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Original Research Article

Admission-Day Glycemic Status and Early Clinical Outcomes in Acute Stroke: An Observational Study from a Tertiary Care Centre in India

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Abstract

Background: Acute dysglycemia — encompassing both hyperglycemia and hypoglycemia — is a common metabolic derangement during the acute phase of cerebrovascular accidents and exerts a significant adverse influence on neurological and survival outcomes.

Objective: To evaluate the association between admission-day glycemic status and short-term clinical and neurological outcomes in patients presenting with acute stroke at a tertiary care centre in eastern India.

Methods: A descriptive observational study enrolling 121 confirmed adult stroke patients admitted within 24 hours of symptom onset over an 18-month period. Capillary blood glucose (CBG) at presentation was used to classify patients into normoglycemia (70–140 mg/dL), hyperglycemia (>140 mg/dL), and hypoglycemia (<70 mg/dL). Neurological severity and functional recovery were quantified on Day 0 and Day 5 using the National Institutes of Health Stroke Scale (NIHSS) and the modified Rankin Scale (mRS).

Results: Of 121 patients, 74.4% had ischemic stroke, 20.7% hemorrhagic stroke, and 5.0% transient ischemic attack (TIA). Normoglycemia was present in 47.9%, hyperglycemia in 47.1%, and hypoglycemia in 5.0%. Admission hyperglycemia was significantly associated with higher 5-day in-hospital mortality (24.6% vs. 6.9% among normoglycemic patients; $p = 0.017$). Multivariate logistic regression identified a history of atrial fibrillation (OR = 10.90; $p = 0.007$) and prior cerebrovascular accident (OR = 6.76; $p = 0.018$) as the strongest independent predictors of poor functional outcome (mRS ≥ 3) at Day 5.

Conclusion: Admission-day hyperglycemia is a potent prognostic marker for short-term in-hospital mortality in acute stroke. Timely glycemic assessment and structured metabolic intervention within the first 24 hours of admission are essential to limiting secondary ischemic propagation and improving early survival outcomes.

Keywords: Acute stroke; dysglycemia; hyperglycemia; NIHSS; modified Rankin Scale; prognosis; India.

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Introduction

Stroke constitutes one of the foremost causes of mortality and sustained functional disability worldwide, accounting for approximately 16 million new clinical events annually, of which an estimated 6.5 million culminate in death. The Global Burden of Disease Study consistently ranks stroke as the second leading cause of death globally, with a disproportionate burden borne by low- and middle-income countries where diagnostic delays, limited infrastructure, and inadequate preventive monitoring compound mortality risk and long-term morbidity. India confronts an accelerating and inequitably distributed rise in stroke incidence, with an increasingly pronounced shift toward younger, working-age populations. Principal contributing factors include a vast uncontrolled burden of systemic hypertension, chronic metabolic disease, sedentary lifestyles, and rapidly shifting nutritional patterns. Marked disparities in both stroke incidence and access to acute care persist across urban–rural and inter-state divides, reflecting differential socioeconomic transitions and healthcare capacity. Glycemic status at the time of acute neurological presentation is a well-established determinant of tissue salvage potential and functional recovery trajectory. Both sustained chronic hyperglycemia

and transient stress-induced glycemic excursions accelerate early tissue deterioration. Elevated blood glucose at presentation intensifies oxidative stress, promotes lactic acidosis through anaerobic glycolysis within the ischemic penumbra, compromises blood–brain barrier integrity, and facilitates hemorrhagic transformation of ischemic lesions. Conversely, acute hypoglycemia deprives neurons of their principal metabolic substrate, precipitating rapid ATP depletion and irreversible injury in watershed territories.

Despite recognition of the adverse role of acute dysglycemia, systematic data linking early glycemic indices to validated clinical scales such as the NIHSS and short-term functional outcomes within Indian tertiary care settings remain inconsistent. The present study was designed to provide a rigorous, prospectively structured evaluation of admission-day blood glucose levels and to delineate their relationship with stroke severity and 5-day recovery outcomes.

Objectives

Primary Objective: To quantify glycemic derangements on the day of hospital admission and determine their statistical association with acute neurological severity as measured by the National Institutes of Health Stroke Scale (NIHSS).

Secondary Objective: To analyze the relationship between admission-day glycemic profiles and 5-day post-admission functional recovery as assessed by the modified Rankin Scale (mRS).

