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"COMPARISON OF CLINICAL OUTCOMES OF ACUTE KIDNEY INJURY PATIENTS UNDERGOING HAEMODIALYSIS AND NOT UNDERGOING HAEMODIALYSIS"

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ABSTRACT

Background: Acute Kidney Injury (AKI) is a critical medical condition characterized by a rapid decline in renal function, often necessitating hospitalization and, in severe cases, renal replacement therapy (RRT) such as haemodialysis. AKI carries significant morbidity and mortality, particularly in low- and middle-income countries where resource constraints may delay appropriate intervention. This study aimed to compare the clinical profile, biochemical parameters, and outcomes of AKI patients undergoing haemodialysis with those managed conservatively.

Methods: A prospective, observational, comparative study was conducted at the Department of General Medicine, Amaltas Institute of Medical Sciences, Bangar, Dewas (M.P), over 18 months. Fifty-two adult patients diagnosed with AKI (per KDIGO 2012 criteria) were enrolled and categorized into two groups: Group A (haemodialysis) and Group B (non-haemodialysis). Clinical features, laboratory findings, and outcomes (recovery, progression to CKD, or in-hospital mortality) were recorded and analyzed using appropriate statistical tests.

Results: Patients in the haemodialysis group had significantly higher serum urea (212.38 ± 18.86 mg/dL), creatinine (12.25 ± 1.12 mg/dL), and potassium levels (5.59 ± 0.52 mmol/L), along with lower hemoglobin (9.80 ± 0.96 g/dL) compared to the non-haemodialysis group ($p < 0.001$ for all). Systemic symptoms such as fever, sepsis, and hypovolemia were also more prevalent. Outcomes were significantly poorer in the dialysis group, with 26.9% mortality and 46.2% progressing to CKD, whereas 76.9% of non-dialysis patients achieved full recovery ($p < 0.001$).

Conclusion: Haemodialysis in AKI is associated with more severe clinical and biochemical profiles and poorer outcomes. Early recognition and risk stratification are essential to optimize management and improve renal recovery.

Keywords: Acute Kidney Injury (AKI), Haemodialysis, Renal Recovery, Chronic Kidney Disease (CKD), In-Hospital Mortality

INTRODUCTION

Acute Kidney Injury (AKI) is characterized by a sudden decline in glomerular filtration rate (GFR), resulting in the accumulation of nitrogenous waste products such as urea and creatinine, along with

other uremic toxins in the bloodstream [1]. The kidneys serve crucial roles in waste excretion, fluid-electrolyte balance, and acid-base homeostasis. Hence, early identification and intervention in AKI are vital to prevent further deterioration in renal function.

Globally, AKI represents a significant cause of hospital admissions, with a high burden of morbidity and mortality [2]. Studies indicate that one in five hospitalized patients may develop AKI [3], with 13.3 million cases reported annually—85% of which occur in low- and middle-income countries [4,5]. In developing nations, infections, obstetric complications, and nephrotoxins—causes nearly eliminated in developed settings—remain prevalent [6].

According to KDIGO guidelines, AKI is diagnosed by a rise in serum creatinine ≥0.3 mg/dL within 48 hours or a 1.5-fold increase from baseline within 7 days [8]. In its severe form, AKI often necessitates renal replacement therapy (RRT), most commonly in the form of haemodialysis, and is associated with in-hospital mortality rates exceeding 40% [8,9]. In India, AKI accounts for nearly 20% of hospital admissions, with about 60% resulting from medical causes such as sepsis, diarrheal illnesses, nephrotoxic drug exposure, and systemic diseases like diabetes, lupus, and hypertension [1,7].

Haemodialysis remains a cornerstone for managing severe AKI. It enables the removal of creatinine, urea, and excess water across a semipermeable membrane, typically administered 2–3 times per week in 2–4 hour sessions [10]. While it alleviates symptoms of renal failure, complications such as anemia, hypertension, and pruritus may persist, requiring ongoing medical management.

Biomarkers like serum creatinine and urea are critical in assessing kidney function. Their elevation reflects renal impairment and is central to AKI diagnosis and monitoring [10]. Mortality in AKI increases with severity, particularly among patients who require but do not receive dialysis, where rates may reach 82% [12].

Given these outcomes, the present study aims to compare the clinical outcomes and biochemical parameters (serum creatinine and urea levels) in AKI patients undergoing haemodialysis versus those managed conservatively. This comparison is essential to guide individualized care strategies and improve outcomes in resource-limited settings.

