

ISSN Print: 2520-5552

ACE Journal of Neurosciences
https://acejneuro.com/

Research Article

Clinical and Imaging Predictors of Functional Outcome in Acute Ischemic Stroke: A Retrospective Study

Akash M Awati[1*]

[1]Associate Professor, Dept of Neurology, Gulbarga Institute of Medical Sciences, Kalaburagi, Karnataka, India

***Corresponding Author**
Akash M Awati
(awatiakash@gmail.com)

Article History
Received: 12.09.2026
Accepted: 27.10.2026
Published: 11.11.2026

doi: 10.61336/acejn.0404.06

Abstract: Background: Reliable early prediction of functional outcome after acute ischemic stroke (AIS) remains a clinical priority. We assessed clinical and imaging admission variables as predictors of 90-day functional outcome. **Methods:** Retrospective cohort of 318 consecutive adults with AIS admitted between January 2022 and December 2024 to a tertiary care center. The primary outcome was favorable status (modified Rankin Scale [mRS] 0–2) at 90 days. Multivariable logistic regression identified independent predictors. **Results:** Favorable outcome occurred in 148 patients (46.5%). Independent predictors were younger age, lower admission NIHSS, higher ASPECTS, admission glucose <180 mg/dL and good collateral status; model AUC 0.86. **Conclusion:** A parsimonious combination of five admission variables strongly predicts 90-day outcome and can support triage and counseling in real-world practice.

Keywords: Acute Ischemic Stroke, Modified Rankin Scale, Nihss, Aspects, Collateral Circulation, Functional Outcome, Prognosis

Copyright @ 2026: This is an open-access article distributed under the terms of the Creative Commons Attribution license which permits unrestricted use, distribution and reproduction in any medium for non-commercial use (NonCommercial, or CC-BY-NC) provided the original author and source are credited.

INTRODUCTION

Stroke remains among the leading causes of death and long-term disability worldwide, imposing an enormous global health and economic burden [1,2]. The Global Burden of Disease 2019 study estimated more than 12 million incident strokes annually, of which roughly 62% were ischemic in nature [3]. In low- and middle-income countries, age-standardized incidence, prevalence and mortality attributable to stroke continue to rise, driven by expanding populations of individuals with hypertension, diabetes mellitus, dyslipidemia and adverse lifestyle risk factors [4,5].

Acute Ischemic Stroke (AIS) results from occlusion of a cerebral artery causing hypoperfusion and neuronal injury. Its clinical trajectory is heterogeneous, ranging from near-complete recovery to severe disability or death and depends on multiple interacting variables including patient age, comorbid disease, stroke severity, infarct topography, collateral circulation and timing of reperfusion therapy [6-8]. Reperfusion strategies intravenous thrombolysis (IVT) with alteplase or tenecteplase and endovascular thrombectomy (EVT) for large-vessel occlusion have transformed acute stroke care over the past two decades and are supported by robust evidence in contemporary guidelines [9-13].

Despite these advances, a substantial proportion of AIS survivors remain functionally dependent at 90 days and reliable early prediction of outcome remains valuable for triage, family counseling, resource allocation and rehabilitation planning [14,15]. The modified Rankin Scale (mRS) at 90 days is the most widely accepted composite endpoint for functional outcome in stroke research [16,17].

Numerous clinical predictors of poor outcome have been identified, including advanced age, higher admission National Institutes of Health Stroke Scale (NIHSS) score, hyperglycemia, atrial fibrillation, pre-stroke disability and delayed presentation [18-23]. Imaging predictors early ischemic changes on non-contrast CT quantified by the Alberta Stroke Program Early CT Score (ASPECTS), infarct core volume on diffusion-weighted MRI, site of arterial occlusion and collateral status on CT angiography have also demonstrated strong prognostic value [24-30]. However, most published prognostic models originate from high-income settings and randomized trial populations and their performance in unselected real-world cohorts, particularly in South Asian populations, is less well characterized [31-33].

We therefore conducted this retrospective observational study to identify independent clinical and imaging predictors of 90-day functional outcome in patients presenting with AIS to a tertiary care center. We hypothesized that a parsimonious combination of readily available admission variables age, NIHSS, ASPECTS, admission glucose and collateral score would independently predict favorable outcome (mRS 0–2).

