

Success rates of endovascular treatment of acute ischemic stroke based on curvature of occluded segment

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Introduction

Good outcome after acute ischemic stroke depends on many factors but early revascularization plays a leading role among these. Revascularization rates continue to improve as technology improves with second generation stent retriever device for thrombectomy. Stent-retrievers are self expanding retrievable stents that have a pre-designed expansile force. At body temperature the stent expands due to body temperature to its pre-set diameters, therefore the stent is left in the in the region of the closed arterial segment for a period of time to let the stent expand and incorporate the clot. Upon retrieving the stent, it's expansile force is lost and the stent collapses over the clot. In this study we reviewed our series of patients treated with a stent retriever, to determine anatomical considerations that alter the effectiveness of these devices, in order to better utilize them and improve time to vessel reopening.

Methods

We retrospectively analyzed all acute stroke interventions performed with stent retriever devices at our institution. We divided the location of occlusion into 3 categories; ICA T-occlusion, straight M1 or M2 segment, or curved M1-M2 junction segment. We statistically analyzed TICI scores, time to vessel opening from groin puncture, and number of passes based on each of the 3 groups.

Results

Of 26 patients, 12 had curved segment and 8 with straight segment MCA occlusion. The average median time to vessel opening from groin puncture time was 127 minutes in curved segment vs 89 minutes in straight segment ($p < 0.05$ using the Kruskal Wallis test), the average number of passes was 2.25 vs 1.63, the % TICI 2B or 3 vessel opening was 16.7% vs 75%. There were 6 cases of T-occlusion with the average time to vessel opening from groin puncture time 120 minutes, the average number of passes was 2.67, the % TICI 2B or 3 vessel opening was 50%.

Discussions

This study analyzes the performance of stent retrievers devices in recanalization of curved versus straight vessels. We found that clots on a curve segment MCA branch with acute angulation had significantly greater time to vessel opening, required more attempts of clot retrieval with worse TICI recanalization rates compared to straight MCA segments. Thus establishing that vessel curvature in relation to thrombus location is an important determinant in success of mechanical thrombectomy with stent retriever. Clots in a curved segment with angles more acute than 90 degrees are more difficult to retrieve using a stent retriever. The mechanical force applied during retriever pullback that is usually dispersed radially is altered because of vector forces of the hyper-acute angle curve, and subsequently has decreased technical success of thrombectomy, whereas mechanical forces are exerted on the target thrombus with less impedance in a straight M1. ICA occlusions also had worse outcomes as there is a higher incidence of propagating embolus and therefore increased time to vessel opening, and lower TICI recanalization scores.

Conclusions

TICI recanalization rates were significantly better when using stent retrievers on a straight segment compared to a curved segment of MCA. The mixed results of ICA bifurcation occlusion is more likely to be explained by a combination of acute angulation, larger clot burden, and higher incidence of propagating embolus associated with these occlusions.

Learning Objectives

Configuration of the parent vessel correlates with the recanalization rates and time to vessel opening.

References

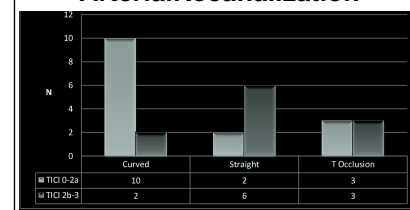
1. Correlation of middle cerebral artery tortuosity with successful recanalization using the Merci retrieval system with or without adjunctive treatments. Yamamoto S1, Yamagami H, Todo K, et al. *Neurol Med Chir (Tokyo)*. 2014;54(2):113-9.
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Analysis of the curve angle of the horizontal MCA segment (M1)

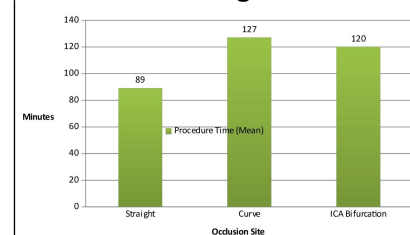


The M1 curve angle is measured as the angle formed by endpoint, vertex and at the level of the M1 endpoint

TICI Score Vs Arterial Recanalization



Time to open vs vessel segment



$p < 0.05$ between straight and curved segment