MATERIAL AND METHODS

After obtaining approval from the Institutional Ethical Committee, this prospective, observational, and comparative study was conducted in the Department of General Medicine at Amaltas Institute of Medical Sciences, Bangar, Dewas Madhya Pradesh. The study was carried out over a period of 18 months. A total of 52 adult patients (aged ≥18 years), admitted to the general medicine wards and intensive care unit (ICU) with a clinical diagnosis of acute kidney injury (AKI), were enrolled. The diagnosis of AKI was established based on the kidney disease: Improving Global Outcomes (KDIGO) 2012 criteria. Prior to participation, written informed consent was obtained from all eligible patients after explaining the purpose, procedures, and confidentiality aspects of the study.

Inclusion and exclusion criteria

Inclusion criteria were patients of either sex, aged ≥18 years, who met the KDIGO criteria for AKI and provided written informed consent. Exclusion criteria included patients below 18 years of age, those with pre-existing chronic kidney disease (CKD), documented diabetic or hypertensive nephropathy, and patients who either refused consent or were lost to follow-up.

The *sample size* was calculated using a standard formula for population proportion with a margin of error set at 5%. Based on the prevalence of AKI (0.836%) as per recent epidemiological data, a minimum of 52 patients fulfilling the inclusion criteria were enrolled in the study.

Methodology

Enrolled patients were then categorized into two groups: Group A (haemodialysis group), comprising patients who underwent haemodialysis during hospitalization based on clinical indications; and Group B (non-haemodialysis group), comprising patients who were managed conservatively without dialysis.

Data were collected prospectively using a structured case record form after obtaining informed consent. Detailed clinical history and physical examination findings were recorded. Baseline investigations included complete blood count (CBC), serum creatinine, blood urea, electrolytes, liver function tests (LFTs), and blood glucose levels. Urine output was monitored, and additional investigations such as urinalysis and imaging studies were performed as required. All biochemical tests were conducted in NABL-accredited laboratories to ensure standardization.

Patient Grouping and Management

Patients were categorized into two groups:

- **Group A (Haemodialysis group):** Patients who received haemodialysis based on clinical indications such as severe azotemia, refractory hyperkalemia, volume overload unresponsive to diuretics, or uremic symptoms (e.g., encephalopathy, pericarditis).
- **Group B (Non-haemodialysis group):** Patients managed conservatively with intravenous fluids, diuretics, electrolyte correction, and supportive measures.

Outcome Measures

Clinical outcomes were assessed at the time of discharge or in-hospital death. Outcomes were categorized as:

1. **Return to Normal Renal Function:** Complete resolution of AKI with normalization of serum creatinine and urine output.
2. **Progression to CKD:** Defined as persistently abnormal renal function at discharge, further subclassified into:
   - CKD requiring maintenance haemodialysis
   - CKD not requiring dialysis
3. **In-Hospital Mortality:** Death due to renal or systemic complications during the hospital stay.

Statistical Analysis

All collected data were entered into Microsoft Excel and analyzed using IBM SPSS software (version 26.0). Continuous variables such as age, serum creatinine, and urea were expressed as mean ± standard deviation (SD), and categorical variables such as gender, outcome status, and treatment group were presented as frequencies and percentages. Comparisons between the two groups were performed using the Independent Samples t-test or Mann–Whitney U test for continuous variables, and Chi-square or Fisher's exact test for categorical data. A p-value of less than 0.05 was considered statistically significant. All results were presented in tabular and graphical formats to facilitate interpretation.

RESULTS

A total of 52 participants were evaluated In this comparative analysis of demographic parameters between AKI patients who underwent haemodialysis (Group A) and those managed conservatively (Group B), no statistically significant differences were observed.

The age distribution across both groups was comparable, with the majority of patients falling within the 51–70 years range. The association between age group and haemodialysis status was not significant ($p = 0.948$), indicating that age stratification did not influence the decision to initiate haemodialysis.

Similarly, the mean age (56.27 ± 11.52 vs. 54.88 ± 11.99 years; $p = 0.673$) and mean weight (64.23 ± 10.31 vs. 62.23 ± 10.31 kg; $p = 0.487$) did not differ significantly between the groups, suggesting that neither parameter was a determining factor in dialysis initiation.