MATERIAL AND METHODS

Study Design and Setting

This was a single-center retrospective observational study conducted at the Department of Neurology of a tertiary care teaching hospital between January 2022 and December 2024. The protocol was approved by the Institutional Ethics

Committee (IEC/2024/NEURO/018) and conducted in accordance with the Declaration of Helsinki [34]. Owing to the retrospective design and use of anonymized data, the requirement for individual informed consent was waived.

Participants

We screened consecutive adult patients (≥18 years) admitted with a clinical diagnosis of AIS confirmed on non-contrast CT and/or MRI. Patients were included if they presented within 7 days of symptom onset, had documented baseline neurological assessment and had at least one follow-up assessment at 90 ± 14 days. We excluded patients with:

sPrimary intracerebral or subarachnoid hemorrhage

- Transient ischemic attack without radiological infarct
- Stroke mimics
- Pre-stroke mRS >2
- Incomplete imaging or missing outcome data
- In-hospital death from a clearly non-neurological cause

Data Collection

Data were extracted from electronic medical records, imaging archives and a prospectively maintained stroke registry using a standardized case-record form. Two trained investigators independently collected the data; discrepancies were resolved by a senior neurologist. Clinical variables comprised demographics, vascular risk factors (hypertension, diabetes mellitus, dyslipidemia, prior stroke/TIA, atrial fibrillation, ischemic heart disease, current smoking), pre-stroke mRS, admission blood pressure, random blood glucose and admission NIHSS. Stroke subtype was classified according to TOAST criteria [36].

Imaging Assessment

All patients underwent non-contrast CT of the brain at admission; when clinically indicated and feasible, CT angiography (CTA) and/or MRI with diffusion-weighted imaging were performed. Two neuroradiologists blinded to clinical outcome independently scored the images. Early ischemic changes on baseline CT/DWI were quantified using ASPECTS (0–10) for anterior circulation strokes and pc-ASPECTS for posterior circulation strokes [34,37]. Site of arterial occlusion on CTA/MRA was categorized as internal carotid artery (ICA), M1/M2 middle cerebral artery (MCA), anterior cerebral artery, basilar/posterior circulation, or no visible occlusion. Collateral status was graded on single-phase CTA using the modified Tan scale (0–3) and dichotomized into poor (0–1) and good (2–3) [27]. Interobserver agreement was assessed by κ statistic on a random 15% subsample and was substantial for both ASPECTS ($\kappa = 0.78$) and collateral grading ($\kappa = 0.74$).

Treatment and Outcome

Treatment decisions intravenous thrombolysis, endovascular thrombectomy, or best medical management—followed contemporary AHA/ASA and Indian Stroke Association recommendations [9,38]. The primary outcome was functional status at 90 days assessed by mRS, obtained through structured in-person or telephonic interview by trained personnel; favorable outcome was defined as mRS 0–2 [17,39] Secondary outcomes included in-hospital mortality, symptomatic intracranial hemorrhage per ECASS III criteria [10] and early neurological deterioration (increase of ≥4 NIHSS points within 72 h) [40].

Statistical Analysis

Continuous variables were summarized as mean ± SD or median (interquartile range, IQR) based on distribution assessed by the Shapiro–Wilk test and compared using the student t test or Mann–Whitney U test. Categorical variables were expressed as frequency (%) and compared using χ^2 or Fisher's exact test. Variables associated with favorable outcome at $p<0.10$ in univariable analysis were entered into a multivariable logistic regression model using backward elimination. Multicollinearity was assessed using variance inflation factors (VIF <2). Model discrimination was assessed by the area under the receiver operating characteristic curve (AUC) and calibration by the Hosmer–Leme show test [41]. Sample size estimation, based on an expected favorable outcome rate of 45% and at least 10 outcome events per candidate predictor for up to 12 variables, indicated a minimum of 270 patients [42]. Analyses were performed in SPSS v26.0 (IBM Corp., Armonk, NY) and R v4.3.1. Two-sided $p<0.05$ was considered significant.

RESULTS

Patient Characteristics

Of 412 patients screened, 318 met eligibility criteria and were included in the final analysis. The mean age was 62.4±13.1 years and 197 (61.9%) were male. Hypertension (68.9%) and diabetes mellitus (39.6%) were the most prevalent risk

factors. Median admission NIHSS was 11 (IQR 6–17) and median ASPECTS was 8 (IQR 6–10). Anterior circulation strokes accounted for 82.4% of cases. Intravenous thrombolysis was administered in 91 patients (28.6%) and endovascular thrombectomy in 34 (10.7%); median door-to-needle time was 52 minutes (IQR 38–71). Baseline characteristics stratified by 90-day outcome are shown in Table 1.

