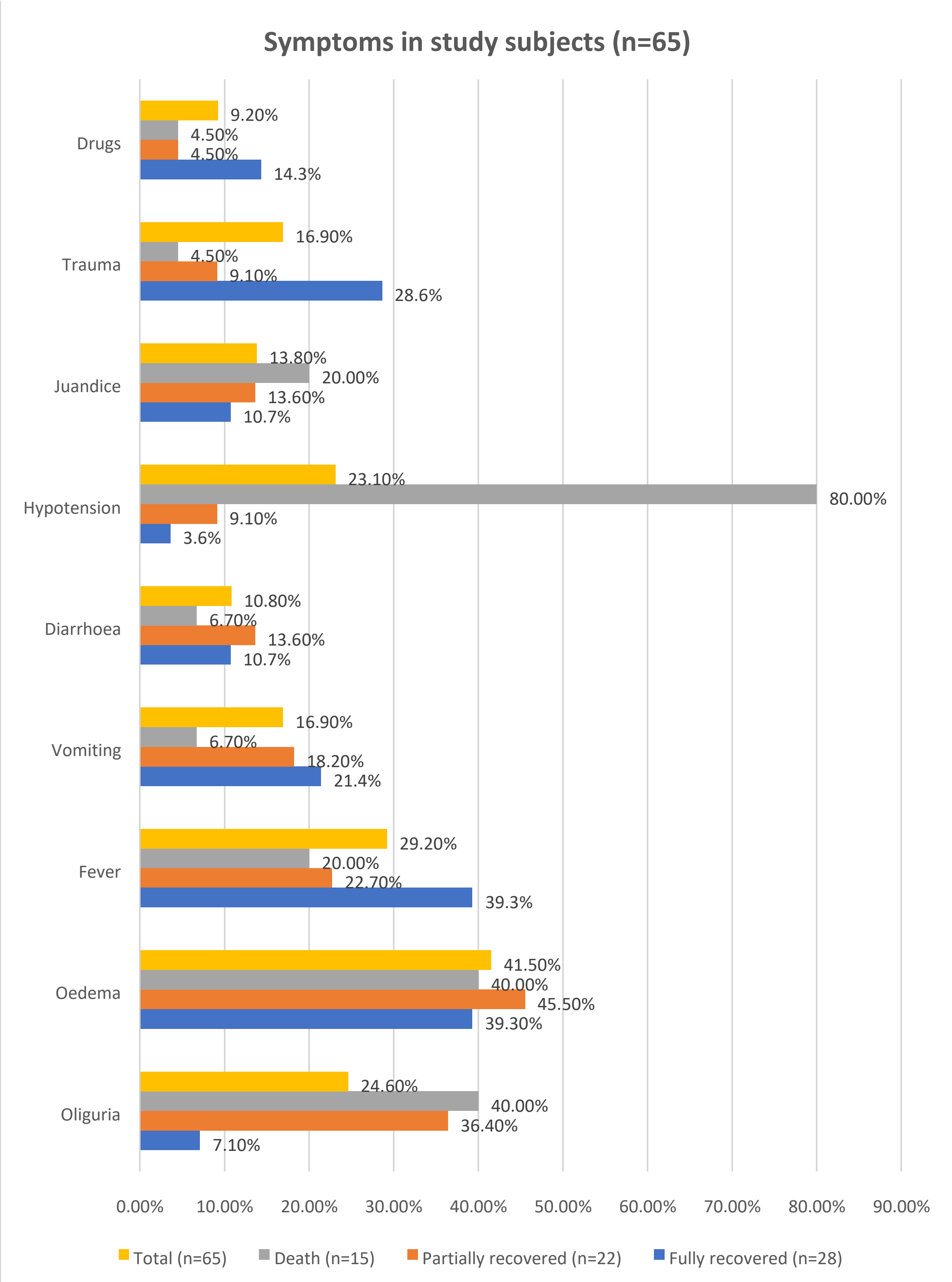
Outcome	No.	%
Fully recovered	28	43.1
Partially recovered	22	33.8
Death	15	23.1

