

Gender Distribution, Comorbidity Profiles, and Short-Term Autonomic Recovery Patterns in Acute Ischemic Stroke: An Indian Cohort Study

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ABSTRACT

Background: Acute ischemic stroke (AIS) is associated with alterations in cardiovascular autonomic regulation and is frequently accompanied by a substantial burden of vascular and metabolic comorbidities. This study evaluated the gender distribution, comorbidity profile, and short-term changes in 24-hour ambulatory blood pressure (ABP) among patients with AIS during hospitalization.

Methods: This prospective observational cohort study included 64 adults with AIS admitted to a tertiary care center in Northern India over a 12-month period. Patients aged ≤ 75 years with clinically and radiologically confirmed AIS and a National Institutes of Health Stroke Scale score of 5–15 were enrolled using purposive sampling. Demographic characteristics and comorbidities were recorded at admission. Twenty-four-hour ambulatory blood pressure monitoring (ABPM) was performed within 24 hours of admission and repeated at discharge. Mean 24-hour systolic blood pressure (SBP) and diastolic blood pressure (DBP) were compared using paired-samples t-tests.

Results: Of the 64 participants, 46 (71.9%) were male and 18 (28.1%) were female. Isolated hypertension was present in 15 (23.4%) participants, isolated diabetes mellitus in 9 (14.1%), and concomitant hypertension and diabetes mellitus in 6 (9.4%). Mean 24-hour SBP decreased significantly from 137.19 ± 9.10 mmHg at admission to 132.50 ± 8.13 mmHg at discharge ($p < 0.001$). Similarly, mean 24-hour DBP decreased from 71.56 ± 5.94 mmHg to 67.50 ± 5.51 mmHg ($p < 0.001$).

Conclusion: This Northern Indian AIS cohort demonstrated a predominance of male patients and a substantial burden of hypertension and diabetes mellitus. Significant reductions in 24-hour SBP and DBP were observed between admission and discharge. These findings indicate short-term changes in ambulatory blood pressure during hospitalization and support further investigation of cardiovascular autonomic and blood pressure patterns following AIS.

Keywords: Acute Ischemic Stroke; Autonomic Recovery; Ambulatory Blood Pressure Monitoring; Blood Pressure; Hypertension; Diabetes Mellitus; Autonomic Nervous System

INTRODUCTION

Acute ischemic stroke (AIS) remains a leading cause of mortality and long-term disability globally, with a disproportionately rising burden in low- and middle-income countries [1,2]. In South Asia, the epidemiological landscape of stroke is characterized by an earlier age of onset, higher severity, and a substantial baseline burden of metabolic syndrome [3]. Beyond the immediate focal neurological deficits, AIS represents a profound physiological stressor that rapidly compromises central autonomic networks, resulting in widespread systemic dysregulation [4,5].

The physiological response to acute cerebral ischemia involves immediate hyperactivation of the sympathetic nervous system and the hypothalamic-pituitary-adrenal (HPA) axis [6]. This acute autonomic dysregulation often manifests clinically as disrupted 24-hour blood pressure values [7]. While these shifts are adaptive in the immediate hyperacute phase to maintain cerebral perfusion, prolonged sympathetic overdrive and persistent cortisol elevation exacerbate secondary brain injury, promote hemorrhagic transformation, and worsen functional outcomes [8].

The short-term trajectory of this autonomic recovery remains underexplored in the Indian demographic. Furthermore, it is increasingly recognized that gender and baseline comorbidity profiles significantly dictate vascular vulnerability and recovery phenotypes [9]. Hypertension and diabetes mellitus uniquely alter baroreceptor sensitivity and endothelial function, thereby blunting the autonomic plasticity required for rapid post-stroke recovery [10]. This study aims to evaluate the gender distribution, comorbidity profiles, and short-term autonomic recovery patterns—measured via ABPM from admission to discharge in an Indian cohort presenting with acute ischemic stroke.