At 90 days, 148 patients (46.5%) achieved favorable outcome (mRS 0–2), 132 (41.5%) had moderate-to-severe disability (mRS 3–5) and 38 (11.9%) had died. The distribution of mRS scores is shown in Figure 1.

Univariable Analysis

On univariable analysis, patients with favorable outcome were younger, had lower admission NIHSS, higher ASPECTS, lower admission glucose, less frequently had atrial fibrillation and prior stroke, more often received IVT and had good collateral status (Table 1, all $p<0.05$). Sex, hypertension, dyslipidemia and ischemic heart disease did not differ significantly between groups.

The proportion of patients achieving favorable outcome declined progressively across NIHSS strata 82.1% among those with NIHSS 0–5, 55.0% with NIHSS 6–10, 32.5% with NIHSS 11–20 and 9.1% with NIHSS >20 ($p<0.001$; Figure 2).

Similarly, favorable outcome rates increased with higher ASPECTS: 15.6% for ASPECTS 0–4, 38.2% for 5–7 and 63.4% for 8–10 ($p<0.001$; Figure 3).

Table 1: Baseline Characteristics Stratified by 90-Day Outcome (n = 318)

Variable	Favorable (mRS 0–2) n = 148	Unfavorable (mRS 3–6) n = 170	p-value
Age, years, mean ± SD	57.8 ± 12.4	66.4 ± 12.6	<0.001
Male, n (%)	92 (62.2)	105 (61.8)	0.94
Hypertension, n (%)	98 (66.2)	121 (71.2)	0.34
Diabetes mellitus, n (%)	51 (34.5)	75 (44.1)	0.08
Dyslipidemia, n (%)	45 (30.4)	58 (34.1)	0.48
Atrial fibrillation, n (%)	14 (9.5)	39 (22.9)	0.001
Prior stroke / TIA, n (%)	12 (8.1)	29 (17.1)	0.02
Current smoker, n (%)	38 (25.7)	41 (24.1)	0.75
Admission NIHSS, median (IQR)	7 (4–11)	15 (10–20)	<0.001
Admission glucose, mg/dL, median (IQR)	138 (108–172)	172 (132–220)	<0.001
ASPECTS, median (IQR)	9 (8–10)	7 (5–8)	<0.001
Good collaterals (Tan 2–3), n (%)	96 (64.9)	61 (35.9)	<0.001
Anterior circulation stroke, n (%)	118 (79.7)	144 (84.7)	0.24
Intravenous thrombolysis, n (%)	55 (37.2)	36 (21.2)	0.002
Endovascular thrombectomy, n (%)	22 (14.9)	12 (7.1)	0.02

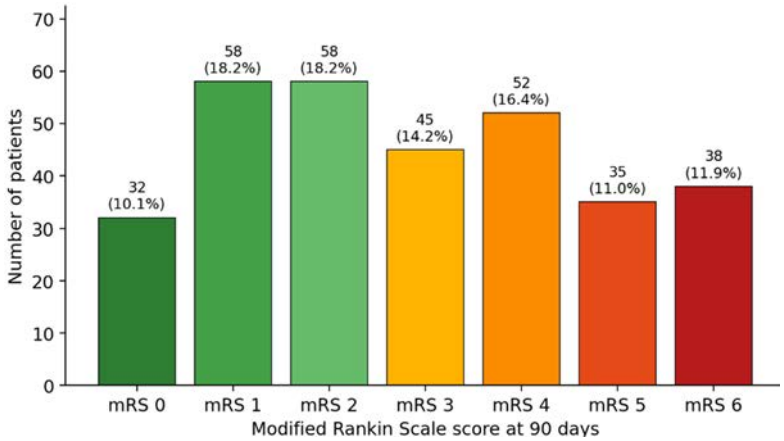

Figure 1: Distribution of Modified Rankin Scale (mRS) Scores at 90 days (n = 318). Green Bars Denote Favorable Outcome (mRS 0–2); Amber/Red Bars Denote Unfavorable Outcome (mRS 3–6)

Multivariable Analysis

In the multivariable logistic regression model, five variables independently predicted favorable outcome: younger age, lower admission NIHSS, higher ASPECTS, admission glucose <180 mg/dL and good collateral status. Receipt of IVT showed a favorable trend but did not reach independent significance after adjustment. Details are presented in Table 2.