Graph 2: Outcome in research participants



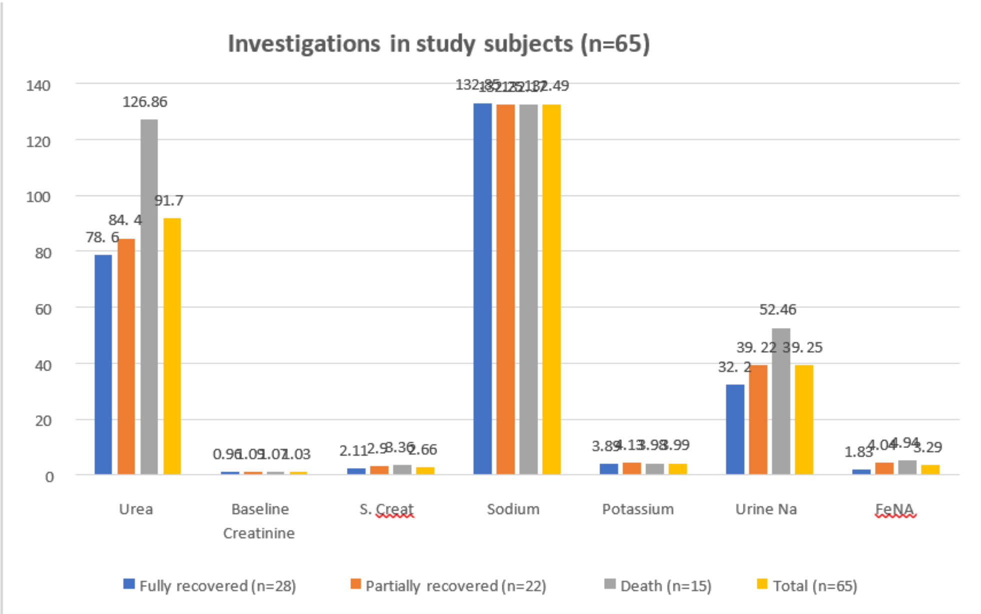
In our investigation, the results of AKI differed greatly, with 43.1% of patients achieving full recovery, 33.8% experiencing partial recovery, and 23.1% unfortunately succumbing to the condition.

Graph 3: Symptoms in study subjects



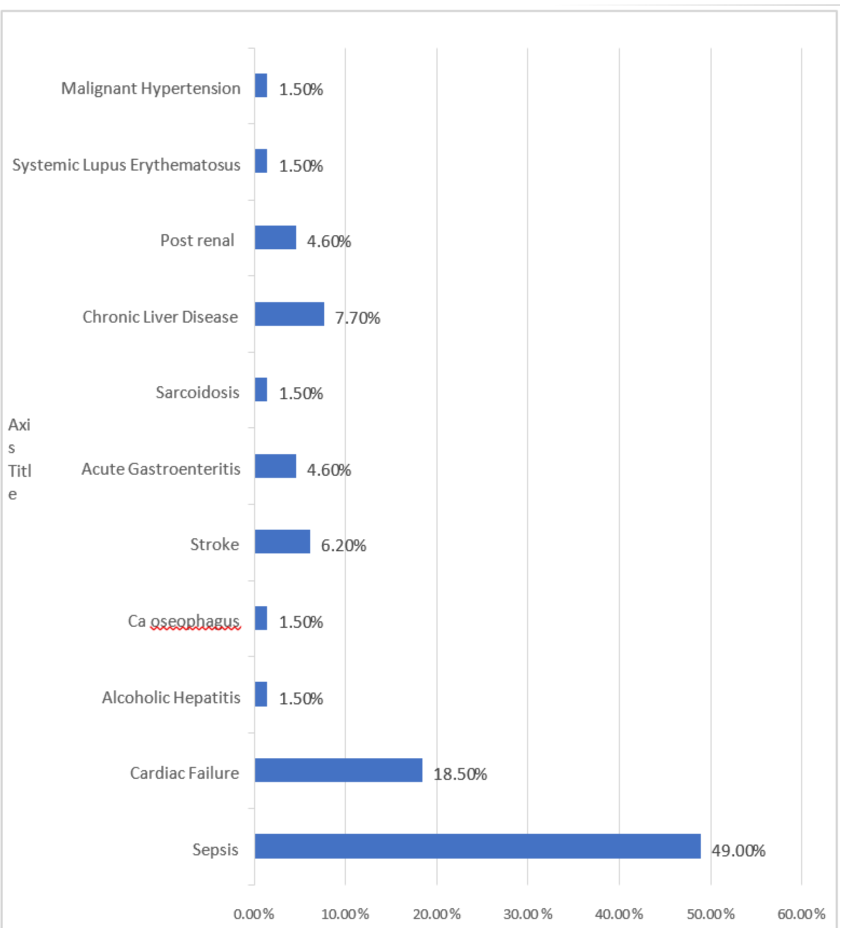
Common symptoms among AKI patients in this study included edema (41.5%), oliguria (24.6%), and hypotension (23.1%). Symptoms such as oliguria and hypotension were significantly associated with higher mortality ($P < 0.001$).

