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Intracranial Atherosclerosis and Thrombectomy: Modifiable Risks and Outcomes in Large Vessel Occlusion Stroke

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Purpose

Mechanical thrombectomy (MT) is the standard of care for acute large vessel occlusion (LVO) within 6-24hrs of onset as demonstrated in multiple trials.[1-5] In the U.S. intracranial atherosclerotic disease (ICAD) is a common comorbidity in LVO, especially amongst the black and Asian population. [6-8] Two recent single center studies showed worse outcomes in ICAD patients with successful MT [9-10]

Our own analysis of 117 patients with TICI3 reperfusion from the SELECT trial[1] demonstrated significant negative impact of ICAD on functional outcomes. We wanted to expand this study to include TICI 2b patients and TICI 3 pts from additional centers n=233. To our knowledge this would be the largest multi-center cohort to evaluate the effect of ICAD on IAT outcomes.

Materials and Methods

We retrospectively analyzed the digital subtraction angiograms (DSA) of 233 MT patients with TICI3, TICI 2b, and TICI 2c recanalization from 9 different institutions (SELECT)[1] for evidence of ICAD. Catheter, stent, and wire positions were noted. We defined ICAD as convincing evidence of atherosclerotic irregularity distal to the carotid siphon, outside the region of recanalization, and not morphologically likely to represent spasm or dissection.[11] ICAD was also evaluated in the contralateral circulation and posterior circulation where available (n=42). All DSAs were evaluated by both a neuroradiology fellow and a neuroradiology attending with 23 years of experience (Figure 1).

ICAD patients were compared to similar patients without ICAD, and outcomes were analyzed using the metrics of mRS shift, mortality, symptomatic intracranial hemorrhage, neurological worsening, final infarct volume (on DWI or CT), and growth in infarct size from baseline. All p-values were calculated using multivariable logistic regression models, which were adjusted for age, NIHSS score, tPA administration, time to procedure, ASPECT score, and CT perfusion core volume (prior to intervention).

Results

We found 32 cases out of 233 with evidence of ICAD. ICAD patients demonstrated significantly increased incidence of hypertension (p-value: 0.043) and diabetes (p-value: 0.016). Poorly controlled diabetes with elevated glucose (p-value: 0.013). There was no significant association with coronary artery disease, congestive heart failure, or atrial fibrillation. (Significant values ($p<0.05$).

In the entire cohort (n=233) there was a significant negative effect of ICAD on mRS shift (p=0.45) but after adjusting for hypertension and diabetes this effect was no longer significant (p=0.156). There was no significant effect on functional outcome, mortality, symptomatic hemorrhage, or final infarct volume. Analyzing the TICI 2b/c subgroup by itself with adjustments for HTN and DM, there was a significant effect on mRS shift (p=0.17) but not in other outcomes.

Limitations of the study included limitations of cerebral angiography to detect non-caliber-changing ICAD, to reliably distinguish it from spasm or other postprocedural changes in a single vessel, 4-vessel angiogram not available on all patients, and insufficient power to correlate ICAD with dissection and spasm.

Conclusion

In our cohort of randomized MT, ICAD was strongly associated with concomitant hypertension and diabetes. Although there was a trend, there was no significant difference in functional outcomes between patients with and without ICAD when adjusted for HTN and DM. There was no statistically significant association of ICAD with coronary artery disease, congestive heart failure, or atrial fibrillation.

Future work includes increasing the study power by including patients in the SELECT2 database. When we added additional centers, previous results were diluted. We should re-analyze the data to assess the effect of individual centers on outcomes.

References

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Figures