The final model discriminated well, with AUC 0.86 (95% CI 0.82–0.90) and adequate calibration (Hosmer–Lemeshow $\chi^2 = 6.4$, $p = 0.60$).

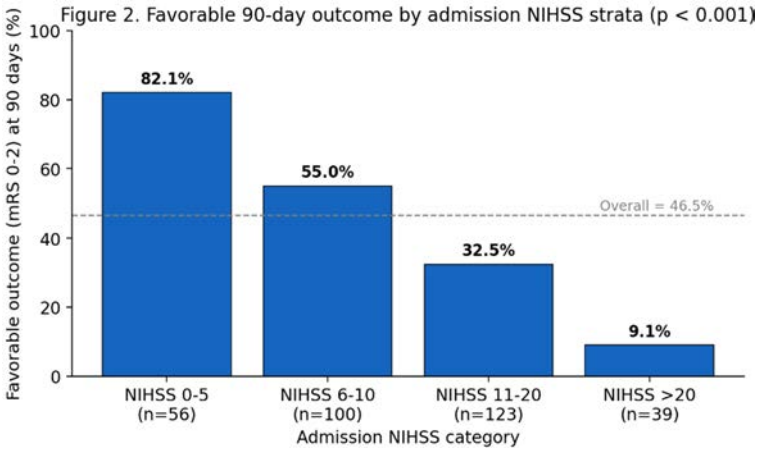

Figure 2: Proportion of Patients with Favorable Outcome (mRS 0–2) at 90 days by Admission NIHSS Strata. The Dashed Horizontal Line Represents the Overall Favorable Outcome rate (46.5%)

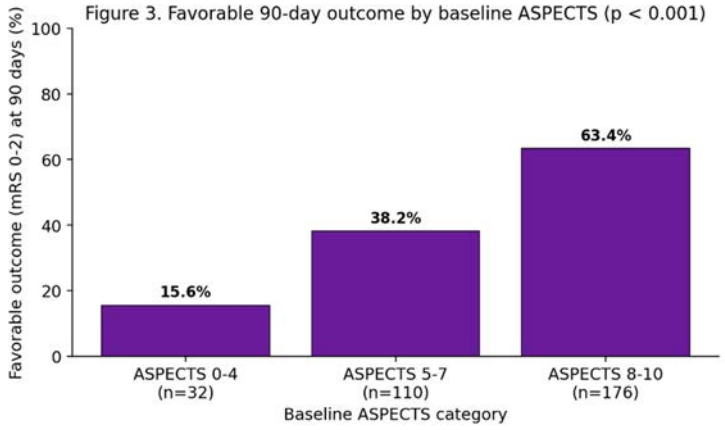

Figure 3: Proportion of Patients with Favorable Outcome (mRS 0–2) at 90 Days by Baseline ASPECTS Category. Higher ASPECTS was Strongly Associated with Better Outcome

Table 2: Multivariable Logistic Regression Independent Predictors of Favorable 90-Day Outcome (mRS 0–2)

Predictor	Adjusted OR	95% CI	p value
Age (per year)	0.96	0.94–0.98	<0.001
Admission NIHSS (per point)	0.85	0.81–0.89	<0.001
ASPECTS (per point)	1.42	1.22–1.66	<0.001
Admission glucose <180 mg/dL	2.18	1.28–3.71	0.004
Good collateral status (Tan 2–3)	2.85	1.54–5.27	<0.001
Intravenous thrombolysis	1.62	0.92–2.86	0.096
Atrial fibrillation	0.71	0.34–1.49	0.37

Secondary Outcomes

In-hospital mortality was 8.5% (27/318). Symptomatic intracranial hemorrhage occurred in 7 patients (2.2%); all had received reperfusion therapy. Early neurological deterioration occurred in 47 patients (14.8%) and was strongly associated with poor outcome (mRS 3–6 in 87.2% vs 44.6%; p<0.001).

DISCUSSION

In this retrospective cohort of 318 patients with acute ischemic stroke managed at a tertiary center, we identified five independent admission predictors of favorable functional outcome at 90 days: younger age, lower NIHSS, higher ASPECTS, euglycemia and good collateral status. The multivariable model demonstrated strong discrimination (AUC 0.86), comparable to established prognostic scores such as ASTRAL, iScore, PLAN, DRAGON and THRIVE-c [43-47].