Review of Literature: The clinical characterization of cerebrovascular accidents has evolved substantially over the past five decades. Initially described as apoplexy, the World Health Organization formalized the operational definition of stroke in 1970 as a rapidly developing focal or global loss of cerebral function lasting more than 24 hours or resulting in death, attributable exclusively to vascular aetiology.

Contemporary updates by the American Heart Association and the American Stroke Association now integrate advanced neuroimaging criteria to precisely differentiate ischemic infarction from hemorrhagic subtypes, while standardizing transient ischemic attacks (TIAs) as transient neurological episodes without evidence of acute tissue necrosis on imaging. Ischemic stroke subtype classification has been systematized through frameworks including the TOAST system, which categorizes events into large-artery atherosclerosis, small-artery occlusion (lacunar), cardioembolism, other determined aetiology, and undetermined cause.

The Causative Classification of Stroke (CCS) and the phenotypic ASCO classification represent more recent advances, leveraging automated algorithmic grading to enhance precision in large-scale epidemiological and therapeutic research.

The biological mechanisms linking acute dysglycemia to accelerated neural injury are well-characterized. Acute hyperglycemia fuels anaerobic glycolysis within the ischemic penumbra, precipitating lactic acid accumulation and intracellular acidosis. The resultant reduction in pH worsens blood–brain barrier permeability, promotes cerebral edema, and potentiates hemorrhagic transformation. Glucose surplus additionally generates reactive oxygen species (ROS), activates microglial neuroinflammatory cascades, and suppresses endogenous neurotrophic signaling, including that mediated by Brain-Derived Neurotrophic Factor (BDNF). Conversely, acute hypoglycemia deprives neurons of substrate, causing rapid neuroglycopenic injury in border-zone regions.

Multiple international cohort studies and registries — including those of Zewde et al., Atam et al., Gangraram et al., and Marulaiah et al. — consistently report that admission hyperglycemia, particularly stress hyperglycemia occurring in non-diabetic patients, is strongly correlated with higher NIHSS scores, greater functional impairment at discharge, and elevated short-term mortality. Longitudinal analyses by Luitse et al. further demonstrate that chronic hyperglycemia, as evidenced by elevated glycosylated hemoglobin (HbA1c), independently constrains functional rehabilitation outcomes independent of acute glycemic levels.

Materials and Methods

Study Design and Setting: This descriptive observational study was conducted within the Department of General Medicine at Mahatma Gandhi Memorial Medical College and Hospital, Jamshedpur, India, over a continuous 18-month period following Institutional Ethics Committee approval.

Patient Selection: Inclusion criteria comprised: a confirmed clinical and radiological diagnosis of acute cerebrovascular accident; age above 18 years; presentation within 24 hours of symptom onset; and complete glycemic data documented within the initial 24 hours of admission.

Exclusion criteria encompassed: presentation beyond 24 hours from symptom onset; active systemic infection, intracranial or extracranial malignancy, or structural head trauma; acute myocardial infarction; pregnancy; pre-existing coagulation pathology; and refusal to provide written informed consent.

Clinical and Laboratory Assessment: On admission, capillary blood glucose (CBG) was measured using a calibrated digital glucometer and

classified into three tiers: normoglycemia (70–140 mg/dL), hyperglycemia (>140 mg/dL), and hypoglycemia (<70 mg/dL). A standardized Case Reporting Form (CRF) captured demographic data, comorbidity history, prior medication adherence, and detailed clinical examination findings. Laboratory investigations included complete blood counts, renal and hepatic function panels, fasting lipid profiles, 12-lead electrocardiography, and non-contrast computed tomography (CT) or magnetic resonance imaging (MRI) of the brain.

Outcome Assessment: Neurological severity was assessed on Day 0 and Day 5 using the NIHSS (12 parameters; total score range 0–42), stratified as minor (1–4), moderate (5–15), moderate-to-severe (16–20), and severe (21–42). Functional recovery at Day 5 was assessed using the mRS: a score of ≤2 denoted a good outcome; a score of ≥3 indicated severe disability or death.

Statistical Methods: Data were managed in Microsoft Excel and analyzed using SPSS (IBM Corp., Armonk, NY). Continuous variables are expressed as mean ± standard deviation (SD); categorical variables as frequencies and percentages. Inter-group comparisons utilized the Chi-square test for categorical endpoints and one-way ANOVA for continuous parameters.

Multivariate logistic regression with stepwise variable selection was performed to identify independent predictors of poor Day 5 functional outcome (mRS ≥ 3). Statistical significance was set at a two-tailed p-value of < 0.05.

