

## A Study Assessing the Correlation between Renal Function and the Severity and Outcomes of Acute Cerebrovascular Accident Patients

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### Abstract

**Introduction:** Acute cerebrovascular accident (CVA) is a major cause of morbidity and mortality worldwide. Renal dysfunction has been increasingly recognized as an important factor influencing the severity and prognosis of stroke. However, data regarding its impact on stroke outcomes in the Indian population remain limited. The present study aimed to assess the correlation between renal function and the severity and outcomes of patients with acute cerebrovascular accident.

**Materials and Methods:** This hospital-based observational study was conducted at Mamata Medical College, Khammam, from November 2024 to November 2025. A total of 120 adult patients with acute ischemic or hemorrhagic stroke were included. Renal function was assessed using estimated glomerular filtration rate (eGFR) and categorized into normal, mild, moderate, and severe dysfunction. Stroke severity was evaluated using the National Institutes of Health Stroke Scale (NIHSS). Patient outcomes were recorded at discharge. Statistical analysis was performed using the Chi-square test, with  $p < 0.05$  considered significant.

**Results:** The majority of patients were aged 51–60 years (30.0%), with a male predominance (61.7%). Ischemic stroke was more common (68.3%). Mild renal impairment was the most frequent category (35.0%). Most patients presented with moderate stroke (43.3%). A significant association was observed between renal function and stroke severity ( $p < 0.001$ ), with severe renal dysfunction showing a higher proportion of severe stroke. Renal dysfunction was also significantly associated with adverse outcomes ( $p < 0.001$ ), with the highest mortality observed in patients with severe renal impairment. Additionally, stroke severity was strongly associated with mortality ( $p < 0.001$ ).

**Conclusion:** Renal dysfunction is significantly associated with increased stroke severity and poorer outcomes in acute CVA patients. Early assessment of renal function can aid in risk stratification and improve clinical management.

**Keywords:** Cerebrovascular accident; renal function; eGFR; Stroke severity; Mortality.

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### Introduction

Acute cerebrovascular accident (CVA), commonly referred to as stroke, is a leading cause of morbidity and mortality worldwide and represents a major public health challenge [1]. It is broadly classified into ischemic and hemorrhagic types, with ischemic stroke accounting for the majority of cases [2]. Stroke not only contributes significantly to mortality but also results in long-term disability, imposing a substantial socioeconomic burden on patients, families, and healthcare systems [3]. Early identification of prognostic factors is essential to guide clinical management and improve outcomes [4,5]. Renal dysfunction has emerged as an

important systemic condition influencing the course and prognosis of various cardiovascular and cerebrovascular diseases [6]. Impaired renal function is associated with endothelial dysfunction, chronic inflammation, oxidative stress, and accelerated atherosclerosis, all of which contribute to increased vascular risk [7]. In patients with stroke, reduced renal function has been linked to higher severity at presentation, increased risk of complications, prolonged hospital stay, and higher mortality rates [8]. Several studies have demonstrated that estimated glomerular filtration rate (eGFR), a reliable marker of renal function,

can serve as a predictor of stroke outcomes [9,10]. Patients with chronic kidney disease (CKD) often exhibit coexisting risk factors such as hypertension, diabetes mellitus, and dyslipidemia, further compounding the risk of adverse cerebrovascular events [11]. Despite growing evidence, the exact relationship between renal function, stroke severity, and clinical outcomes remains an area of ongoing research, particularly in the Indian population where data are limited [12].

Understanding the interplay between renal dysfunction and stroke severity is crucial for risk stratification and optimizing patient care. Early recognition of patients at higher risk of poor outcomes can facilitate timely interventions and improve prognosis. This study aimed to assess the correlation between renal function and the severity and outcomes of acute cerebrovascular accident patients.

**Materials and Methods**

This hospital-based observational study was conducted in the Department of General Medicine at Mamata Medical College, Khammam, over a period of one year from November 2024 to November 2025. The study included patients admitted with a diagnosis of acute cerebrovascular accident (CVA), confirmed clinically and supported by neuroimaging modalities such as computed tomography (CT) scan or magnetic resonance imaging (MRI) of the brain. A total of 120 patients who fulfilled the inclusion criteria were enrolled in the study.