Graph 4: Investigations in study subjects



Elevated total leukocyte count (TLC) and the levels of serum creatinine were associated with greater mortality in our study which was statically significant (P<0.01), emphasizing the importance of these parameters in assessing the severity and prognosis of AKI.

Graph 5: Aetiology in study subjects

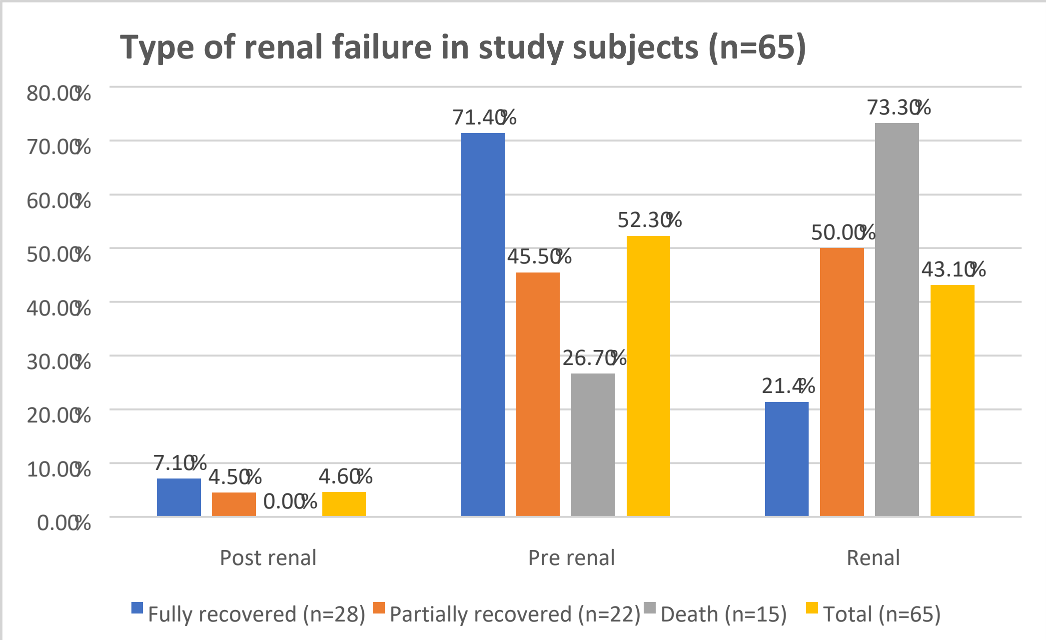


In our analysis, the most frequent diagnosis linked to acute kidney damage (AKI) was sepsis, which explained 49.2% of cases. Heart failure (18.5%) was also a significant contributor to AKI in our study. Chronic liver disease accounted for 7.7%, followed by stroke (6.2%), acute gastroenteritis (4.6%), and post-renal causes (4.6%) in this study.