MATERIALS & METHODS

This prospective observational study was conducted in the Department of Physiology

at King George's Medical University, Lucknow. The aim was to evaluate 24-hour ambulatory blood pressure in patients with acute ischemic stroke. Ethical approval for this study was obtained from the Institutional Ethics Committee of King George's Medical University (Ref. No. XXII-PGTSC-IIA/P7), and written informed consent was obtained from all participants prior to enrolment.

Study design and participants

Adults aged ≤ 75 years admitted with acute ischemic stroke confirmed by clinical examination and neuroimaging (non-contrast CT within 24 hours of symptom onset) were eligible. Patients with a National Institutes of Health Stroke Scale (NIHSS) score between 5 and 15 at admission were included to represent moderate stroke severity. Exclusion criteria were hemorrhagic stroke, subarachnoid hemorrhage, brainstem strokes, transient ischemic attack, cortical vein thrombosis, atrial fibrillation, pre-existing endocrine disorders affecting cortisol or melatonin, corticosteroid therapy or drugs influencing melatonin secretion, and pregnancy or lactation. A purposive sampling strategy was applied, and a total of 64 patients fulfilling the eligibility criteria were recruited.

Data collection procedure

Data were collected at two time points: within 24 hours of admission and at the time of discharge. At the time of admission, demographic characteristics, clinical findings, and associated comorbidities, both biomarkers and blood pressure indices (at admission and discharge) were measured and systematically recorded.

Ambulatory blood pressure monitoring (ABPM)

Twenty-four-hour ABPM was performed using the Microlife WatchBP O3 device, which applies the oscillometric technique and is validated by international standards. Blood pressure monitoring was automated, with measurements scheduled every 30 minutes during daytime activity and every 60

minutes throughout the sleep period. Parameters recorded included 24-hour systolic and diastolic pressures and standard deviations of both [11,12].

Demographic Assessment: Baseline demographic characteristics, including gender and age, were systematically recorded at the time of admission. A detailed medical history was obtained to establish comorbidity profiles, specifically focusing on the presence of isolated hypertension, isolated diabetes mellitus, and their concurrent presentation.

Statistical Analysis

Categorical variables were summarized as frequencies and percentages. Continuous variables were expressed as mean $\pm$ standard deviation (SD). The normality of continuous data was assessed using the Shapiro–Wilk test. As the ambulatory blood pressure measurements at admission and discharge were obtained from the same participants, paired-samples *t*-tests were used to compare normally distributed admission and

discharge values for 24-hour systolic blood pressure (SBP) and diastolic blood pressure (DBP). Mean changes between admission and discharge were also calculated. A two-sided *p* value <0.05 was considered statistically significant. Statistical analyses were performed using SPSS version 26.0 (IBM Corp., Armonk, NY, USA).

RESULT

Demographic and Gender Distribution:

The study cohort consisted of 64 patients. Table 1 shows a descriptive demographic disparity, with males constituting nearly three-quarters of the cohort (71.9%, $n=46$), while 28.1% ($n=18$) were female.

Comorbidity Profiles: Table 1 details that metabolic and vascular comorbidities were prevalent. Specifically, 23.4% ($n=15$) of patients presented with isolated hypertension, and 14.1% ($n=9$) with isolated diabetes mellitus. Furthermore, 9.4% ($n=6$) suffered from combined hypertension and diabetes mellitus.

Table 1: Baseline Demographic and Comorbidity Distribution of the Study Cohort (N=64)

Parameter	Frequency (n)	Percentage (%)
Gender		
Male	46	71.9
Female	18	28.1
Metabolic Comorbidities		
Isolated Hypertension	15	23.4
Isolated Diabetes Mellitus	9	14.1
Combined Hypertension + Diabetes	6	9.4
Other /No prior known diagnosis	34	53.1

Short-Term Autonomic Recovery: Paired admission and discharge data analysis for the study cohort (N=64) demonstrates significant short-term reductions in ambulatory blood pressure parameters during hospitalization. Evaluated via paired *t*-tests, the mean 24-hour systolic blood

pressure (SBP) significantly decreased from 137.19 ± 9.10 at admission to 132.50 ± 8.13 at discharge ($p < 0.001$). Concurrently, the mean 24-hour diastolic blood pressure (DBP) exhibited a significant reduction from 71.56 ± 5.94 at admission to 67.50 ± 5.51 at discharge ($p < 0.001$).