Our observed favorable outcome rate of 46.5% is in line with contemporary registries such as the Get with The Guidelines–Stroke database and the SITS-International registry [48,49]. The strong independent effect of admission NIHSS reproduces one of the most consistently reported findings in stroke prognostication: each additional NIHSS point at admission decreased the odds of favorable outcome by approximately 15%, closely matching prior work [19,20,50]. NIHSS thus remains a cornerstone bedside prognostic instrument in AIS and continues to underpin most published prognostic scores.

Age remains the most robust non-modifiable predictor of outcome. Older adults have reduced brain reserve, greater comorbidity burden and diminished neuroplasticity, all of which limit recovery [18,51]. Nonetheless, elderly patients should not be excluded from reperfusion therapy on the basis of age alone; several trials and registries have shown benefit of thrombolysis and thrombectomy across all age groups, including octogenarians and nonagenarians [52,53].

The prognostic value of ASPECTS in our cohort supports its role as a rapid, reproducible imaging biomarker of early ischemic change on non-contrast CT [24,25]. An ASPECTS threshold of ≥6 has been used in most landmark thrombectomy trials to select patients likely to benefit from endovascular therapy [11,54]. Our finding of a 42% increase in the odds of favorable outcome per unit increase in ASPECTS reinforces the utility of this scale in resource-limited settings where advanced perfusion imaging (CT perfusion, MRI DWI/PWI) may not be routinely available [55]. Automated ASPECTS software has additionally been shown to be non-inferior to expert neuroradiologists and can accelerate decision-making [55].

Admission hyperglycemia is a well-recognized adverse prognostic marker that may reflect a stress response, undiagnosed diabetes, or worsening of ischemic injury via lactic acidosis, oxidative stress and impaired reperfusion [21,56]. Our observation that admission glucose <180 mg/dL was independently associated with favorable outcome is consistent with meta-analyses reporting worse functional outcomes and higher hemorrhagic transformation risk in hyperglycemic stroke [57]. However, the SHINE trial did not demonstrate benefit of intensive glucose lowering [58], underscoring that hyperglycemia is likely as much a marker of disease severity as a directly modifiable therapeutic target.

Good collateral status emerged as a particularly powerful independent predictor, nearly tripling the odds of favorable outcome. Collaterals sustain penumbral tissue, slow infarct progression and enhance response to reperfusion [27,28,59]. Our findings align with post-hoc analyses of MR CLEAN and ESCAPE, which showed that patients with good collaterals derived substantially larger treatment effects from thrombectomy [60,61]. Simple single-phase CTA scoring, as used in our study, offers a pragmatic and widely deployable means of collateral evaluation.

Although IVT did not reach independent significance in our multivariable model, this likely reflects the modest proportion treated (28.6%) and confounding by indication—patients receiving IVT often had more severe strokes. The favorable trend (aOR 1.62) and lack of increased mortality are reassuring and consistent with individual-patient-data meta-analyses of trials showing net benefit up to 4.5 hours after onset [62,63]. Endovascular thrombectomy was performed in only 10.7% of patients, reflecting the constraints of access to interventional services in our region a challenge shared across South Asia and other low- and middle-income settings [64,65].

Strengths and limitations

Our study has several strengths: consecutive enrollment, blinded imaging assessment with good interobserver agreement, complete 90-day follow-up and application of contemporary statistical standards including sample-size adequacy for multivariable modeling. Limitations include the single-center retrospective design, which may limit generalizability; lack of routine advanced perfusion imaging; the absence of newer biomarkers such as high-sensitivity C-reactive protein, NT-proBNP, or neurofilament light chain; and reliance on telephonic mRS assessment in a subset of patients, though this method has been validated.[39] Selection bias cannot be entirely excluded and residual confounding by unmeasured variables (e.g., pre-hospital delay, workflow metrics, rehabilitation intensity) is possible. External validation in a prospective, multicenter cohort would strengthen the generalizability of our model.

CONCLUSION

In this real-world retrospective cohort of acute ischemic stroke patients from a tertiary care center, five easily obtainable admission variables age, NIHSS, ASPECTS, blood glucose and collateral status independently predicted 90-day functional outcome, with strong overall discrimination (AUC 0.86). These findings support the routine incorporation of a simple clinical–imaging composite into acute stroke workflows to guide triage, family counseling, therapeutic decisions and rehabilitation planning, particularly in resource-limited settings where access to advanced perfusion imaging and endovascular therapy remains inequitable. Prospective multicenter validation and integration with emerging perfusion metrics and serum biomarkers are warranted to refine risk stratification further.