Results

A total of 121 participants fulfilling all eligibility criteria were enrolled and completed the full diagnostic and follow-up protocol. Baseline demographic and clinical characteristics are presented in Tables 1 through 3; clinical outcomes by glycemic tier are summarized in Tables 4 and 5; and independent predictors of functional outcome are shown in Table 6.

Table 1: Distribution of Study Participants by Age Group and Gender

Variable	Frequency (n = 121)	Percentage (%)
Age < 25 years	8	6.6%
Age 26–40 years	11	9.1%
Age 41–55 years	25	20.7%
Age 56–70 years	36	29.8%
Age 71–85 years	41	33.9%
Gender: Female	45	37.2%
Gender: Male	76	62.8%

Table 2: Clinical Baseline Profile, Comorbidities, and Stroke Subtypes

Clinical Parameter	Frequency	Percentage (%)
Hypertension	65	53.7%
Diabetes Mellitus	32	26.4%
Dyslipidemia	24	19.8%
Poor Medication Compliance	72	59.5%
Ischemic Stroke	90	74.4%
Hemorrhagic Stroke	25	20.7%
Transient Ischemic Attack (TIA)	6	5.0%
Presentation within 24 hours of symptom onset	121	100.0%

Table 3: Presenting Symptoms and Lipid Abnormalities

Symptom / Lipid Abnormality	Frequency	Percentage (%)
Motor Weakness / Focal Numbness	49	40.5%
Speech Difficulties / Aphasia / Dysarthria	27	22.3%
Visual Disturbances	19	15.7%
Acute Loss of Consciousness	18	14.9%
Severe Headache	8	6.6%
Elevated Total Cholesterol	45	37.2%
Elevated Triglycerides	33	27.3%
Low HDL Cholesterol	23	19.0%
Elevated LDL Cholesterol	20	16.5%

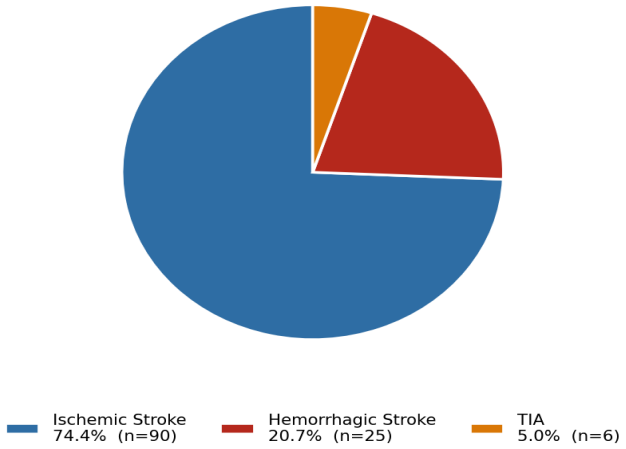


Figure 1: Proportional distribution of confirmed stroke subtypes at admission (n = 121). Ischemic stroke constituted the majority, accounting for 74.4% of cases

Table 4: Comparative NIHSS Neurological Severity — Day 0 vs. Day 5

Severity Category	Day 0 — n (%)	Day 5 — n (%)
Minor Stroke (NIHSS 1–4)	32 (26.4%)	41 (33.9%)
Moderate Stroke (NIHSS 5–15)	54 (44.6%)	58 (47.9%)
Moderate-to-Severe (NIHSS 16–20)	22 (18.2%)	16 (13.2%)
Severe Stroke (NIHSS 21–42)	13 (10.7%)	6 (5.0%)
Mean NIHSS Score ± SD	13.9 ± 10.7	9.2 ± 7.4

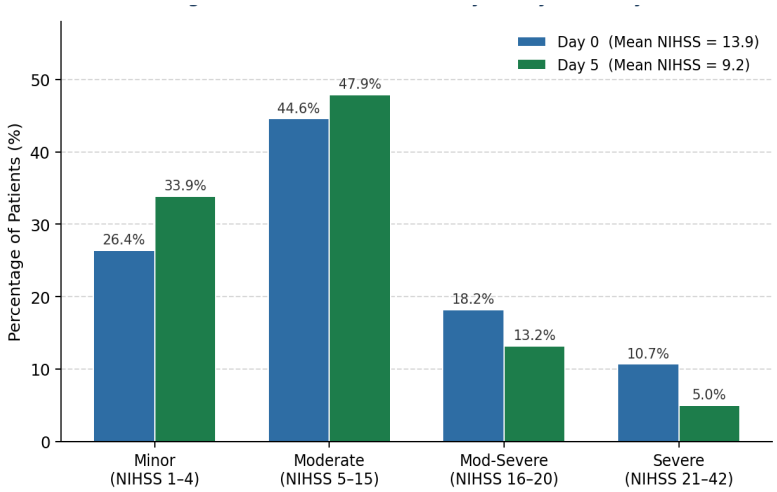


Figure 2: Grouped bar chart comparing neurological severity at admission (Day 0) and Day 5. Mean NIHSS improved from 13.9 ± 10.7 at admission to 9.2 ± 7.4 at Day 5, reflecting early neurological recovery across the cohort