Table 3: Type of renal failure and outcome in study subjects

Type of renal failure	Fully recovered (n=28)	Partially recovered (n=22)	Death (n=15)	Total (n=65)	P value
Post renal	2(7.1%)	1(4.5%)	0(0.0%)	3(4.6%)	0.02
Pre renal	20(71.4%)	10(45.5%)	4(26.7%)	34(52.3%)	
Renal	6(21.4%)	11(50.0%)	11(73.3%)	28(43.1%)	

Graph 6: Type of renal failure and outcome in study



In our investigation, the results of AKI differed greatly, with 43.1% of patients achieving full recovery, 33.8% experiencing partial recovery, and 23.1% unfortunately succumbing to the condition.

5. DISCUSSION

Acute kidney injury (AKI) is the most common complication in hospitalized patients and is associated with high morbidity and mortality.[20] The incidence of AKI is increasing due to the growing incidence of risk factors, including cardiovascular disease, use of nephrotoxic medication and contrast-containing imaging.[21] As mild increases of serum creatinine (SCr) are associated with adverse outcome, it's important to identify risk factors and to increase awareness of AKI in healthcare systems.[22] However, AKI is often missed, due to lack of awareness and knowledge on early recognition, prevention and management of AKI by physicians from different specialties.[23] Importantly, recent studies indicated that early detection of AKI improves short and long-term outcomes.[24]

Common symptoms among AKI patients in this study included edema (41.5%), oliguria (24.6%), and hypotension (23.1%). Symptoms such as oliguria and hypotension were significantly associated with higher mortality ($P < 0.001$). This finding is supported by studies from Mehta et al[25] (2002) which identified these symptoms as critical indicators of severe AKI. These symptoms suggest that patients presenting with oliguria and hypotension should be closely monitored and managed aggressively to prevent adverse outcomes. The frequency of coexisting diseases such systemic hypertension (40%) and Type 2 Diabetes Mellitus (T2DM) (44.6%) in our cohort is in line with findings from Singbartl and Kellum (2012)[26] which highlighted these conditions considered important AKI risk factors.

Elevated total leukocyte count (TLC) and the levels of serum creatinine were associated with greater mortality in our study which was statically significant (P<0.01), emphasizing the importance of these parameters in assessing the severity and prognosis of AKI. The correlation between high TLC and serum creatinine levels with poor outcomes suggests that these parameters should be routinely monitored in AKI patients to guide treatment decisions. BUN levels were increased in patients with AKI, with higher levels observed in those who did not survive. Urine sodium and fractional excretion of sodium (FeNA) levels were also notably higher in the death group in this study and was statically significant(P<0.05), consistent with the literature that indicates these markers can help differentiate between different types of AKI and predict outcomes. In our analysis, the most frequent diagnosis linked to acute kidney damage (AKI) was sepsis, which explained 49.2% of cases. The primary causes of sepsis identified were urinary tract infections, pneumonia, aspiration pneumonitis, cellulitis, diabetic foot ulcer, and pyelonephritis. This result is consistent with research by Eswaraappa M et al[27] found sepsis to be a major cause of AKI in critically sick patients.

Apart from diagnosing AKI, baseline SCr is also necessary to evaluate the deterioration of renal function in AKI and to follow the extent of recovery after an AKI event. The methods to estimate baseline SCr in literature include admission SCr, lowest value prior to admission, minimum SCr value during hospital admission or a calculation using the MDRD equation in patients without baseline.[28] The definition for baseline SCr is of great importance, since this can significantly affect the assessment of the AKI prevalence and of the associated mortality risk and renal outcomes. Taking the SCr at admission has been shown to be unrepresentative as baseline, since this value could be influenced by the ongoing disease.[29] On the other hand, using the lowest baseline definition may overestimate AKI prevalence, as shown in this study. As a result, several studies have over- or underestimated AKI diagnosis using different baseline definitions in different populations.[30]

6. CONCLUSION

In conclusion, this study shows that ambiguous definitions for baseline can have major consequences on the AKI diagnosis in patients. Incorrect definition of baseline may result in misdiagnosis of AKI patients with suboptimal decisions for treatment and medication as result. Clinicians, as well as researchers and developers of automatic diagnostic tools such as clinical decision support systems should take these considerations into account when aiming to diagnose AKI in clinical and research settings.

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