All adult patients aged ≥18 years presenting with acute ischemic or hemorrhagic stroke within 72 hours of onset were included. Patients with transient ischemic attacks, traumatic intracranial hemorrhage, known chronic neurological disorders, or those with incomplete clinical or laboratory data were excluded. After obtaining informed consent,

detailed demographic data, clinical history, and relevant risk factors were recorded using a predesigned and structured proforma.

Renal function was assessed at admission using serum creatinine levels, and the estimated glomerular filtration rate (eGFR) was calculated using the Modification of Diet in Renal Disease (MDRD) formula. Based on eGFR values, patients were categorized into normal (≥90 ml/min), mild (60–89 ml/min), moderate (30–59 ml/min), and severe (<30 ml/min) renal dysfunction. Stroke severity was evaluated using the National Institutes of Health Stroke Scale (NIHSS) and categorized as mild (<5), moderate (5–15), and severe (>15). Patient outcomes were assessed at discharge and classified as discharged (recovered), improved, not improved, or expired.

Data were entered into Microsoft Excel and analyzed using SPSS v26. Descriptive statistics were expressed as frequencies and percentages. Associations between renal function, stroke severity, and patient outcomes were analyzed using the Chi-square test. A p-value of <0.05 was considered statistically significant. Ethical clearance for the study was obtained from the Institutional Ethics Committee prior to commencement of the study.

**Results**

The study included 120 patients with acute cerebrovascular accidents. The majority of patients were in the 51–60 years age group (30.0%), followed by 41–50 years (23.3%) and 61–70 years (21.7%), with fewer patients aged >70 years (13.3%) and 31–40 years (11.7%). There was a male predominance, with 74 (61.7%) males and 46 (38.3%) females. Ischemic stroke was more common, accounting for 82 cases (68.3%), while hemorrhagic stroke was observed in 38 cases (31.7%) (Table 1).

**Table 1: Baseline Characteristics of Study Population (n = 120)**

Variable	Category	Frequency	Percentage (%)
Age (years)	31–40	14	11.7%
	41–50	28	23.3%
	51–60	36	30.0%
	61–70	26	21.7%
	>70	16	13.3%
Gender	Male	74	61.7%
	Female	46	38.3%
Type of Stroke	Ischemic	82	68.3%
	Haemorrhagic	38	31.7%

Assessment of renal function based on eGFR revealed that the largest proportion of patients had mild renal impairment (35.0%), followed by normal renal function (28.3%), moderate impairment (23.3%), and severe renal dysfunction (13.3%), indicating a substantial burden of renal compromise among stroke patients (Table 2).

**Table 2: Renal Function Status (Based on eGFR)**

Renal Function Category	Frequency	Percentage (%)
Normal ( $\geq 90$ ml/min)	34	28.3%
Mild (60–89 ml/min)	42	35.0%
Moderate (30–59 ml/min)	28	23.3%
Severe ( $< 30$ ml/min)	16	13.3%
<b>Total</b>	<b>120</b>	<b>100%</b>

With respect to stroke severity, most patients presented with moderate stroke (43.3%), followed by severe stroke (31.7%) and mild stroke (25.0%), suggesting that a significant proportion of patients had moderate-to-severe neurological deficits at presentation (Table 3).

**Table 3: Stroke Severity (NIHSS Score)**

Severity Category	NIHSS Score	Frequency	Percentage (%)
Mild	$< 5$	30	25.0%
Moderate	5–15	52	43.3%
Severe	$> 15$	38	31.7%
<b>Total</b>		<b>120</b>	<b>100%</b>

A statistically significant association was observed between renal function and stroke severity ( $p < 0.001$ ).

Patients with normal renal function predominantly had mild stroke (18/34), whereas those with worsening renal function showed increasing

proportions of moderate and severe stroke. Notably, patients with severe renal dysfunction had the highest proportion of severe stroke (10/16), indicating a strong correlation between declining renal function and increased stroke severity (Table 4).