Furthermore, the distribution of sex showed no significant association with haemodialysis requirement ($p = 0.402$), with males constituting a slightly higher proportion in the dialysis group. [Table 1]

Table 1: Association Between Demographic Parameters and Haemodialysis Status (n = 52)

Parameter	Category	Group A (N=26)	Group B (N=26)	Total	p-value
Age Group (years)	31–40	3 (11.5%)	4 (15.4%)	7 (13.5%)	0.948*
	41–50	5 (19.2%)	4 (15.4%)	9 (17.3%)	
	51–60	7 (26.9%)	6 (23.1%)	13 (25.0%)	
	61–70	7 (26.9%)	9 (34.6%)	16 (30.8%)	
	71–80	4 (15.4%)	3 (11.5%)	7 (13.5%)	
Mean Age (years)	–	56.27 ± 11.52	54.88 ± 11.99	–	0.673**
Mean Weight (kg)	–	64.23 ± 10.31	62.23 ± 10.31	–	0.487**
Sex	Male	16 (61.5%)	13 (50.0%)	29 (55.8%)	0.402**
	Female	10 (38.5%)	13 (50.0%)	23 (44.2%)	

**Chi square test; **Independent t test; P value<0.05 was considered statistically significant*

In this study of 52 AKI patients, several clinical symptoms were significantly associated with the need for haemodialysis. Nausea/vomiting (61.5% vs 19.2%, p = 0.002), fever (61.5% vs 15.4%, p = 0.001), edema (53.8% vs 19.2%, p = 0.010), sepsis (61.5% vs 30.8%, p = 0.026), and hypovolemia (65.4% vs 15.4%, p < 0.001) were all more prevalent in the haemodialysis group. Although shortness of breath was more common in the haemodialysis group (50.0% vs 26.9%), it was not statistically significant (p = 0.087). [Table 2]

Table 2: Association Between Clinical Symptoms and Haemodialysis Status (n = 52)

Clinical Symptom	Group A (N=26)	Group B (N=26)	Total (n)	p-Value
Nausea/Vomiting	16 (61.5%)	5 (19.2%)	21	0.002
Shortness of Breath	13 (50.0%)	7 (26.9%)	20	0.087
Fever	16 (61.5%)	4 (15.4%)	20	0.001
Edema	14 (53.8%)	5 (19.2%)	19	0.010
Sepsis	16 (61.5%)	8 (30.8%)	24	0.026
Hypovolemia	17 (65.4%)	4 (15.4%)	21	<0.001

**Chi square test; P value<0.05 was considered statistically significant*

\A comparison of biochemical parameters at the time of admission revealed significant differences between patients who underwent haemodialysis (Group A) and those who were managed conservatively (Group B). The mean urea level was considerably higher in the haemodialysis group (212.38 ± 18.86 mg/dL) compared to the non-haemodialysis group (90.69 ± 16.56 mg/dL), with a p-value of <0.001. Similarly, serum creatinine levels were elevated in the dialysis group (12.25 ± 1.12 mg/dL) versus (5.21 ± 0.99 mg/dL), also statistically significant (p < 0.001). Hyperkalemia was evident in the dialysis group with a mean potassium level of 5.59 ± 0.52 mmol/L, whereas patients not on dialysis had a mean of 2.67 ± 0.51 mmol/L (p < 0.001). Conversely, hemoglobin levels were significantly lower in the dialysis group (9.80 ± 0.96 g/dL) compared to the non-dialysis group (12.78 ± 1.01 g/dL), indicating a higher prevalence of anemia in the former. These differences underline the severity of biochemical derangements necessitating haemodialysis intervention. [Table 3]

Table 3: Comparison of Biochemical Parameters Between Haemodialysis and Non-Haemodialysis Groups at Admission

Parameter	Group A (N=26)	Group B (N=26)	p-value
Urea (mg/dL)	212.38 ± 18.86	90.69 ± 16.56	0.000**
Creatinine (mg/dL)	12.25 ± 1.12	5.21 ± 0.99	0.000**
Potassium (mmol/L)	5.59 ± 0.52	2.67 ± 0.51	0.000**
Hemoglobin (g/dL)	9.80 ± 0.96	12.78 ± 1.01	0.000**

