

Impact of Steroid (Dexamethasone) Therapy on Clinical Outcomes and Functional Recovery in Patients with Acute Stroke

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Received: 27 January 2026

Accepted: 10 February 2026

Published: 19 February 2026

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Abstract

Background: Stroke is a leading cause of death and long-term disability worldwide, particularly in developing countries. Inflammation and cerebral edema contribute to secondary brain injury following acute stroke, and corticosteroids are often used to reduce these effects. However, their role in improving clinical outcomes and functional recovery remains controversial. This study aimed to evaluate the impact of steroid therapy on clinical outcomes and functional recovery among patients with acute stroke.

Methods: This prospective observational study was conducted in the Department of Neurology, National Institute of Neuro Sciences and Hospital, Dhaka, Bangladesh, from October 2023 to September 2025. A total of 300 adult patients with acute ischemic or hemorrhagic stroke were enrolled consecutively. Socio-demographic data, clinical characteristics, stroke severity (GCS and mRS), steroid therapy details, and hospital stay were recorded.

Results: Most patients were aged 61–70 years (28.0%), and females predominated (59.3%). Intracerebral hemorrhage was the commonest stroke subtype (55.3%). Severe disability at admission (mRS 5) was observed in 79.7% of patients. Steroids were administered to 60.0% of cases, mainly for 1–5 days. Overall, 68.7% were discharged alive, while 31.3% died. Favorable functional outcome (mRS ≤ 2) was achieved in 7.3% at discharge and 17.0% at follow-up. Complications occurred in 47.0% of patients, most commonly electrolyte imbalance (23.7%).

Conclusion: There is no survival benefit or reduction of morbidity in hospitalized or follow-up cohorts of steroid (dexamethasone) therapy patients. Early intervention and evidence-based management strategies are essential to optimize outcomes.

Keywords: Acute stroke, corticosteroids, steroid therapy, dexamethasone, functional recovery, modified Rankin Scale, clinical outcomes.

1. INTRODUCTION

Stroke is one of the leading causes of mortality and long-term disability worldwide and represents a major public health burden, particularly in low- and middle-income countries.¹ It occurs due to an abrupt interruption of cerebral blood flow resulting from either vascular occlusion or hemorrhage, leading to ischemic or hemorrhagic brain injury.² Acute stroke is frequently associated with significant neurological deficits, prolonged hospitalization, functional dependence, and reduced quality of life.³ In developing countries, including Bangladesh, the rising prevalence of hypertension, diabetes mellitus, and other vascular risk factors has contributed to an increasing incidence of stroke and related complications.⁴

Following the primary insult, secondary brain injury plays a crucial role in determining clinical outcomes. Cerebral edema, inflammation, oxidative stress, and disruption of the blood–brain barrier contribute to worsening neuronal damage and neurological deterioration during the acute phase.⁵ Corticosteroids possess potent anti-inflammatory and anti-edematous properties and have long been used in various neurological conditions to reduce intracranial pressure and cerebral swelling.⁶ These pharmacological effects have prompted interest in the potential role of steroid therapy in improving outcomes after acute stroke by minimizing inflammatory responses and limiting secondary injury.⁷

However, the effectiveness of steroids in stroke management remains controversial. While some clinicians use corticosteroids empirically to control cerebral edema, several studies have reported inconsistent or limited benefits, and concerns exist regarding possible adverse effects such as infection, hyperglycemia, and gastrointestinal complications.⁸ Moreover, evidence regarding their impact on functional recovery, disability status, and overall survival is inconclusive.⁹ Consequently, routine use of steroids in acute stroke is not universally recommended, and further evaluation is needed to clarify their clinical utility, particularly in real-world hospital settings.¹⁰

Assessment of clinical outcomes using standardized measures such as the Glasgow Coma Scale (GCS) and modified Rankin Scale (mRS) allows objective evaluation of neurological status and functional recovery.¹¹

Comparing these outcomes between patients receiving steroid therapy and those managed without steroids may provide valuable insights into the benefits or risks associated with such treatment.¹²

Therefore, this study aimed to evaluate the impact of steroid therapy on clinical outcomes and functional recovery among patients with acute stroke admitted to a tertiary care neurological center. By analyzing survival, complications, and functional status at discharge and follow-up, this study seeks to generate evidence that may guide clinical decision-making and optimize management strategies for acute stroke patients.