Ethics Approval

Institutional Ethics Committee approval (IEC/2024/NEURO/018); informed consent waived due to retrospective design.

Data availability

Anonymized data available from the corresponding author on reasonable request

REFERENCES

1. GBD 2019 Diseases and Injuries Collaborators. "Global burden of 369 diseases and injuries in 204 countries and territories, 1990–2019." *The Lancet*, vol. 396, no. 10258, 2020, pp. 1204–1222.
2. Feigin, V.L. *et al*. "Global, regional and national burden of stroke and its risk factors, 1990–2019." *The Lancet Neurology*, vol. 20, no. 10, 2021, pp. 795–820.
3. GBD 2019 Stroke Collaborators. "Global burden of stroke and its risk factors 1990–2019." *The Lancet Neurology*, vol. 20, 2021, pp. 1029–1045.
4. Krishnamurthi, R.V. *et al*. "Global and regional burden of first-ever ischaemic and haemorrhagic stroke during 1990–2010." *The Lancet Global Health*, vol. 1, no. 5, 2013, pp. e259–e281.
5. Kamalakannan, S. *et al*. "Incidence and prevalence of stroke in India: A systematic review." *Indian Journal of Medical Research*, vol. 146, no. 2, 2017, pp. 175–185.
6. Powers, W.J. *et al*. "Guidelines for the early management of patients with acute ischemic stroke: 2019 Update." *Stroke*, vol. 50, no. 12, 2019, pp. e344–e418.
7. Sacco, R.L. *et al*. "An updated definition of stroke for the 21st century." *Stroke*, vol. 44, no. 7, 2013, pp. 2064–2089.
8. Grefkes, C. and G.R. Fink. "Recovery from stroke: Current concepts and future perspectives." *Neurological Research and Practice*, vol. 2, 2020, p. 17.
9. Powers, W.J. *et al*. "2018 guidelines for the early management of patients with acute ischemic stroke." *Stroke*, vol. 49, no. 3, 2018, pp. e46–e110.
10. Hacke, W. *et al*. "Thrombolysis with alteplase 3 to 4.5 hours after acute ischemic stroke." *The New England Journal of Medicine*, vol. 359, no. 13, 2008, pp. 1317–1329.
11. Goyal, M. *et al*. "Endovascular thrombectomy after large-vessel ischaemic stroke: A meta-analysis of individual patient data from five randomized trials." *The Lancet*, vol. 387, no. 10029, 2016, pp. 1723–1731.
12. Nogueira, R.G. *et al*. "Thrombectomy 6 to 24 hours after stroke with a mismatch between deficit and infarct." *The New England Journal of Medicine*, vol. 378, no. 1, 2018, pp. 11–21.
13. Albers, G.W. *et al*. "Thrombectomy for stroke at 6 to 16 hours with selection by perfusion imaging." *The New England Journal of Medicine*, vol. 378, no. 8, 2018, pp. 708–718.
14. Feigin, V.L. *et al*. "Global burden of stroke." *Circulation Research*, vol. 120, no. 3, 2017, pp. 439–448.
15. Katan, M. and A. Luft. "Global burden of stroke." *Seminars in Neurology*, vol. 38, no. 2, 2018, pp. 208–211.
16. van Swieten, J.C. *et al*. "Interobserver agreement for the assessment of handicap in stroke patients." *Stroke*, vol. 19, no. 5, 1988, pp. 604–607.
17. Banks, J.L. and C.A. Marotta. "Outcomes validity and reliability of the modified rankin scale." *Stroke*, vol. 38, no. 3, 2007, pp. 1091–1096.
18. Saposnik, G. *et al*. "Stroke outcome in those over 80: A multicenter cohort study across Canada." *Stroke*, vol. 39, no. 8, 2008, pp. 2310–2317.
19. Adams, H.P., Jr. *et al*. "Baseline NIH stroke scale score strongly predicts outcome after stroke." *Neurology*, vol. 53, no. 1, 1999, pp. 126–131.
20. Muir, K.W. *et al*. "Comparison of neurological scales and scoring systems for acute stroke prognosis." *Stroke*, vol. 27, no. 10, 1996, pp. 1817–1820.
21. Capes, S.E. *et al*. "Stress hyperglycemia and prognosis of stroke in nondiabetic and diabetic patients." *Stroke*, vol. 32, no. 10, 2001, pp. 2426–2432.
22. Kimura, K. *et al*. "Atrial fibrillation as a predictive factor for severe stroke and early death." *Journal of Neurology, Neurosurgery & Psychiatry*, vol. 76, no. 5, 2005, pp. 679–683.
23. Saver, J.L. *et al*. "Time to treatment with intravenous tPA and outcome from acute ischemic stroke." *JAMA*, vol. 309, no. 23, 2013, pp. 2480–2488.
24. Barber, P.A. *et al*. "Validity and reliability of a quantitative CT score in predicting outcome of hyperacute stroke before thrombolytic therapy." *The Lancet*, vol. 355, no. 9216, 2000, pp. 1670–1674.
25. Pexman, J.H. *et al*. "Use of the ASPECTS for assessing CT scans in patients with acute stroke." *AJNR American Journal of Neuroradiology*, vol. 22, no. 8, 2001, pp. 1534–1542.
26. Yoo, A.J. *et al*. "Infarct volume is a pivotal biomarker after intra-arterial stroke therapy." *Stroke*, vol. 43, no. 5, 2012, pp. 1323–1330.
27. Tan, I.Y. *et al*. "CT angiography clot burden score and collateral score." *AJNR American Journal of Neuroradiology*, vol. 30, no. 3, 2009, pp. 525–531.
28. Bang, O.Y. *et al*. "Impact of collateral flow on tissue fate in acute ischaemic stroke." *Journal of Neurology, Neurosurgery & Psychiatry*, vol. 79, no. 6, 2008, pp. 625–629.
29. Menon, B.K. *et al*. "Multiphase CT angiography: A new tool for the imaging triage of patients with acute ischemic stroke." *Radiology*, vol. 275, no. 2, 2015, pp. 510–520.
30. Wintermark, M. *et al*. "Imaging recommendations for acute stroke and TIA patients." *AJNR American Journal of Neuroradiology*, vol. 34, no. 11, 2013, pp. E117–E127.
31. Pandian, J.D. and P. Sudhan. "Stroke epidemiology and stroke care services in India." *Journal of Stroke*, vol. 15, no. 3, 2013, pp. 128–134.

