First pass effect

Stent retriever mechanical thrombectomy is commonly used for acute large vessel occlusion treatment (ELVO) in acute ischemic stroke. Clot imaging parameters such as clot length, diameter, distance to the internal carotid artery terminus, and vessel angle where the stent retriever (SR) is deployed may predict the likelihood of achieving first pass effect (FPE). Most of the proposed factors that seem to affect recanalization success have been studied individually, and conflicting data derived from clinical versus in vitro studies using 3-dimensional printed models of intracranial circulation currently exist.

Using patient-specific 3-dimensional phantoms of the cervical and intracranial circulation, Pressman et al. simulated middle cerebral artery occlusion M1 and M2 treated with Stent retriever mechanical thrombectomy using Solitaire (Medtronic) or Trevo (Stryker). The primary outcome was FPE, defined as Thrombolysis in Cerebral Infarction score of 2c-3 achieved after a single thrombectomy attempt. We also performed retrospective analysis of same clot imaging characteristics of consecutive cases of MCA occlusion and its association with FPE matching the 3-dimensional in vitro experiments. Analysis was conducted using IBM SPSS Statistics Version 25 (IBM Corp., Armonk, NY). Chi-square tests and bivariate logistic regressions were the main statistical tests used in analysis. A p-value of less than .05 was considered to indicate statistical significance. Ninety-five confidence intervals (95% CI) were generated.

Results: We compared 41 thrombectomy experiments performed using patient-specific 3-dimensional in vitro models with a retrospective cohort of 41 patients treated with SR thrombectomy. We found that in the in vitro cohort, higher MCA angulation was associated with a lower likelihood of FPE (odds ratio [OR] = 0.967, 95% CI = 0.944-0.991, p = .008). Meanwhile in the in vivo cohort, higher MCA angulation was associated with a higher likelihood of FPE (OR = 1.039, 95% CI = 1.003-1.077, p = .033). Neither clot length nor location of clot (M1 vs. M2) was associated with a difference in FPE rates in either cohort.

Comparison of Stent retriever mechanical thrombectomy performed during actual middle cerebral artery occlusion cases versus patient-specific 3-dimensional replicas revealed MCA angulation as an independent predictor of procedure success or failure. However, the opposite direction of effect was observed between the two studied environments, indicating potential limitations of studying Stent retriever mechanical thrombectomy using 3-dimensional models of large vessel occlusion [1].

1)
Pressman E, Sommer KN, Waqas M, Siddiqui AH, Ionita CN, Mokin M. Comparison of stent retriever thrombectomy using 3-dimensional patient-specific models of intracranial circulation with actual middle cerebral artery occlusion thrombectomy cases. J Neuroimaging. 2021 Dec 27. doi: 10.1111/jon.12961. Epub ahead of print. PMID: 34958701.