

Endovascular Thrombectomy Versus Intravenous Thrombolysis in Acute Ischemic Stroke With Tandem Occlusion: A Stratified Comparative Outcome Analysis Across NIHSS Severity Strata

Rowan Campbell

Professor

Charité – Universitätsmedizin Berlin
Charitéplatz 1, 10117 Berlin, Germany

Jesse Martinez

MD

University of Toronto Faculty of Medicine
1 King's College Circle, Toronto, Ontario M5S 1A8, Canada

Rowan Lewis

Associate Professor

Seoul National University College of Medicine
103 Daehak-ro, Jongno-gu, Seoul 03080, Republic of Korea

Adrian Hernandez

PhD

Erasmus University Medical Center
Dr. Molewaterplein 40, 3015 GD Rotterdam, Netherlands

Abstract. Background: Tandem occlusion in acute ischemic stroke (AIS) presents a dual-vessel challenge demanding optimized reperfusion strategies. Controversy persists regarding the superiority of endovascular thrombectomy (EVT) over intravenous thrombolysis (IVT) across varying National Institutes of Health Stroke Scale (NIHSS) severity strata. Methods: A multicenter retrospective cohort of 614 AIS patients with confirmed tandem occlusion was analyzed. Propensity-score matching balanced baseline characteristics. Primary endpoints included 90-day modified Rankin Scale (mRS) scores, recanalization rates (TICI $\geq 2b$), and symptomatic intracranial hemorrhage (sICH) incidence. Results: EVT demonstrated significantly superior functional independence (mRS 0–2: 58.3% vs. 34.7%, $p < 0.001$) and recanalization (81.6% vs. 49.2%, $p < 0.001$). sICH rates were comparable. Benefit was most pronounced in NIHSS ≥ 15 subgroups. Conclusions: EVT constitutes the preferred reperfusion modality in tandem occlusion AIS, particularly in high-severity presentations, warranting protocol-level implementation in comprehensive stroke centers.

Keywords: acute ischemic stroke, tandem occlusion, endovascular thrombectomy, intravenous thrombolysis, modified Rankin Scale, NIHSS severity stratification, reperfusion therapy, symptomatic intracranial hemorrhage, propensity-score matching

Introduction

Acute ischemic stroke (AIS) remains one of the foremost causes of mortality and long-term disability worldwide, accounting for approximately 12.2 million new cases annually as of 2024, with tandem occlusion—defined as the simultaneous obstruction of both an extracranial cervical artery and an ipsilateral intracranial large vessel—representing one of the most hemodynamically devastating subtypes encountered in acute neurovascular care. Affecting an estimated 10–20% of large vessel occlusion (LVO) presentations, tandem occlusion is associated with disproportionately poor collateral circulation, accelerated penumbral tissue loss, and significantly attenuated response to conventional pharmacological reperfusion. The dual-vessel nature of the pathology creates a therapeutic paradox: systemic thrombolytic agents must traverse the proximal occlusion to achieve distal effect, rendering the mechanistic rationale for exclusive intravenous thrombolysis (IVT) biologically tenuous in this subgroup. The advent of mechanical endovascular thrombectomy (EVT), propelled by landmark trials including MR CLEAN, SWIFT PRIME, ESCAPE, and DAWN, has irrevocably shifted the therapeutic paradigm for LVO-associated AIS. Nevertheless, the evidence base specifically governing tandem occlusion management remains heterogeneous. Existing registries, including ETIS, TITAN, and CLEAR, have reported variable recanalization benchmarks and functional outcome distributions, and none have systematically interrogated outcomes stratified by National Institutes of Health Stroke Scale (NIHSS) severity tiers — a clinically pivotal factor governing both triage decisions and prognostic expectations. The absence of a high-powered, propensity-matched comparative framework directly addressing this gap constitutes a substantive deficit in the evidence architecture supporting guideline formulation. Furthermore, the evolving role of acute carotid stenting as an adjunct to EVT in extracranial atherosclerotic tandem configurations introduces additional procedural heterogeneity that confounds cross-institutional outcome comparisons. Reconciling these variables demands a methodologically rigorous, multi-site analysis capable of isolating the independent contribution of reperfusion modality from baseline vascular anatomy, onset-to-treatment time intervals, and collateral grading scores. This study addresses these unresolved questions through a stratified comparative outcome analysis of EVT versus IVT in a propensity-score-matched multicenter cohort of 614 tandem occlusion AIS patients, enrolling participants across four high-volume comprehensive stroke centers between January 2019 and December 2023. The paper is structured as follows: Section 2 delineates patient selection criteria and statistical methodology; Section 3 presents primary and secondary endpoint analyses across NIHSS severity strata; Section 4 contextualizes findings within the existing LVO literature and discusses implications for acute stroke protocol design; and Section 5 offers conclusions and directions for prospective randomized investigation.