32. Suwanwela, N.C. "Stroke epidemiology in Thailand." *Journal of Stroke*, vol. 16, no. 1, 2014, pp. 1–7.
33. Kim, J.S. "Stroke in Asia: A global disaster." *International Journal of Stroke*, vol. 9, no. 7, 2014, pp. 856–857.
34. World Medical Association. "WMA declaration of helsinki: Ethical principles for medical research involving human subjects." 2013.
35. Brott, T. *et al*. "Measurements of acute cerebral infarction: A clinical examination scale." *Stroke*, vol. 20, no. 7, 1989, pp. 864–870.
36. Adams, H.P., Jr. *et al*. "Classification of subtype of acute ischemic stroke." *Stroke*, vol. 24, no. 1, 1993, pp. 35–41.
37. Puetz, V. *et al*. "Extent of hypoattenuation on CT angiography source images predicts functional outcome in patients with basilar artery occlusion." *Stroke*, vol. 39, no. 9, 2008, pp. 2485–2490.
38. Khurana, D. *et al*. "Recommendations for the early management of acute ischemic stroke: Indian stroke association consensus statement." *Journal of Stroke Medicine*, vol. 1, no. 2, 2018, pp. 79–113.
39. Bruno, A. *et al*. "Simplified modified rankin scale questionnaire: Reproducibility over the telephone." *Stroke*, vol. 42, no. 8, 2011, pp. 2276–2279.
40. Seners, P. *et al*. "Incidence, causes and predictors of neurological deterioration occurring within 24 h following acute ischaemic stroke." *Journal of Neurology, Neurosurgery & Psychiatry*, vol. 86, no. 1, 2015, pp. 87–94.
41. Hosmer, D.W. and S. Lemeshow. *Applied Logistic Regression*. 3rd ed., Wiley, 2013.
42. Peduzzi, P. *et al*. "A simulation study of the number of events per variable in logistic regression analysis." *Journal of Clinical Epidemiology*, vol. 49, no. 12, 1996, pp. 1373–1379.
43. Ntaios, G. *et al*. "An integer-based score to predict functional outcome in acute ischemic stroke: The ASTRAL score." *Neurology*, vol. 78, no. 24, 2012, pp. 1916–1922.
44. Saposnik, G. *et al*. "I Score: A risk score to predict death early after hospitalization for an acute ischemic stroke." *Circulation*, vol. 123, no. 7, 2011, pp. 739–749.
45. O'Donnell, M.J. *et al*. "The PLAN score: A bedside prediction rule for death and severe disability following acute ischemic stroke." *Archives of Internal Medicine*, vol. 172, no. 20, 2012, pp. 1548–1556.
46. Strbian, D. *et al*. "Predicting outcome of IV thrombolysis-treated ischemic stroke patients: The DRAGON score." *Neurology*, vol. 78, no. 6, 2012, pp. 427–432.
47. Flint, A.C. *et al*. "Improved ischemic stroke outcome prediction using model estimation of outcome probability: THRIVE-c calculation." *International Journal of Stroke*, vol. 10, no. 6, 2015, pp. 815–821.
48. Fonarow, G.C. *et al*. "Door-to-needle times for tPA administration and clinical outcomes in acute ischemic stroke." *JAMA*, vol. 311, no. 16, 2014, pp. 1632–1640.