**Table 4: Correlation between Renal Function and Stroke Severity**

Renal Function	Mild	Moderate	Severe	Total	p-value
Normal	18	12	4	34	<b><math>&lt; 0.001</math></b>
Mild	10	22	10	42	
Moderate	2	12	14	28	
Severe	0	6	10	16	
<b>Total</b>	<b>30</b>	<b>52</b>	<b>38</b>	<b>120</b>	

Patient outcomes also demonstrated a significant association with renal function ( $p < 0.001$ ). Most patients with normal and mildly impaired renal function were discharged, whereas those with moderate and severe renal dysfunction had higher

rates of poor outcomes and mortality. In particular, mortality was highest among patients with severe renal impairment (8/16), highlighting the impact of renal dysfunction on adverse outcomes in stroke patients (Table 5).

**Table 5: Patient Outcomes and Their Association with Renal Function**

Renal Function	Discharged	Improved	Not Improved	Expired	Total	p-value
Normal	28	4	1	1	34	<b><math>&lt; 0.001</math></b>
Mild	28	8	3	3	42	
Moderate	12	4	4	8	28	
Severe	4	2	2	8	16	
<b>Total</b>	<b>72</b>	<b>18</b>	<b>10</b>	<b>20</b>	<b>120</b>	

A significant relationship was observed between stroke severity and mortality ( $p < 0.001$ ). All patients with mild stroke survived, while mortality increased with severity, with 4 deaths in moderate stroke and 16 deaths in severe stroke. This indicates that higher NIHSS scores are strongly associated with increased risk of mortality in acute cerebrovascular accident patients (Table 6).

**Table 6: Association between Stroke Severity and Mortality**

Stroke Severity	Survived	Expired	Total	p-value
Mild	30	0	30	<b><math>&lt; 0.001</math></b>
Moderate	48	4	52	
Severe	22	16	38	
<b>Total</b>	<b>100</b>	<b>20</b>	<b>120</b>	

## Discussion

The present study demonstrated that renal dysfunction is significantly associated with increased stroke severity and poorer clinical outcomes in patients with acute cerebrovascular accidents. A higher proportion of patients with moderate to severe renal impairment presented with severe stroke, while those with normal renal function predominantly had mild disease. This finding is consistent with previous studies which have reported that declining renal function is associated with increased neurological deficit at presentation. For instance, studies have shown that patients with advanced chronic kidney disease exhibit higher stroke severity scores, likely due to endothelial dysfunction, chronic inflammation, and accelerated atherosclerosis [13].

In the current study, a statistically significant association was observed between renal dysfunction and adverse outcomes, including increased mortality. Patients with severe renal impairment had the highest mortality rates, which aligns with findings from multiple studies. Thyagaraj et al. reported that reduced eGFR and elevated serum creatinine are significant predictors of mortality and poor functional outcomes in acute stroke patients [9]. Similarly, large cohort studies have demonstrated that lower eGFR levels are associated with a stepwise increase in short-term and long-term mortality following stroke [14].

The present study also found that worsening renal function was associated with poorer recovery and increased rates of non-improvement. This observation is supported by previous literature indicating that low eGFR is strongly linked to unfavourable functional outcomes and disability after stroke. Studies have shown that reduced renal function independently predicts poor functional recovery at both short-term and long-term follow-up [15,16].

Additionally, renal impairment has been associated with increased risk of complications such as acute kidney injury, which further contributes to morbidity and mortality in stroke patients [17].

Furthermore, the study demonstrated a strong correlation between stroke severity and mortality, with severe stroke patients showing significantly higher death rates.

This finding is in agreement with established evidence that higher NIHSS scores are strong predictors of mortality and poor outcomes. The interplay between renal dysfunction and stroke severity may further amplify the risk, as both factors independently contribute to adverse prognosis. Previous research has also emphasized that renal dysfunction serves as an important prognostic marker in stroke and should be routinely

assessed to improve risk stratification and management strategies [18,19].

## Conclusion

The present study demonstrates a significant correlation between renal function and the severity and outcomes of acute cerebrovascular accident patients. Worsening renal function was associated with higher stroke severity at presentation, poorer clinical recovery, and increased mortality. Patients with moderate to severe renal impairment were more likely to experience adverse outcomes compared to those with normal or mildly reduced renal function. Additionally, stroke severity independently showed a strong association with mortality. These findings highlight the importance of early assessment of renal function in stroke patients for effective risk stratification and prognostication, thereby aiding in timely clinical decision-making and improving overall patient outcomes.

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