

ASSESSMENT OF CAUSES OF INTENSIVE CARE UNIT ADMISSIONS IN RENAL DISEASE PATIENTS: A CROSS-SECTIONAL STUDY

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Abstract: *The incidence of End-Stage Renal Disease (ESRD) is on the rise, making it a significant group of patients requiring admission to critical care units. At the same time, the field of Acute Kidney Injury (AKI) has flourished, leading to an increased number of patients with kidney dysfunction in critical care units. Our objective is to assess the causes of admission of patients with kidney disease in a large tertiary care hospital, the Medical Intensive Care Unit (MICU). This is a retrospective electronic case notes study. We collected data from the electronic records of all patients admitted to the MICU with renal problems from 1/7/2022 until 1/10/2022. The data was later analyzed in Microsoft Excel. During the study period, 503 patients were admitted to the MICU, of which 160 (31.8%) had renal disease. The median age was 50 years, ranging from 17 to 92 years. Females accounted for 42.5% of patients, while males accounted for 48.5%. Of the 160 patients, 97 (60.5%) were known to have ESRD, while 63 (39.5%) had AKI due to systemic illness. Fluid overload (40/55, 76.3%), followed by uremic encephalopathy (15/55, 27.2%) and hyperkalemia (12/55, 21.8%), remained the most common causes for initiation of Renal Replacement Therapy (RRT) in 55/97 (56.7%) ESRD patients. The mortality rate was 23.7% (38/160) in renal patients in the medical ICU. Our study highlights the increasing number of patients with kidney disease requiring admission to a medical ICU and their high mortality rate. Sepsis remains the leading cause of admission for ESRD patients on Maintenance Hemodialysis (MHD). At the same time, fluid overload was found to be the primary cause of starting RRT in advanced kidney disease.*

Keywords: ESRD End Stage Renal Disease, MHD Maintenance Hemodialysis, RRT Renal Replacement Therapy, AKI Acute Kidney Injury

Introduction

Intensive Care Units (ICUs) are crucial in the healthcare system, providing specialized care for patients with severe and life-threatening conditions (Louzada and Ferreira, 2021). Among the various patient populations admitted to ICUs, renal disease patients represent a significant and distinctive group. Renal disease encompasses a broad spectrum of disorders, from acute kidney injury (AKI) to CKD and ESRD, often complicated by comorbid conditions such as diabetes, hypertension, and cardiovascular disease (Kasongo et al., 2022). These complexities necessitate a comprehensive assessment of the specific triggers and contributing factors that lead to ICU admissions in this patient population. Understanding these underlying causes is essential for optimizing healthcare delivery and improving patient outcomes. The management of renal disease is complex, and these patients often face multiple challenges due to the potential consequences of kidney dysfunction (Masina et al., 2022).

Chronic kidney disease (CKD) and acute kidney injury (AKI) are widespread health issues affecting millions of people worldwide. CKD is characterized by the gradual decline in kidney function over time. AKI involves the abrupt decline in kidney function, often triggered by various factors such as infections, medications, or surgery (Susantitaphong et al., 2013; Sylvanus et al., 2019). These

kidney-related disorders are not only familiar but also associated with increased morbidity and mortality with a myriad of complications, including electrolyte imbalances, fluid retention, and metabolic disturbances. Patients with renal disease often suffer from multiple comorbidities, including diabetes, hypertension, and cardiovascular diseases, making them more susceptible to critical illnesses and complications that necessitate ICU care (Bagasha et al., 2015; Banda et al., 2020; Susantitaphong et al., 2013).

The reasons for ICU admissions in renal disease patients are multifactorial and can be attributed to various factors, including disease severity, comorbid conditions, and the healthcare environment (Masina et al., 2022). Understanding the specific causes of ICU admissions in this population is essential for improving the quality of care, optimizing resource allocation, and ultimately enhancing patient outcomes. Therefore, this study is warranted for assessing factors contributing to the high rate of ICU admissions among individuals with renal disease.