***Independent t test; P value<0.05 was considered statistically significant*

A statistically significant association was observed between haemodialysis status and patient outcomes in individuals with acute kidney injury (AKI), as evidenced by a Chi-Square value of 13.642 and a p-value < 0.001. Patients who required haemodialysis experienced substantially worse outcomes: 26.9% died, 46.2% progressed to chronic kidney disease (CKD), and only 26.9% recovered normal renal function. In contrast, among those who did not undergo haemodialysis, mortality was markedly lower at 3.8%, CKD progression was seen in 19.2%, and a significant 76.9% achieved full renal recovery. These findings highlight that the need for haemodialysis serves as a clinical indicator of more severe and potentially irreversible renal injury, whereas patients managed conservatively were more likely to exhibit reversible AKI and favorable clinical outcomes. [Figure 1]

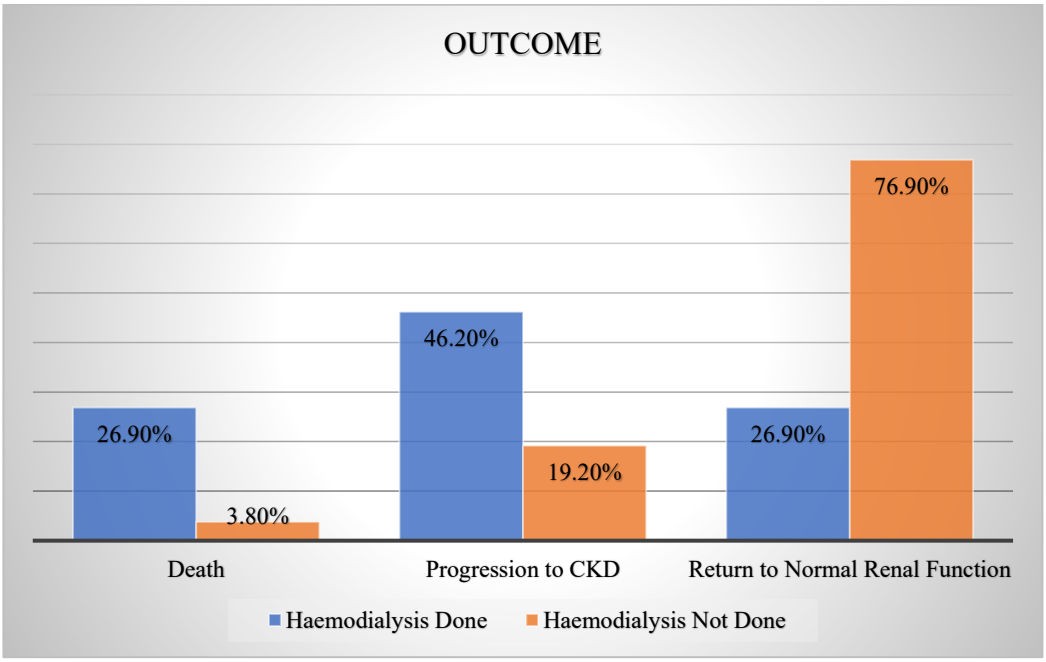

Figure 1. Association between haemodialysis Status and Outcome

DISCUSSION

Acute kidney injury (AKI) remains a significant cause of morbidity and mortality among hospitalized patients, especially in intensive care units. The decision to initiate renal replacement therapy (RRT), most commonly in the form of haemodialysis, is often predicated upon clinical severity, biochemical abnormalities, and hemodynamic considerations. Despite advancements in critical care nephrology, uncertainty persists regarding the optimal timing, indications, and long-term outcomes of dialysis initiation in AKI. This prospective observational study conducted at the Amaltas Institute of Medical Sciences aimed to compare the clinical profiles and outcomes of AKI patients managed conservatively versus those requiring haemodialysis, in order to better understand predictors of adverse outcomes and renal recovery.

The present study demonstrated no statistically significant differences in age, sex, or body weight between the haemodialysis and non-haemodialysis groups, suggesting that demographic variables alone do not dictate dialysis requirement in AKI. The mean ages in both groups were comparable—56.27 ± 11.52 years in the dialysis group and 54.88 ± 11.99 years in the non-dialysis group ($p = 0.673$). This aligns with the findings of Uchino et al. [13], who observed that age and sex were not predictive of dialysis requirement in AKI patients across multiple centers. Similarly, Mehta et al. [14] emphasized that while older age may increase susceptibility to AKI, it is not independently associated with dialysis necessity. Tafese ST et al. [15] also reported similar demographic patterns in Ethiopian dialysis cohorts, where mean age was younger (42.7 years) due to underlying CKD prevalence but did not independently predict outcomes.