2. METHODOLOGY & MATERIALS

This prospective observational study was conducted at the Department of Neurology, National Institute of Neuro Sciences and Hospital, Dhaka, Bangladesh over a period of two years from October 2023 to September 2025 to evaluate the impact of steroid therapy on clinical outcomes and functional recovery in patients with acute stroke. A total of 300 consecutive patients diagnosed with acute stroke and admitted during the study period were enrolled. Patients aged 18 years or older with confirmed ischemic stroke, intracerebral hemorrhage, or subarachnoid hemorrhage based on clinical assessment and neuroimaging were included. Patients with transient ischemic attack, traumatic brain injury, brain tumors, or incomplete clinical data were excluded.

Baseline socio-demographic information, including age, sex, and residence, was recorded at admission. Clinical characteristics such as stroke type, time from symptom onset to hospital admission, Glasgow Coma Scale (GCS), modified Rankin Scale (mRS), and associated comorbidities were documented. Patients were categorized according to whether they received systemic steroid (dexamethasone) therapy, and details regarding steroid status, duration of therapy, and hospital stay were collected. All patients were managed according to standard institutional stroke protocols.

Outcome measures included in-hospital survival, complications, discharge mRS, and follow-up mRS to assess functional recovery. Favorable outcome was defined as mRS 0–2, moderate disability as mRS 3–4, and poor outcome as mRS 5–6. Data were analyzed using SPSS version 25.

Descriptive statistics were used and results were presented as frequency and percentage.

3. RESULTS

In this study table 1 presents the socio-demographic characteristics of the study population comprising 300 patients with acute stroke. The majority of patients were aged between 61–70 years (28.0%), followed by 51–60 years (23.3%) and 41–50 years (19.7%), indicating that stroke was more prevalent among middle-aged and elderly individuals. Only a small proportion of patients were aged ≤ 40 years (12.0%) and > 80 years (4.0%). Female patients constituted a higher proportion of the study population (59.3%) compared to males (40.7%). Regarding residence, more than half of the participants were from urban areas (54.3%), while 45.7% were from rural areas. Table 2 illustrates the baseline clinical and stroke-related characteristics of the 300 enrolled patients at admission. Intracerebral hemorrhage (ICH) was the most common stroke type, accounting for 55.3% of cases, followed by ischemic stroke (32.7%) and subarachnoid hemorrhage (12.0%). Nearly half of the patients (47.0%) presented to the hospital within 7–24 hours of symptom onset, while only 13.3% arrived within 6 hours, indicating delayed hospital presentation in a considerable proportion of cases. Assessment of baseline severity showed that the majority of patients had significant disability at admission, with 79.7% having an mRS score of 5. Regarding consciousness level, 38.7% had moderate GCS (9–12) and 38.0% had severe impairment (≤ 8), reflecting substantial neurological compromise at presentation. Hypertension was the most prevalent comorbidity (48.3%), followed by combined hypertension and diabetes (23.7%),

whereas only 15.7% had no comorbid conditions. Table 3 shows the steroid therapy and treatment-related characteristics of the study population. Among the 300 patients, the majority received steroid therapy, with 180 patients (60.0%) administered corticosteroids, while 120 patients (40.0%) did not receive steroids. Regarding the duration of steroid use, 39.7% of patients had no steroid exposure, 23.0% received steroids for 1–3 days, and 31.0% were treated for 4–5 days, whereas only a small proportion (6.3%) received steroids for six days or more. Analysis of hospital stay revealed that most patients (65.0%) were hospitalized for five days or less, while 25.0% stayed between 6–10 days and 10.0% required prolonged hospitalization of more than 10 days. Table 4 summarizes the clinical outcomes and functional recovery of the 300 patients with acute stroke. Most patients were discharged alive (68.7%), while 31.3% died during hospitalization, indicating a substantial in-hospital mortality rate. Assessment of functional status at discharge using the modified Rankin Scale (mRS) showed that only 7.3% achieved a favorable outcome (mRS 1–2), whereas 35.6% had moderate disability (mRS 3–4) and the majority (57.0%) experienced severe disability or death (mRS 5–6). At follow-up, functional improvement was observed in some patients, with the proportion of favorable outcomes increasing to 17.0%. However, nearly half of the patients (49.3%) still remained severely disabled or deceased. Complications were reported in 47.0% of cases, while 53.0% had no complications. Electrolyte imbalance was the most common complication (23.7%), followed by multiple complications (10.7%), seizures (6.7%), aspiration pneumonia (5.3%), and urinary tract infection (0.7%).