Table 5: Clinical Outcomes by Admission Glycemic Tier

Outcome	Normoglycemia (n = 58)	Hyperglycemia (n = 57)	Hypoglycemia (n = 6)	p-value
Good Outcome (mRS ≤ 2)	27 (46.6%)	20 (35.1%)	4 (66.7%)	0.212[n]
Poor Outcome (mRS ≥ 3)	31 (53.4%)	37 (64.9%)	2 (33.3%)	—
Mean Admission NIHSS (± SD)	13.3 ± 9.3	14.3 ± 11.3	15.7 ± 18.9	0.816ˆ
Alive at Day 5	54 (93.1%)	43 (75.4%)	6 (100.0%)	0.017*[n]
Deceased at Day 5	4 (6.9%)	14 (24.6%)	0 (0.0%)	—

* Statistically significant ($p < 0.05$) | [n] Chi-square test | ˆ One-way ANOVA

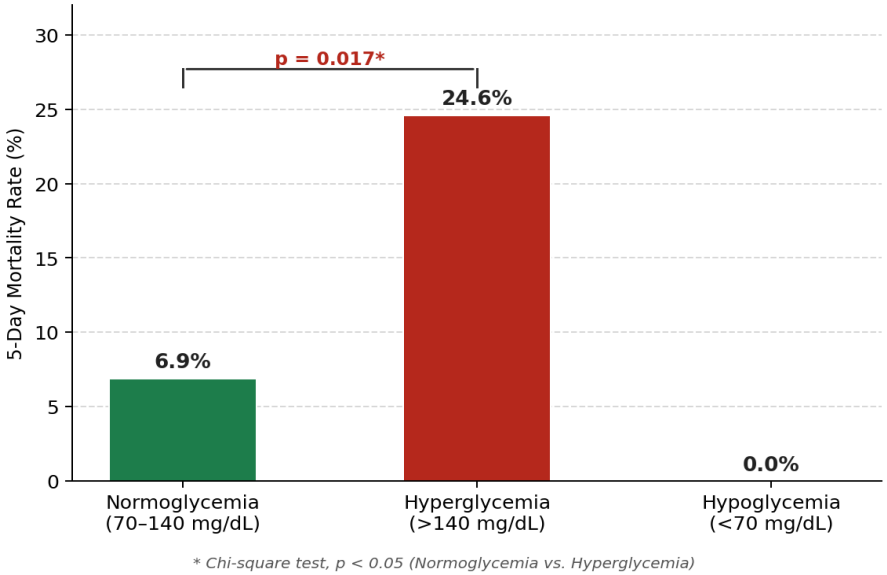


Figure 3: 5-day in-hospital mortality rates stratified by admission glycemic tier. Admission hyperglycemia was significantly associated with greater mortality relative to normoglycemia (24.6% vs. 6.9%; p = 0.017, Chi-square test)

Table 6: Multivariate Logistic Regression — Independent Predictors of Poor Day 5 Functional Outcome (mRS ≥ 3)

Predictor Variable	Log Odds	SE	OR	z-stat	p-value
Intercept	2.479	1.216	13.04	2.039	0.041
Age (continuous scale)	−0.025	0.013	0.975	−1.842	0.066
Gender (Male vs. Female)	0.706	0.496	2.025	1.422	0.155
Atrial Fibrillation (Yes vs. No)	2.389	0.885	10.90	2.698	0.007*
Prior Stroke / TIA (Yes vs. No)	1.911	0.806	6.76	2.369	0.018*
Hyperglycemia vs. Normoglycemia	0.410	0.487	1.506	0.841	0.400
Hypoglycemia vs. Normoglycemia	−2.464	1.121	0.085	−2.198	0.028*
Stroke Severity: Moderate vs. Minor	−1.221	0.580	0.295	−2.105	0.035*
In-hospital Infection (Yes vs. No)	−0.657	0.570	0.915	−1.153	0.249