Clinical symptoms such as nausea, vomiting, fever, and edema were significantly more prevalent in the haemodialysis group, indicating a greater degree of uremic and systemic derangement. Nausea/vomiting occurred in 61.5% of dialysis patients versus 19.2% in non-dialysis patients ($p = 0.002$), consistent with studies by Hoste et al. [16] and Bagshaw et al. [17], who associated gastrointestinal symptoms with advanced azotemia and RRT need. Fever, indicative of sepsis—a known AKI trigger—was noted in 61.5% of dialysis patients compared to only 15.4% in non-dialysis patients ($p = 0.001$). This supports findings by Bouchard et al. [18], who linked septic AKI with higher mortality and dialysis use. Edema was significantly associated with dialysis need (53.8% vs. 19.2%; $p = 0.010$), underscoring the role of fluid overload as both a trigger for and consequence of severe AKI, as also demonstrated by Ostermann and Chang.

Biochemical parameters in this study served as clear indicators of disease severity and the need for haemodialysis. Patients who underwent dialysis had markedly elevated mean blood urea (212.38 ± 18.86 mg/dL) and serum creatinine (12.25 ± 1.12 mg/dL), both statistically significant ($p < 0.001$). These findings resonate with the KDIGO guidelines and previous evidence from Chertow et al. [19], which underscore the utility of azotemia in guiding dialysis initiation. Furthermore, serum potassium was significantly higher in dialysis patients (5.59 ± 0.52 mmol/L), confirming the importance of hyperkalemia as a dialysis trigger and mortality predictor.

Hemoglobin levels were significantly lower in dialysis patients (9.80 ± 0.96 g/dL) compared to non-dialysis patients (12.78 ± 1.01 g/dL) ($p < 0.001$), reflecting possible chronicity or severe systemic inflammation. Anemia in AKI has been previously linked to adverse outcomes and delayed recovery, as noted by Vaara et al. [20]. Tafese ST et al. [15] reported that nearly 84% of their dialysis patients required transfusions due to profound anemia, consistent with our findings.

The most compelling aspect of the study was the statistically significant difference in clinical outcomes between the two groups. Mortality was higher in the haemodialysis group (26.9%) versus the non-dialysis group (3.8%) ($p = 0.001$), and progression to chronic kidney disease (CKD) was also greater among dialysis patients (46.2% vs. 19.2%). Conversely, complete renal recovery was observed in 76.9% of non-dialysis patients versus only 26.9% in dialysis recipients. These findings echo those of the SHARF registry and the prospective work by Harel et al. [21], which confirmed that dialysis-requiring AKI is associated with poor renal recovery and higher long-term morbidity.

The mortality figures reported by Tafese ST et al. [15] (42.6% overall) further substantiates this trend. In their study, AKI patients had marginally higher mortality than CKD patients (47.6% vs. 40.4%), influenced largely by delayed presentation, limited dialysis access, and economic factors. These challenges mirror the constraints in low- and middle-income countries (LMICs), including India, where infrastructural and financial limitations still hinder timely nephrology interventions.

This study highlights that while haemodialysis can be lifesaving for AKI patients, it is associated with higher risks of mortality and poor renal recovery due to more severe clinical presentations such as metabolic imbalances, infections, and fluid overload. In contrast, patients managed conservatively showed better outcomes when identified and treated early. Key biochemical markers and symptoms should guide timely nephrology referrals. The study emphasizes the need for improved access to dialysis, early diagnosis, and resource allocation, especially in resource-limited settings. However, limitations include a small sample size, single-center design, lack of long-term follow-up, unadjusted comorbidities, and variability in dialysis initiation decisions.

CONCLUSION

This study demonstrates that the clinical outcomes in acute kidney injury (AKI) are significantly influenced by the requirement for haemodialysis. Patients undergoing dialysis exhibited more severe biochemical disturbances—including markedly elevated urea, creatinine, and potassium levels—and a higher incidence of systemic complications such as sepsis, hypovolemia, and anemia. Consequently, these patients had poorer outcomes, with increased mortality and progression to chronic kidney disease. In contrast, patients managed conservatively without dialysis had better clinical profiles and a higher likelihood of full renal recovery. Notably, demographic factors such as age, sex, and weight

did not significantly impact the need for dialysis, highlighting the role of clinical severity in determining outcomes. These findings emphasize the need for early identification of high-risk AKI features and prompt decision-making regarding renal replacement therapy. Incorporating structured assessment protocols may improve prognosis and optimize resource utilization, especially in low-resource healthcare settings where timely dialysis access is often limited.

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