Acute ischemic stroke outcome

see Modified treatment in cerebral ischemia score

Early neurological deterioration (END) is a common condition associated with poor outcomes after acute ischemic stroke.

When treating acute ischemic stroke patients in our daily clinical practice, we strive to achieve recanalization of the occluded blood vessel as fast as possible using pharmacological thrombolysis and mechanical clot removal. However, successful recanalization does not equal successful reperfusion of the ischemic tissue due to mechanisms such as microvascular obstruction. Even if successful reperfusion is achieved, numerous other post-recanalization tissue damage mechanisms may impair patient outcomes, namely blood-brain barrier breakdown, reperfusion injury and excitotoxicity, late secondary changes, and post-infarction local and global brain atrophy. Several cerebroprotectants are currently evaluated as adjunctive treatments to pharmacological thrombolysis and mechanical clot removal, many of which interfere with post-recanalization tissue damage pathways. However, our current lack of knowledge about the prevalence and importance of the various post-recanalization tissue damage mechanisms makes it difficult to reliably identify the most promising cerebroprotectants and design appropriate clinical trials to evaluate them. Serial human MRI studies with complementary animal studies in higher-order primates could provide answers to these critical questions and should be first conducted to allow for adequate neuroprotection trial design, which could accelerate the translation of cerebroprotective agents from bench to bedside to further improve patient outcomes [1)].

Ren et al. demonstrated national marked and sustainable improvement in adherence to door-to-needle time, door-to-puncture time, and successful reperfusion from 2013 to 2017 in Japan in patients with acute ischemic stroke. Adhering to the key Quality Indicators substantially affected in-hospital outcomes, underlining the importance of monitoring the quality of care using evidence-based QIs and the nationwide Close The Gap-Stroke program [2)].

Clinical outcomes of patients with acute ischemic stroke depend in part on the extent of their collateral circulation. Good collateral circulation has also been associated with the greater benefits of intravenous thrombolysis and endovascular treatment. Treatment decisions for these reperfusion therapies are increasingly guided by a combination of clinical and imaging parameters, particularly in later time windows. Computed tomography and magnetic resonance imaging enable a rapid assessment of both the collateral extent and cerebral perfusion. Yet, the role of the collateral circulation in clinical decision-making is currently limited and may be underappreciated due to the use of rather coarse and rater-dependent grading methods. Uniken et al. discussed determinants of collateral circulation in patients with acute ischemic stroke, reported on commonly used and emerging neuroimaging techniques for assessing collateral circulation, and discuss the therapeutic and prognostic implications of collateral circulation in relation to reperfusion therapies for acute

ischemic stroke [3].

Severe neurological deficits at presentation, total anterior circulation stroke, and diabetes mellitus predict unfavorable outcomes. Previous TIA is associated with an increased risk of recurrence [4]

The independent association between sustained hyperchloremia and lack of favorable outcomes at 90-day suggests that avoidance of hyperchloremia may reduce the rate of lack of favorable acute ischemic stroke outcomes and death or disability [5].

Sweid et al. demonstrated that rescue stenting is a feasible, safe, and effective procedure to improve acute ischemic stroke outcome and should be seriously considered if the primary mechanical thrombectomy is not successful [6]

Despite being the current standard of care, outcomes after endovascular thrombectomy (EVT) for acute ischemic stroke (AIS) remain highly variable. Though several scoring systems exist to predict outcomes in AIS, they were mainly developed to direct patient selection for treatment.

As the second-leading cause of death, stroke faces several challenges in terms of treatment because of the limited therapeutic interventions available. Previous studies primarily focused on metabolic and blood flow properties as a target for ischemic stroke treatment, including recombinant tissue plasminogen activator and mechanical thrombectomy, which are the only USFDA approved therapies. These interventions have the limitation of a narrow therapeutic time window, the possibility of hemorrhagic complications, and the expertise required for performing these interventions. Thus, it is important to identify the contributing factors that exacerbate the ischemic stroke outcome and to develop therapies targeting them for regulating cellular homeostasis, mainly neuronal survival and regeneration. Glial cells, primarily microglia, astrocytes, and oligodendrocytes, have been shown to have a crucial role in the prognosis of ischemic brain injury, contributing to inflammatory responses. They play a dual role in both the onset as well as resolution of the inflammatory responses. Understanding the different mechanisms driving these effects can aid in the development of therapeutic targets and further mitigate the damage caused. In a review, Jadhav et al. summarize the functions of various glial cells and their contribution to stroke pathology. The review highlights the therapeutic options currently being explored and developed that primarily target glial cells and can be used as neuroprotective agents for the treatment of ischemic stroke [7].