* Statistically significant at $p < 0.05$ | Residual Deviance = 129.67 | AIC = 165.67 | McFadden's Pseudo-R^2 = 0.213

Discussion

The demographic profile of this cohort closely aligns with established neuro-epidemiological patterns from South Asian settings. The predominance of patients in the 71–85-year age bracket (33.9%) reinforces the recognized association between advancing age and escalating cerebrovascular vulnerability, consistent with regional data from Deuri et al., who documented inferior functional recovery trajectories in elderly patients attributable to multi-system physiological decline. The marked male preponderance (62.8%) echoes reports from Kumar et al. and Zewde et al. and is attributable to the greater prevalence among men of modifiable risk exposures including tobacco use, alcohol consumption, and sustained occupational stress.

The metabolic comorbidity profile — characterized by high rates of hypertension (53.7%) and confirmed diabetes mellitus (26.4%) — serves as a primary pathogenetic accelerant of ischemic propagation. Of particular clinical significance is the high rate of pre-admission medication non-compliance (59.5%), which reveals a substantial and remediable gap in community-level chronic disease management. These findings echo those of Gangraram et al., who linked inconsistent antihypertensive and antidiabetic medication use to higher baseline NIHSS scores and increased risk of hemorrhagic transformation. The central clinical finding of this study is the robust and statistically significant association between admission-day hyperglycemia and early in-hospital mortality. With 47.1% of the enrolled cohort hyperglycemic at presentation, the 5-day mortality rate in this subgroup reached 24.6%, compared with 6.9% among normoglycemic patients ($p = 0.017$). This finding corroborates those of Atam et al., who identified stress-induced hyperglycemia as an independent in-hospital mortality predictor irrespective of antecedent diabetes status. Critically, the absence of statistically significant inter-group

differences in mean admission NIHSS across glycemic tiers (p = 0.816) demonstrates that dysglycemia independently accelerates cellular injury within metabolically salvageable penumbral tissue, rather than simply functioning as a surrogate marker for larger infarct volume.

The multivariate regression model revealed an unexpected finding regarding hypoglycemia: a statistically significant inverse association with poor functional outcome (OR = 0.085; p = 0.028). This may reflect a distinct pathophysiological subgroup characterized by milder strokes, more responsive to bedside glucose correction, or may represent a chance finding given the very small hypoglycemic subgroup (n = 6).

Substantial caution is warranted before drawing clinical generalizations from this observation, and dedicated studies with larger hypoglycemic cohorts are necessary. The strongest independent determinants of poor 5-day functional outcome were a history of atrial fibrillation (OR = 10.90; p = 0.007) and prior cerebrovascular events (OR = 6.76; p = 0.018), underscoring the critical importance of dedicated cardiac monitoring, anticoagulation optimization, and robust secondary stroke prophylaxis in at-risk populations.

Conclusions

This 18-month tertiary care observational study of 121 verified acute stroke patients demonstrates that admission-day hyperglycemia is both highly prevalent (47.1%) and a statistically significant independent predictor of short-term in-hospital mortality (p = 0.017). The absence of significant inter-group differences in admission NIHSS confirms that early dysglycemia operates as an active biological modifier of ischemic tissue survival, rather than a passive reflection of initial infarct magnitude.

Multivariate analysis further identifies a history of atrial fibrillation and recurrent cerebrovascular events as the most powerful independent determinants of early functional disability. The elevated rate of pre-hospital medication non-compliance (59.5%) underscores an urgent need for structured community-level surveillance, patient education, and proactive management of chronic vascular risk.

These findings collectively highlight that immediate glycemic triage, rapid identification of dysglycemic states, and standardized metabolic intervention protocols within the first 24 hours of acute stroke admission represent essential, actionable strategies for optimizing neuroprotection, reducing penumbral injury, and minimizing preventable mortality within regional tertiary care networks.