Table 1. Socio-demographic characteristics of the study population (n = 300)

Variable	Frequency (n)	Percent (%)
Age group (years)		
≤ 40	36	12
41–50	59	19.7
51–60	70	23.3
61–70	84	28
71–80	39	13
> 80	12	4
Sex		
Male	122	40.7
Female	178	59.3
Residence		
Urban	163	54.3
Rural	137	45.7

Table 2. Baseline clinical and stroke characteristics of the study population (n = 300)

Variable	Frequency (n)	Percent (%)
Stroke type		
Intracerebral hemorrhage (ICH)	166	55.3
Ischemic stroke	98	32.7
Subarachnoid hemorrhage (SAH)	36	12
Onset to admission time (hours)		
≤ 6 hours	40	13.3
7–24 hours	141	47
25–48 hours	43	14.3
> 48 hours	76	25.3
Admission mRS		
2	1	0.3
3	21	7
4	39	13
5	239	79.7
Admission GCS		
Severe (≤ 8)	114	38
Moderate (9–12)	116	38.7
Mild (13–15)	70	23.3
Comorbidities		
Hypertension (HTN)	145	48.3
Diabetes mellitus (DM)	15	5
HTN + DM	71	23.7
Multiple comorbidities	22	7.3
None	47	15.7

Table 3. Steroid therapy and treatment characteristics of the study population (n = 300)

Variable	Frequency (n)	Percent (%)
Steroid therapy status		
Given	180	60
Not given	120	40
Steroid duration (days)		
0 day (no steroid)	119	39.7
1–3 days	69	23
4–5 days	93	31
≥ 6 days	19	6.3
Hospital stay (days)		
≤ 5 days	195	65
6–10 days	75	25
> 10 days	30	10

Table 4. Clinical outcomes and functional recovery of the study population (n = 300)

Variable	Frequency (n)	Percent (%)
Hospital outcome		
Discharged alive	206	68.7
Death	94	31.3
Discharge mRS (DC-mRS)		
1–2 (favorable outcome)	22	7.3
3–4 (moderate disability)	107	35.6
5–6 (severe disability/death)	171	57
Follow-up mRS (Fup-mRS)		
0–2 (favorable outcome)	51	17
3–4 (moderate disability)	101	33.7
5–6 (severe disability/death)	148	49.3
Complications		
Present	141	47
Absent	159	53

Type of complication		
Electrolyte imbalance	71	23.7
Aspiration pneumonia	16	5.3
Seizure	20	6.7
UTI	2	0.7
Multiple complications	32	10.7
No complication	159	53

4. DISCUSSION

This prospective observational study evaluated the impact of steroid therapy on clinical outcomes and functional recovery among 300 patients with acute stroke and demonstrated substantial morbidity and mortality, with limited favorable functional outcomes. The majority of our patients were older adults, particularly within 61–70 years (28.0%) and 51–60 years (23.3%), which aligns with the well-established association between increasing age and higher stroke risk. Similar age-related vulnerability has been reported in large neurological outcome studies, where advancing age correlated with poorer recovery and greater disability.¹³ The higher proportion of female patients in our cohort (59.3%) is also consistent with sex-related differences in stroke epidemiology and outcomes described by Lagebrant et al., who noted variations in functional recovery between males and females.¹⁴

