Large Vessel Occlusion

- Association between Time and Severe Hypoperfusion with Risk of Hemorrhagic Transformation in Stroke Patients
- Endovascular Treatment in Stroke Patients of Working Age: A Multicenter Observational Study of Real-World Outcomes
- Efficacy and Safety of Mechanical Thrombectomy in Acute Ischemic Stroke Secondary to Infective Endocarditis: A Systematic Review and Meta-Analysis
- "Seal and Shock": Intravascular Lithotripsy for Management of Large-Vessel Coronary Perforation and Balloon Underexpansion
- Association of hypoperfusion intensity ratio and cerebral blood volume Index with good outcome in patients transferred for thrombectomy
- Outcomes of endovascular thrombectomy in acute ischemic stroke patients with insulin resistance
- Safety of emergent intracranial stenting after thrombolysis: a multicenter matched analysis
- Rare coexistence of large vessel vasculitis and nonbacterial thrombotic endocarditis: a case report

Epidemiology

Large vessel occlusions (LVOs), variably defined as blockages of the proximal intracranial anterior and posterior circulation, account for approximately 24% to 46% of acute ischemic strokes

In the USA, around 30% of 795,000 strokes per year are due to proximal large-vessel occlusion, and these are a major cause of death and disability [1)]

Large Vessel Occlusion was predominant in patients with acute ischemic stroke in COVID-19 pandemic across 2 continents, occurring at a significantly younger age and affecting African Americans disproportionately in the USA [2)].

Emergent large vessel occlusion accounts for 20-40% of ischemic strokes and is the most debilitating form of stroke.

Classification

Large Vessel Occlusion (LVO) refers to ischemic strokes caused by blockage of large intracranial arteries. LVO classification is key for diagnosis, triage, and selecting patients for mechanical thrombectomy.

I. By Anatomical Location

Anterior Circulation LVO

- **Internal Carotid Artery (ICA)**
  - Cervical ICA (extracranial)
  - Intracranial ICA (supraclinoid segment)
- **Middle Cerebral Artery (MCA)**
  - M1 segment: from ICA bifurcation to main branches
  - M2 segment: opercular branches in Sylvian fissure
- **Anterior Cerebral Artery (ACA)** – less frequent
  - A1 segment

Posterior Circulation LVO

- **Basilar Artery**
- **Vertebral Artery** (intracranial segment)
- **Posterior Cerebral Artery (PCA)**
  - P1 segment

II. By Occlusion Site and Accessibility

Type	Examples	Accessibility
Proximal LVO	ICA-T, MCA-M1, Basilar trunk	Favorable for thrombectomy
Distal (medium) LVO	MCA-M2, ACA-A2, PCA-P2	Variable, but potentially eligible
Tandem Occlusion	Cervical ICA + intracranial MCA	Complex endovascular strategy

III. By Etiology

- **Atherothrombotic** – intracranial atherosclerosis
- **Cardioembolic** – e.g. atrial fibrillation
- **Artery-to-artery embolism** – e.g. carotid plaque rupture
- **Dissection** – often in younger patients
- **Cryptogenic** – no clear source found

IV. Radiologic Classification

- **CTA/CTP findings**
  - Site of occlusion
  - Clot length
  - Collateral circulation status
- **ASPECTS (Alberta Stroke Program Early CT Score)**
  - Indirect estimate of infarct core
- **Advanced Perfusion Metrics**
  - Hypoperfusion Intensity Ratio (HIR)
  - Cerebral Blood Volume Index (CBVI)

V. Clinical Relevance

Purpose	Use Case
Prehospital Triage	LVO prediction scores (e.g. RACE, LAMS)
Therapy Selection	Mechanical thrombectomy decision-making
Prognosis Estimation	Based on location, collaterals, imaging

Etiology

Approximately 10% to 20% of large vessel occlusion (LVO) strokes involve tandem lesions (TLs), defined as concomitant intracranial LVO and stenosis or occlusion of the cervical internal carotid artery.

Complications

Acute Ischemic Stroke.

Guidelines

The current guideline recommends using an intravenous tissue-type plasminogen activator (IV tPA) prior to mechanical thrombectomy (MT) in eligible acute ischemic stroke (AIS) with emergent large vessel occlusion (ELVO) [3)]

Treatment

Large Vessel Occlusion Treatment.

Outcome

Large vessel occlusion outcome.

Retrospective cohort studies

To analyze the effect of fasting blood glucose levels after reperfusion of acute large vessel occlusion (ALVO) on patient functional prognosis.

Methods: Retrospectively included ALVO patients from three large stroke centers in China, all of whom achieved vascular reperfusion after mechanical thrombectomy or bridging thrombolysis. The prognosis scores of all patients at 90 ± 7 days post-recanalization were categorized into a good prognosis group (mRS 0-2) and a poor prognosis group (mRS 3-6). The relationship between mean blood glucose levels at 72 h post-recanalization and prognosis was explored using multivariable logistic regression analysis. Then we measured the area under the ROC curve for all factors to assess their predictive performance.

Results: (1) Totally 2,056 patients were included in the study, with 1,488 males and 568 females. There were 1,370 patients in the good prognosis group (mRS 0-2) and 686 in the poor prognosis group (mRS 3-6). (2) The two groups exhibited significant differences in terms of age, preoperative mRS score, history of diabetes, and mean fasting blood glucose (MFBG) ($p < 0.001$). (3) With 90-day mRS as the outcome variable, all independent variables were included in Univariate and multivariate regression analyses analysis, and the results showed that: age, preoperative mRS score, history of diabetes, and MFBG are all independent predictors of prognosis after recanalization of ALVO, with MFBG demonstrating a higher predictive power than the other factors (AUC = 0.644).