References

1. Adams HP Jr, Biller J. Classification of Subtypes of Ischemic Stroke. Stroke. 2015;46(5):e114–e117.
2. Arsava EM, Ballabio E, Benner T, et al. The Causative Classification of Stroke system. Neurology. 2010;75(14):1277–1284.
3. Amarenco P, Bogousslavsky J, Caplan LR, et al. New Approach to Stroke Subtyping: The A-S-C-O (Phenotypic) Classification. Cerebrovasc Dis. 2009;27(5):502–508.
4. Pandian JD, Gall SL, Kate MP, et al. Prevention of stroke: a global perspective. Lancet. 2018;392(10154):1269–1278.
5. Behera DK, Rahut DB, Mishra S. Analyzing stroke burden and risk factors in India using data from the Global Burden of Disease Study. Sci Rep. 2024;14(1):22640.
6. Saini V, Guada L, Yavagal DR. Global Epidemiology of Stroke and Access to Acute Ischemic Stroke Interventions. Neurology. 2021;97(20 Suppl 2):S6–S16.
7. Ashburner JM, Go AS, Chang Y, et al. Effect of Diabetes and Glycemic Control on Ischemic Stroke Risk in AF Patients. J Am Coll Cardiol. 2016;67(3):239–247.
8. Tiwari S, Joshi A, Rai N, Satpathy P. Impact of Stroke on Quality of Life of Stroke Survivors and Their Caregivers. J Neurosci Rural Pract. 2021;12(4):680–686.
9. Yang CJ, Liao WI, Wang JC, et al. Usefulness of HbA1c-based glycemic variables in diabetic patients with acute ischemic stroke. Am J Emerg Med. 2017;35(9):1240–1246.
10. Kim YS, Kim C, Jung KH, et al. Range of glucose as a glycemic variability and 3-month outcome in diabetic patients with acute ischemic stroke. PLoS One. 2017;12(9):e0183894.
11. Duan ZW, Li ZN, Zhai YJ, et al. Effects of glycemic indicators on early neurological outcomes in acute ischemic stroke treated with thrombolysis. World J Diabetes. 2025;16(3):944–951.
12. Lattanzi S, Bartolini M, Provinciali L, Silvestrini M. Glycosylated Hemoglobin and Functional Outcome after Acute Ischemic Stroke. J Stroke Cerebrovasc Dis. 2016;25(7):1786–1791.
13. Palaiodimou L, Lioutas VA, Lambadiari V, et al. Glycemic variability of acute stroke patients and clinical outcomes: a continuous glucose monitoring study. Ther Adv Neurol Disord. 2021;14:17562864211045876.
14. Boulanger J, Lindsay M, Gubitz G, et al. Canadian Stroke Best Practice Recommendations for Acute Stroke Management, 6th Edition, 2018. Int J Stroke. 2018;13(9):949–984.

15. Ferrari F, Moretti A, Villa RF. Hyperglycemia in acute ischemic stroke: physiopathological and therapeutic complexity. Neural Regen Res. 2022;17(2):292–299.
16. Merlino G, Smeralda C, Sponza M, et al. Dynamic Hyperglycemic Patterns Predict Adverse Outcomes in Acute Ischemic Stroke Undergoing Mechanical Thrombectomy. J Clin Med. 2020;9(6):1932.
17. Lyden P, Brott T, Tilley B, et al. Improved reliability of the NIH Stroke Scale using video training. Stroke. 1994;25(11):2220–2226.
18. Lyden PD, Lu M, Levine SR, et al. A Modified NIHSS for Use in Stroke Clinical Trials. Stroke. 2001;32(6):1310–1317.
19. Reznik ME, Yaghi S, Jayaraman MV, et al. Baseline NIHSS is an inferior predictor of functional outcome in the era of acute stroke intervention. Int J Stroke. 2018;13(8):806–810.
20. Tanaka R, Ueno Y, Miyamoto N, et al. Impact of diabetes and prediabetes on short-term prognosis in acute ischemic stroke. J Neurol Sci. 2013;332(1–2):45–50.
21. Wada S, Yoshimura S, Inoue M, et al. Outcome Prediction in Acute Stroke Patients by Continuous Glucose Monitoring. J Am Heart Assoc. 2018;7(8):e008744.
22. Woo E, Chan YW, Yu YL, Huang CY. Admission glucose level in relation to mortality and morbidity in 252 stroke patients. Stroke. 1988;19(2):185–191.
23. Banks JL, Marotta CA. Outcomes Validity and Reliability of the Modified Rankin Scale. Stroke. 2007;38(3):1091–1096.
24. Li J, Quan K, Wang Y, et al. Effect of Stress Hyperglycemia on Neurological Deficit and Mortality in Acute Ischemic Stroke. Front Neurol. 2020;11:584286.
25. Luitse MJ, Velthuis BK, Kappelle LJ, et al. Chronic hyperglycemia is related to poor functional outcome after acute ischemic stroke. Int J Stroke. 2017;12(2):180–186.