Methodology

A cross-sectional study was conducted from July 2022 to October 2022 at the department of Nephrology Central Park Medical College & Teaching Hospital to assess causes contributing to the ICU admissions in renal disease patients.

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This study was planned and conducted per the guidelines of the Helsinki Declaration. Therefore, ethical approval was obtained from the institutional review board of the institution and hospital (IRB NO), and prior written informed consent was obtained from all study participants or their guardians.

In this study, all the admitted patients of ICU due to renal etiology were included, and sociodemographic details, including age, gender, and ethnicity, were recorded. Moreover, study variables included causes of renal admission, i.e., AKI/CKD, fluid overload, uremic encephalopathy, hyperkalemia, sepsis catheter-related blood stream infections (CRBSI), and over all mortality and recovery rate were recorded. After getting informed consent from patients or their guardians, all the details were recorded on a prescribed study Performa approved by the ethical review committee.

Anonymous data was entered into Microsoft Excel ver. 2021 was fully assessed for errors after cross-verification data was exported into Statistical Packages Software for Social Sciences (SPSS) ver. 26 for statistical analysis. Qualitative data was assessed in frequencies and percentages and presented as pie charts and graphs; for the assessment of study variables, a chi-square test was employed to assess within the study group. A p-value of 0.05 was regarded as cut off for significance.

Results

From July 2022 to October 2022, 503 patients were admitted to the medical intensive care unit (MICU) with a median age of 50 ± 24 and an age range of 17 to 93 years. Out of 503 MICU admissions, 160 (31.8%) were of renal cause. Among these 160 renal patients, 60.625% (n=97) were males, while 39.325% (n=63) were females (Figure 1). Out of 160 patients with renal etiology in MICU, 63 (39.4%) had AKI due to systemic causes, while 97 (60.6%) had chronic kidney disease (CKD). In these CKD patients (n=97), 55 patients (56.7%) were on renal replacement therapy (RRT) /dialysis. The causes of RRT were assessed by employing the chi-square test, as explained in Table 1.

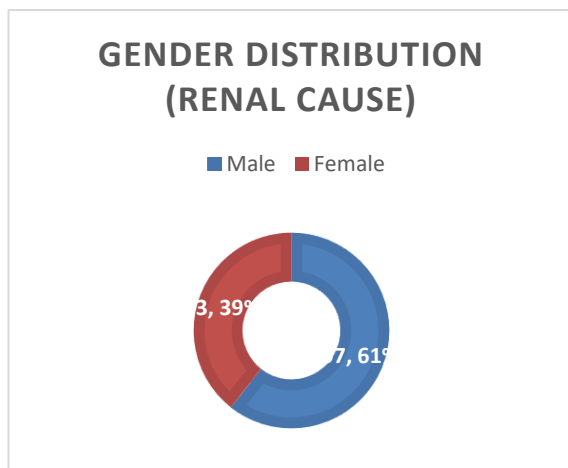


Figure 1: Distribution of gender in renal cause of MICU admission

On application of the chi-square test to assess causes of RRT, fluid overload (72.72) was the predominant cause for

RRT and in MICU admission, followed by uremic encephalopathy (27.28%). In comparison, 21.81% of patients had additional hyperkalemia along the fluid overload and uremic encephalopathy with a p-value of 0.004, making fluid-overload a leading cause of MICU admission in renal patients, as explained in table 1.

Table 1: Assessment of Causes of RRT in MICU-based Renal Patients on Chi-Square Test

Cause of RRT	n	%	p-value
Fluid Over Load	40	72.72	0.004*
Uremic Encephalopathy	15	27.28	
Hyperkalemia	12	21.81	

For the RRT in MICU, 31 (56.36%) out of 55 had emergency DL in ICU, while others already had line access. Of 160 patients, 122 (76.3%) were shifted back to the ward and recovered, while 38 (23.7%) expired.