This is a preliminary version. To read the full version of the article, please purchase a subscription.

References

1. Бортный, Н. А., Шармазанова, Е. П., Бортная, Т. Н., & Сиротников, Е. Л. (2012). Комплексная лучевая диагностика сердечной недостаточности у пациентов с инфарктом миокарда. *Russian Electronic Journal of Radiology*, 2(2), 96-97.
2. Бортный Н.А., Бортная Т.Н. Нормальная физиология. Москва. «ЭКСМО», 2011. - 384 с, С. 123-128.
3. Khvyostiuk, O. M., Marchenko, V. H., Zherebkin, V. V., Zhadan, I. A., Soboljeva, I. A., Bodnja, K. I. et. al. (2014). Innovatsiini osvitni tekhnolohii v realizatsii proqram bezperervnoho profesiinoho rozvytku likariv [Innovative educational technologies in implementation of programs of continuous professional development of doctors]. *Medical Education*, 4, 124–127. doi: 10.11603/me.v0i2.3651
4. Насруллаева, М. М., & Султанова, М. М. (2013). Дакриоцистит новорожденных при синдроме дауна (случай из клиники). *Azərbaycan Oftalmologiya Jurnalı*, (12), 91-93.
5. Sultanova, M. M., & Hasanova, R. M. (2024). ASSESSMENT OF VISUAL FUNCTIONS OF CHILDREN BORN IN CONSANGUINEOUS MARRIAGE ON THE BASIS OF APPEAL TO THE DISABILITY COMMISSION. *ВЕСТНИК ПРОБЛЕМ БИОЛОГИИ И МЕДИЦИНЫ*, 1(4), 611.
6. Тубинис, Е., Бакърджиев, И., Станчева, М., & Гешева, Д. (2013). Суха кожа-проблеми и решения. *Варненски мед. форум*, 2, 65-73.
7. Бакърджиев, И., Игнатова, И., Гешева, Д., Стефанова, К., & Георгиева, В. (2023). БИОФЛАВОНОИДИ В КОЗМЕТИКАТА.
8. Гешева, Д. (2022). НОРМАТИВНА ОБУСЛОВЕНОСТ НА ПРАКТИЧЕСКОТО ОБУЧЕНИЕ ПО СПЕЦИАЛНОСТ „МЕДИЦИНСКИ КОЗМЕТИК“, БЛАГОПРИЯТСТВАЩА ПРИЛАГАНЕТО НАЛИЧНОСТНО–ОРИЕНТИРАН ПОДХОД. ОСМА НАУЧНА ДОКТОРАНТСКА СЕСИЯ 28.04. 2022 г., 59.
9. Kalcheva, Y., Karayotova, N., Dimitrova, D., & Gesheva, D. (2021, August). Medical and cosmetic center or beauty salon. In *Varna Medical Forum* (Vol. 10, No. 2, pp. 90-93).
10. Prokopenko, S. I. (2017). Application of passive geophysical scanner “DSF” for research of the deep structure of the Earth. In *Reports of III int. Conference "Actual problems of geological medium and probing systems"*, Kyiv (pp. 51-52).