In our study, intracerebral hemorrhage (ICH) constituted the predominant stroke subtype (55.3%), exceeding ischemic stroke (32.7%). This higher hemorrhagic proportion may reflect referral bias to a tertiary neurocritical center. Liang et al. reported that patients with basal ganglia ICH often present with worse functional outcomes and prolonged recovery, which is comparable to our findings of severe disability at admission.¹⁵ Moreover, nearly half of our patients (47.0%) presented between 7–24 hours after symptom onset, and only 13.3% arrived within 6 hours, suggesting delayed hospital presentation. Such delays reduce opportunities for early interventions and are known to adversely affect prognosis, as highlighted by Potla and Ganti and by Vergouwen and Rinkel in acute cerebrovascular emergencies.^{16,17}

Baseline neurological severity in our cohort was considerable, with 79.7% having an admission mRS of 5 and 38.0% presenting with severe GCS (≤ 8). Severe neurological impairment has been consistently linked to poor outcomes and increased mortality. Studies focusing on inflammatory and systemic indices, including those by Adiguzel et al., Lee et al., and Wu et al.,

have shown that higher inflammatory burden and severe presentation predict worse functional recovery and complications, supporting our observation of significant disability and a 31.3% in-hospital mortality rate.^{18,19,20} Hypertension was the most frequent comorbidity (48.3%), and combined hypertension and diabetes were also common (23.7%), reflecting known vascular risk profiles associated with adverse stroke outcomes.

Steroid therapy was administered to 60.0% of our patients, primarily for short and intermediate duration (1–5 days). Although corticosteroids theoretically reduce cerebral edema and inflammation, current evidence regarding their clinical benefit remains uncertain. Xu et al. emphasized the potential neuroprotective effects of neurosteroid, but clinical translation has been inconsistent.²¹ Despite steroid use in the majority of our cohort, only 7.3% achieved favorable functional status at discharge and 17.0% at follow-up, while nearly half (49.3%) remained severely disabled or deceased. These findings suggest that steroid therapy may not substantially alter long-term functional outcomes, consistent with reports that inflammation control alone may be insufficient to reverse established neurological injury.

Complications were observed in 47.0% of patients, with electrolyte imbalance being the most frequent (23.7%). Such metabolic disturbances and infections have been associated with poorer recovery and increased mortality, as noted by Adiguzel et al. and Pacinella et al., who highlighted the contribution of systemic inflammation and medical complications to secondary brain injury.^{18,22} The persistence of moderate-to-severe disability in our follow-up data underscores the chronic impact of acute stroke and the need for comprehensive rehabilitation strategies.

Our findings demonstrate that acute stroke in this setting is characterized by delayed presentation, severe baseline deficits, high complication rates, and limited functional recovery. Although steroids were frequently used, their benefit on outcomes appeared modest. These results

highlight the importance of early presentation, optimal supportive care, and evidence-based therapies to improve survival and functional independence.

5. LIMITATIONS OF THE STUDY

This study has several limitations. First, being a single-center prospective observational study, the findings may not be generalizable to all populations and causal relationships between steroid therapy and outcomes cannot be firmly established. Second, the absence of randomization and potential confounding factors such as variations in stroke severity, treatment protocols, and comorbidity burden may have influenced the observed clinical and functional outcomes.

6. CONCLUSION

In conclusion, there is no survival benefit or reduction of morbidity in hospitalized or follow-up cohorts of steroid (dexamethasone) therapy patients. Early hospital presentation, effective management of complications, and evidence-based treatment strategies remain essential to improve clinical outcomes and long-term functional independence in patients with acute stroke.

FINANCIAL SUPPORT AND SPONSORSHIP

No funding sources.

CONFLICTS OF INTEREST

There are no conflicts of interest.

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Citation: Dr. Mohammad Sadekur Rahman Sarkar et al. *Impact of Steroid (Dexamethasone) Therapy on Clinical Outcomes and Functional Recovery in Patients with Acute Stroke*. *ARC Journal of Neuroscience*. 2026; 9(1):13-19. DOI: <https://doi.org/10.20431/2456-057X.0901003>.

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