For acute ischemic stroke patients included in controlled trials, an easy-to-apply prognostic models based on age and National Institutes of Health Stroke Scale score correctly predicted survival and functional recovery after 3 months. Furthermore, a simple adaptation helps to adjust for a different prognosis and is recommended if a large data set is available [8].

To determine the value of susceptibility weighted imaging (SWI) for collateral estimation and for predicting functional outcomes after acute ischemic stroke. To identify independent predictors of favorable functional outcomes, age, sex, risk factors, baseline National Institutes of Health Stroke Scale (NIHSS) score, baseline diffusion-weighted imaging (DWI) lesion volume, site of steno-occlusion, SWI collateral grade, mode of treatment, and successful reperfusion were evaluated by multiple logistic regression analyses. A total of 152 participants were evaluated. A younger age (adjusted odds ratio (aOR), 0.42; 95% confidence interval (CI) 0.34 to 0.77; P < 0.001), a lower baseline NIHSS score (aOR 0.90; 95% CI 0.82 to 0.98; P = 0.02), a smaller baseline DWI lesion volume (aOR 0.83; 95% CI 0.73 to 0.96; P = 0.01), an intermediate collateral grade (aOR 9.49; 95% CI 1.36 to 66.38; P = 0.02), a good collateral grade (aOR 6.22; 95% CI 1.16 to 33.24; P = 0.03), and successful reperfusion (aOR 5.84; 95% CI 2.08 to 16.42; P = 0.001) were independently associated with a favorable functional outcome. There was a linear association between the SWI collateral grades and functional outcome (P = 0.008). Collateral estimation using the prominent vessel sign on SWI is clinically reliable, as it has prognostic value [9].

Imaging, immune-inflammatory, and coagulation biomarkers add predictive information to the NIHSS clinical score and these biomarkers in combination may act as predictors of 1-year mortality after IS. An early prediction of IS outcome is important for personalized therapeutic strategies that may improve the outcome of IS [10]

Early neurological deterioration (END) is a common condition associated with poor outcome after acute ischemic stroke.

The majority of victims must endure life-long disabilities that not only affect their livelihood, but also have an enormous societal economic impact.

Blood pressure (BP) variability is independently and linearly associated with the development of neurologic deterioration in acute stage of ischemic stroke [11].

For Nozoe et al. no significant differences in blood pressure, heart rate, and parasympathetic nerve activity were observed. In patients with acute ischemic stroke, it is likely that the increase in sympathetic nervous activity during mobilization is associated with ND [12].

Cerebral infarction outcome

see Cerebral infarction outcome.

1)
Ospel J, Rex N, Kandregula S, Goyal M. The Vessel Has Been Recanalized: Now What? Neurotherapeutics. 2023 Apr 4. doi: 10.1007/s13311-023-01367-3. Epub ahead of print. PMID: 37014594.
2)
Ren N, Ogata S, Kiyoshige E, Nishimura K, Nishimura A, Matsuo R, Kitazono T, Higashi T, Ogasawara K, Iihara K; Close The Gap-Stroke, J-ASPECT Study Collaborators. Associations Between Adherence to

Evidence-Based, Stroke Quality Indicators and Outcomes of Acute Reperfusion Therapy. Stroke. 2022 Aug 16:101161STROKEAHA121038483. doi: 10.1161/STROKEAHA.121.038483. Epub ahead of print. PMID: 35971841.
3)

Uniken Venema SM, Dankbaar JW, van der Lugt A, Dippel DWJ, van der Worp HB. Cerebral Collateral Circulation in the Era of Reperfusion Therapies for Acute Ischemic Stroke. Stroke. 2022 Aug 8:101161STROKEAHA121037869. doi: 10.1161/STROKEAHA.121.037869. Epub ahead of print. PMID: 35938420.
4)