49. Wahlgren, N. *et al*. "Thrombolysis with alteplase for acute ischaemic stroke in SITS-MOST." *The Lancet*, vol. 369, no. 9558, 2007, pp. 275–282.
50. Weimar, C. *et al*. "Predicting s." *Journal of Neurology*, vol. 249, no. 7, 2002, pp. 888–895.
51. Kammersgaard, L.P. *et al*. "Short- and long-term prognosis for very old stroke patients." *Age and Ageing*, vol. 33, no. 2, 2004, pp. 149–154.
52. Mishra, N.K. *et al*. "Thrombolysis in very elderly people: SITS-ISTR vs VISTA." *BMJ*, vol. 341, 2010, article c6046.
53. Alawieh, A. *et al*. "Thrombectomy for acute ischemic stroke in the elderly." *Stroke*, vol. 50, no. 6, 2019, pp. 1440–1448.
54. Berkhemer, O.A. *et al*. "A randomized trial of intraarterial treatment for acute ischemic stroke (MR CLEAN)." *The New England Journal of Medicine*, vol. 372, no. 1, 2015, pp. 11–20.
55. Nagel, S. *et al*. "e-ASPECTS software is non-inferior to neuroradiologists in applying the ASPECT score." *International Journal of Stroke*, vol. 12, no. 6, 2017, pp. 615–622.
56. Bruno, A. *et al*. "Admission glucose level and clinical outcomes in the NINDS rt-PA stroke trial." *Neurology*, vol. 59, no. 5, 2002, pp. 669–674.
57. Kruyt, N.D. *et al*. "Hyperglycemia in acute ischemic stroke." *Nature Reviews Neurology*, vol. 6, no. 3, 2010, pp. 145–155.
58. Johnston, K.C. *et al*. "Intensive vs Standard Treatment of Hyperglycemia and Functional Outcome in Patients with Acute Ischemic Stroke: The SHINE randomized clinical trial." *JAMA*, vol. 322, no. 4, 2019, pp. 326–335.
59. Liebeskind, D.S. "Collateral Circulation." *Stroke*, vol. 34, no. 9, 2003, pp. 2279–2284.
60. Berkhemer, O.A. *et al*. "Collateral status on baseline CTA and intra-arterial treatment effect in proximal anterior circulation stroke." *Stroke*, vol. 47, no. 3, 2016, pp. 768–776.
61. Menon, B.K. *et al*. "Differential effect of baseline CTA collaterals on clinical outcome in IMS III." *Stroke*, vol. 46, no. 5, 2015, pp. 1239–1244.
62. Emberson, J. *et al*. "Effect of treatment delay, age and stroke severity on the effects of intravenous thrombolysis with alteplase: individual-patient-data meta-analysis." *The Lancet*, vol. 384, no. 9958, 2014, pp. 1929–1935.
63. IST-3 Collaborative Group. "Benefits and harms of intravenous thrombolysis within 6 h of acute ischaemic stroke (IST-3)." *The Lancet*, vol. 379, no. 9834, 2012, pp. 2352–2363.
64. Pandian, J.D. *et al*. "Stroke systems of care in low- and middle-income countries." *The Lancet*, vol. 396, no. 10260, 2020, pp. 1443–1451.
65. Sylaja, P.N. *et al*. "Ischemic stroke profile, risk factors and outcomes in India: Indo-US collaborative stroke project." *Stroke*, vol. 49, no. 1, 2018, pp. 219–222.