Conclusion: Various factors are correlated with the prognosis in patients who have undergone ALVO recanalization. Notably, the MFBG level demonstrates a significant predictive value for outcomes within the first 72 h following the recanalization procedure [4).

Case series

In a retrospective multicenter study, patients with anterior circulation large vessel occlusions who underwent pretreatment non-contrast CT (NCCT) and CT perfusion (CTP), successful reperfusion (modified Thrombolysis in Cerebral Infarction ≥2b), and post-treatment MRI, were included from three stroke centers. Automated calculation of ischemic core volumes was obtained on NCCT scans using ML algorithm deployed by e-Stroke Suite and from CTP using Olea software (Olea Medical). Comparative analysis was performed between estimated core volumes on NCCT and CTP and against MRI calculated final infarct volume (FIV).

A total of 111 patients were included. Estimated ischemic core volumes (mean±SD, mL) were 20.4±19.0 on NCCT and 19.9±18.6 on CTP, not significantly different (P=0.82). There was moderate (r=0.40) and significant (P<0.001) correlation between estimated core on NCCT and CTP. The mean difference between FIV and estimated core volume on NCCT and CTP was 29.9±34.6 mL and 29.6±35.0 mL, respectively (P=0.94). Correlations between FIV and estimated core volume were similar for NCCT (r=0.30, P=0.001) and CTP (r=0.36, P<0.001).

Results show that ML-based estimated ischemic core volumes on NCCT are comparable to those obtained from concurrent CTP in magnitude and in degree of correlation with MR-assessed final infarct volume (FIV). [5)].

This study provides valuable insights into the use of ML algorithms to estimate ischemic core volumes in stroke patients using NCCT and CTP scans. However, the study has limitations, including a relatively small sample size, potential biases. While the findings are promising, further research with larger, more diverse samples and a focus on clinical outcomes is necessary to validate the practical utility of these methods in stroke management.

Of 685 patients, 623 (mean [SD] age, 67 [12.2] years; 406 [65.2%] male) were included in the analysis, of whom 363 (58.4%) were in the CAS group and 260 (41.6%) were in the nonstenting group. The carotid artery stenting (CAS) group had a lower proportion of patients with atrial fibrillation (38 [10.6%] vs 49 [19.2%], P = .002), a higher proportion of preprocedural degree of cervical stenosis on digital subtraction angiography (90%-99%: 107 [32.2%] vs 42 [20.5%], P < .001) and atherosclerotic disease (296 [82.0%] vs 194 [74.6%], P = .003), a lower median (IQR) National Institutes of Health Stroke Scale score (15 [10-19] vs 17 [13-21], P < .001), and similar rates of intravenous thrombolysis and stroke time metrics when compared with the nonstenting group. After adjustment for confounders, the odds of favorable functional outcome (adjusted odds ratio [aOR], 1.67; 95% CI, 1.20-2.40; P = .007), favorable shift in mRS scores (aOR, 1.46; 95% CI, 1.02-2.10; P = .04), and successful reperfusion (aOR, 1.70; 95% CI, 1.02-3.60; P = .002) were significantly higher for the CAS group compared with the nonstenting group. Both groups had similar odds of sICH (aOR, 0.90; 95% CI, 0.46-2.40; P = .87) and 90-day mortality (aOR, 0.78; 95% CI, 0.50-1.20; P = .27). No heterogeneity was noted for 90-day functional outcome and sICH in prespecified subgroups.

In this multicenter, international cross-sectional study, CAS of the cervical lesion during MT was associated with improvement in functional outcomes and reperfusion rates without an increased risk of sICH and mortality in patients with TLs [6)].

Among 202 patients, 106 (52%) had ASPECTS 3 or less (mean [SD] age, 76.7 [9.6] years; 54 female individuals [50.9%]) and 96 had ASPECTS 4 to 5 (mean [SD] age, 75.6 [10.6] years; 36 female individuals [37.5%]). Of patients with ASPECTS 3 or less, 12 (21.4%) in the EVT group and 9 (18.0%) in the no EVT group had an mRS score of 0 to 3 (odds ratio [OR], 1.24; 95% CI, 0.47-3.26). Of patients with ASPECTS 4 to 5, 19 patients (43.2%) in the EVT group and 4 (7.7%) in the no EVT group had an mRS score of 0 to 3 at 90 days (OR, 9.12; 95% CI, 2.80-29.70; interaction P = .01). The ordinal shift across the range of mRS scores toward a better outcome was not significant in those with ASPECTS or 3 or less (common OR, 1.56; 95% CI, 0.79-3.10) but was significant in those with ASPECTS 4 to 5 (common OR, 4.48; 95% CI, 2.07-9.71; interaction P = .046). The risk of intracranial hemorrhage was significantly increased in patients with ASPECTS 3 or less when EVT was conducted (OR, 4.14; 95% CI, 1.84-9.32) and nonsignificantly increased in those with ASPECTS 4 to 5 (OR, 2.05; 95% CI, 0.89-4.73; interaction P = .24).

Conclusions and Relevance: In this study, EVT was associated with improved 90-day functional outcomes in patients with acute large vessel occlusion stroke and ASPECTS was 4 to 5 but not in those with ASPECTS 3 or less [7)].

A total of 162 patients (104 men, median age 76 years old) were enrolled. Forty one patients (25%) was atherosclerotic occlusion. Non-culprit stenosis was frequently observed in the atherosclerotic occlusion group than the embolic occlusion group (68% vs. 26%, P < 0.001). The presence of non-culprit stenosis was independently associated with atherosclerotic occlusion (OR, 11.00; 95% CI, 3.96-30.52; P < 0.001).

In hyperacute stroke receiving endovascular therapy, non-culprit stenosis identification may be needed in order to perform an adequate revascularization, especially for atherosclerotic occlusion [8)].

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