Table 2: Twenty-four-hour systolic and diastolic blood pressure at admission and discharge of the Study Cohort (N=64)

Parameter	Admission (Mean $\pm$ SD)	Discharge (Mean $\pm$ SD)	p-value
Mean 24h SBP	137.19 ± 9.10	132.50 ± 8.13	<0.001
Mean 24h DBP	71.56 ± 5.94	67.50 ± 5.51	<0.001
SBP = systolic blood pressure; DBP = diastolic blood pressure.			

Note: Analyzed by paired *t*-test, data are mean $\pm$ SD.

DISCUSSION

This prospective cohort study highlights critical demographic disparities and establishes the trajectory of short-term autonomic recovery in an Indian AIS population. The prominent male preponderance observed in our cohort (71.9% vs. 28.1%) aligns strongly with established regional epidemiological registries and the INTERSTROKE study findings for South Asia [13]. This disparity likely reflects a higher cumulative exposure to traditional, modifiable lifestyle risk factors among Indian men, including higher prevalence rates of tobacco smoking, dyslipidemia, and central obesity [14,15].

The baseline comorbidity profile of our cohort underscores the presence of metabolic dysregulation in stroke pathogenesis. With nearly half the cohort suffering from hypertension, diabetes, or both, the data reinforces the vascular vulnerability of this demographic. Hypertension remains an important modifiable risk factor for stroke [16]. In the context of acute stroke, preexisting chronic hypertension affects autoregulatory mechanisms [17].

A central finding of this study is the documentation of severe acute autonomic dysregulation followed by partial short-term recovery. The acute phase of AIS is characterized by a "sympathetic storm," which not only drives deleterious blood pressure surges but also stimulates profound HPA-axis hyperactivation.

The parallel improvements in 24-hour ABPM parameters further validate this systemic physiological recalibration. The transition from erratic blood pressure variability and non-dipping status toward normalized circadian hemodynamics suggests a gradual return of baroreflex sensitivity and vagal tone. However, interpreting these recovery patterns requires a nuanced understanding of gender-related cardiovascular risk. Men in our cohort entered the ischemic event with a theoretically higher burden of established vascular damage. The underlying architectural damage to the vasculature

caused by years of undiagnosed or poorly managed hypertension may limit complete autonomic restitution.

These findings emphasize the critical need for gender-specific risk stratification and targeted intervention in South Asian populations. Preventative strategies must aggressively target the highly prevalent, modifiable risk factors predominantly seen in men. Furthermore, post-stroke care pathways should move beyond standard neurological assessments to integrate individualized monitoring of autonomic recovery. Tracking ABPM could provide clinicians with actionable data. This study demonstrates a marked male predominance and a high baseline burden of hypertension and diabetes within a Northern Indian acute ischemic stroke cohort. The acute stroke phase is characterized by severe autonomic disruption; however, overall improvements in ambulatory blood pressure parameters indicates robust short-term physiological recovery during hospitalization. Recognizing these demographic vulnerabilities and tracking autonomic recovery trajectories is essential for developing gender-specific prevention protocols, refining risk stratification, and personalizing rehabilitation strategies for stroke survivors in South Asia. Tailor antihypertensive resumption, physical rehabilitation intensity, and secondary prevention strategies.

CONCLUSION

This study demonstrates a marked male predominance and a high baseline burden of hypertension and diabetes within a Northern Indian acute ischemic stroke cohort. The acute stroke phase is characterized by severe autonomic disruption; however, overall improvements in ambulatory blood pressure parameters indicates robust short-term physiological recovery during hospitalization. Recognizing these demographic vulnerabilities and tracking autonomic recovery trajectories is essential for developing gender-specific prevention protocols, refining risk stratification, and

personalizing rehabilitation strategies for stroke survivors in South Asia.

Declaration

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