Discussion

The findings of this cross-sectional study shed light on the significant burden of renal disease patients requiring admission to the medical intensive care unit (MICU) in a large tertiary care hospital. Renal disease patients encompass a diverse population, including those with end-stage renal disease (ESRD), chronic kidney disease (CKD), and acute kidney injury (AKI). This study aimed to explore the causes behind the increasing number of ICU admissions among these individuals and to evaluate the outcomes associated with their admission.

The incidence of end-stage renal disease (ESRD) has been steadily increasing, and this population comprises a substantial portion of patients requiring ICU care. This trend is not surprising, considering the growing prevalence of CKD and AKI, which predispose patients to critical illnesses. Additionally, advancements in the field of acute kidney injury (AKI) have expanded our understanding of the condition, further contributing to the rising number of renal disease patients in critical care units (Siddiqi et al., 2023).

The demographic data collected in this study offers valuable insights into the patient population. The median age of 50, with a wide age range of 17 to 93 years, underscores the broad age distribution of renal disease patients requiring MICU admission. This indicates that renal diseases can affect individuals of various age groups, emphasizing the need for a comprehensive approach to their care. The nearly equal gender distribution (42.5% females and 48.5% males) demonstrates that renal diseases do not discriminate by gender.

The study classifies renal disease patients into two primary categories: those with ESRD and those with AKI due to systemic illness. The prevalence of known ESRD cases (60.5%) among MICU admissions highlights the severity of renal disease in this population. The outcomes and management of these patients are complex and often involve renal replacement therapy (RRT), as demonstrated by the finding that 56.7% of ESRD patients require RRT (Gomes et al., 2020).

The causes for initiating RRT in ESRD patients are of particular interest, as they provide insights into this

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population's specific challenges. Fluid overload was identified as the leading cause for initiating RRT, affecting a significant proportion of ESRD patients. This suggests that fluid management and preventing volume overload are critical aspects of caring for ESRD patients in the ICU. Uremic encephalopathy and hyperkalemia were also identified as important factors in RRT initiation, emphasizing the need for close monitoring and managing electrolyte imbalances in these patients (Hoste et al., 2018; Kim et al., 2022).

A significant finding is the overall mortality rate of 23.7% among renal patients in the MICU. It underscores the critical nature of their conditions and the challenges they face. This finding highlights the importance of early identification, prompt intervention, and specialized care for renal disease patients in the ICU (Hill et al., 2016). Furthermore, it underscores the need for strategies to improve outcomes and reduce mortality in this patient population. Sepsis is recognized as a leading cause of admission for ESRD patients receiving maintenance hemodialysis (MHD), which is consistent with existing literature on the topic (Janke et al., 2016). The high mortality rate and the prevalence of sepsis among these patients underscore the importance of infection prevention and early intervention in the management of renal disease patients (Gomes et al., 2020). The relatively small sample size, limited follow-up, and short observation period may restrict the study's ability to capture the full spectrum of causes and outcomes in renal disease patients. The study does not explore potential ethnic or geographic variations, detailed comorbidity analyses, or external factors that could influence ICU admissions. Finally, it identifies associations but does not establish causality, necessitating further research to explore causal relationships in this context.

Conclusion

The findings reveal a diverse population, encompassing individuals with end-stage renal disease (ESRD) and acute kidney injury (AKI), and highlight the challenges and complexities associated with their care. Fluid overload, uremic encephalopathy, and hyperkalemia emerge as primary causes for the initiation of renal replacement therapy (RRT) in ESRD patients, emphasizing the need for meticulous fluid and electrolyte management. The study also highlights the persistent high mortality rate among renal patients in the MICU, with sepsis as a leading cause of admission for ESRD patients on maintenance hemodialysis (MHD).

Declarations

Data Availability statement

All data generated or analyzed during the study are included in the manuscript.

Ethics approval and consent to participate

Approved by the department Concerned.

Consent for publication

Approved

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Conflict of interest

The authors declared absence of conflict of interest.

Author Contribution

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Conception of Study, Development of Research Methodology Design, Study Design,, Review of manuscript, final approval of manuscript

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