Nedeltchev, K., der Maur, T. A., Georgiadis, D., Arnold, M., Caso, V., Mattle, H. P., Schroth, G., Remonda, L., Sturzenegger, M., Fischer, U., & Baumgartner, R. W. (2005). Ischemic stroke in young adults: predictors of outcome and recurrence. Journal of neurology, neurosurgery, and psychiatry, 76(2), 191–195. https://doi.org/10.1136/jnnp.2004.040543
5)

Qureshi AI, Huang W, Gomez FE, Malhotra K, Arora N, Chandrasekaran PN, Siddiq F, French BR, Gomez CR, Suarez JI. Early hyperchloremia and outcomes after acute ischemic stroke. J Stroke Cerebrovasc Dis. 2022 May 24;31(8):106523. doi: 10.1016/j.jstrokecerebrovasdis.2022.106523. Epub ahead of print. PMID: 35633589.
6)

Sweid A, Sajja KC, Mouchtouris N, Weinberg JH, Shivashankar K, Saad H, Abbas R, El Naamani K, Ramesh S, Schaefer J, Saiegh FA, Jabbour P, Herial NA, Zarzour H, Tjoumakaris S, Romo V, Rosenwasser RH, Gooch MR. Rescue stenting for acute ischemic stroke with refractory emergent large vessel occlusion in the modern thrombectomy era. Clin Neurol Neurosurg. 2022 Feb 22;215:107183. doi: 10.1016/j.clineuro.2022.107183. Epub ahead of print. PMID: 35259678.
7)

Jadhav P, Karande M, Sarkar A, Sahu S, Sarmah D, Datta A, Chaudhary A, Kalia K, Sharma A, Wang X, Bhattacharya P. Glial Cells Response in Stroke. Cell Mol Neurobiol. 2022 Jan 23. doi: 10.1007/s10571-021-01183-3. Epub ahead of print. PMID: 35066715.
8)

König IR, Ziegler A, Bluhmki E, Hacke W, Bath PM, Sacco RL, Diener HC, Weimar C; Virtual International Stroke Trials Archive (VISTA) Investigators. Predicting long-term outcome after acute ischemic stroke: a simple index works in patients from controlled clinical trials. Stroke. 2008 Jun;39(6):1821-6. doi: 10.1161/STROKEAHA.107.505867. Epub 2008 Apr 10. PMID: 18403738.
9)

Lee HJ, Roh HG, Lee SB, Jeon YS, Park JJ, Lee TJ, Jung YJ, Choi JW, Chun YI, Ki HJ, Cho J, Lee JS, Kim HJ. Collateral estimation by susceptibility-weighted imaging and prediction of functional outcomes after acute anterior circulation ischemic stroke. Sci Rep. 2021 Nov 1;11(1):21370. doi: 10.1038/s41598-021-00775-9. PMID: 34725373.
10)

Lehmann ALCF, Alfieri DF, de Araújo MCM, Trevisani ER, Nagao MR, Pesente FS, Gelinski JR, de Freitas LB, Flauzino T, Lehmann MF, Lozovoy MAB, Breganó JW, Simão ANC, Maes M, Reiche EMV. Immune-inflammatory, coagulation, adhesion, and imaging biomarkers combined in machine learning models improve the prediction of death 1 year after ischemic stroke. Clin Exp Med. 2021 Jun 12. doi: 10.1007/s10238-021-00732-w. Epub ahead of print. PMID: 34120242.
11)

Chung JW, Kim N, Kang J, Park SH, Kim WJ, Ko Y, Park JH, Lee JS, Lee J, Yang MH, Jang MS, Oh CW, Kwon OK, Jung C, Kim BJ, Han MK, Gorelick PB, Bae HJ. Blood pressure variability and the development of early neurological deterioration following acute ischemic stroke. J Hypertens. 2015 Jul 31. [Epub ahead of print] PubMed PMID: 26237556.
12)

Nozoe M, Yamamoto M, Kobayashi M, Kanai M, Kubo H, Shimada S, Mase K. Heart Rate Variability During Early Mobilization in Patients with Acute Ischemic Stroke. Eur Neurol. 2018 Sep 11;80(1-2):50-54. doi: 10.1159/000492794. [Epub ahead of print] PubMed PMID: 30205405.