



ORIGINAL ARTICLE

Medicine Science 2020;9(3):700-3

## Efficiency of mechanical thrombectomy in acute ischemic stroke patients

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Received 11 June 2020; Accepted 10 July 2020

Available online 17.08.2020 with doi: 10.5455/medscience.2020.06.105

### Abstract

The aim of this single-center study is to assess the outcomes in patients with acute ischemic stroke underwent endovascular mechanical thrombectomy. The data and outcome of patients who were admitted due to acute ischemic stroke caused by a large vessel occlusion in the anterior or posterior circulation and treated with endovascular stent retriever mechanical thrombectomy between 2014 and 2018 were retrospectively evaluated. Recanalization success was assessed based on Thrombolysis in Cerebral Infarction (TICI) scores, and the TICI grades 2b and 3 were considered as 'successful'. Functional outcomes of the patients were assessed by modified Rankin Scale (mRS) at the 3rd month follow up and a score of  $\leq 2$  points was considered as 'good clinical outcome'. Successful recanalization was achieved in 34 patients (69%). At the 3rd month follow-up, 23 patients (46,9%) had mRS scores of  $\leq 2$  points. The overall mortality rate at the 90th day was %30 (n=15). After endovascular thrombectomy, symptomatic intracranial hemorrhage was seen in 9 patients, groin hematoma due to vascular access in 5 patients, which did not require additional treatment, and pseudoaneurysm in 3 patients. Stent retriever mechanical thrombectomy is an effective and safe procedure in patients admitted due to acute ischemic stroke caused by large vessel occlusion.

**Keywords:** Acute stroke, endovascular treatment, stent retriever thrombectomy

### Introduction

The main goal of the treatment in acute ischemic stroke is to recanalize the occluded artery as soon as possible, thereby maintaining the brain perfusion and protecting the patient from irreversible brain injury. The mainstay of the reperfusion treatment is providing the recanalization in a rapid and safe way [1]. The administration of intravenous (IV) thrombolytics, such as tissue plasminogen activator (t-PA), is an important treatment commonly used to re-establish the cerebral blood flow and has shown significant benefits on patients. However, the finding that IV administered thrombolytics can result in lower rate of recanalization in acute strokes resulting from large artery

occlusions, depending on the thrombus size and localization, has led to seeking for alternative therapies in patients presented with acute stroke [2-6].

In the last decade, controlled randomized multicenter clinical trials have been published which have demonstrated the superiority of mechanical thrombectomy by stent retriever devices, a new method of ischemic stroke treatment, compared to intravenous thrombolysis, with effective and safe outcomes based on strong evidence [7-11]. We aimed to evaluate the outcome of patients admitted to our center with acute ischemic stroke who were treated with mechanical thrombectomy only.

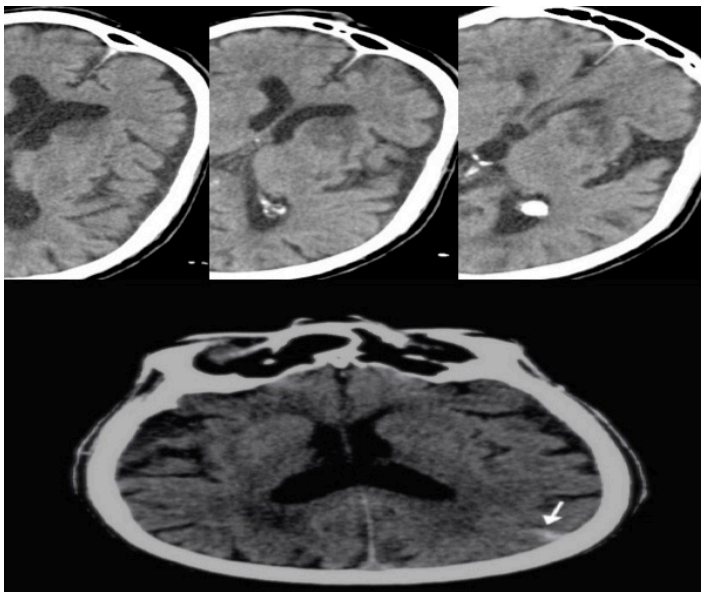
### Material and Methods

#### Patients

This retrospective study was approved by the institutional Review Board of our institution. A written informed consent was obtained from each patient.

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Our center is a tertiary healthcare institution, which serves a population of about 600,000. However, since it is a reference healthcare center, this number reaches almost one million. In this study, we retrospectively evaluated the outcomes of the patients presented with acute ischemic stroke caused by occlusions in the anterior cerebral artery (ACA) A1, middle cerebral artery (MCA) M1, posterior cerebral Artery P1 (PCA), and basilar artery (BA) and tandem occlusion in internal cerebral artery (ICA) and MCA and were treated with endovascular mechanical thrombectomy between 2014 and 2018. The patients with physical examination findings in the emergency department compatible with 'stroke' were first assessed by unenhanced cranial computed tomography (CT) and then quickly by cranial CT angiography. Among the patients with large vessel occlusion and without cranial hemorrhage, those with an National Institutes of Health Stroke Scale (NIHSS) score of >6 and an Alberta Stroke Program Early CT (ASPECT) score of >6 (Figure 1) who did not exceed a maximum 6 hours for the anterior circulation occlusion and a maximum 15 hours for the posterior circulation occlusion were treated with endovascular mechanical thrombectomy. The patients with serum glucose <50 mg/dL, thrombocytopenia (<30000 /mm<sup>3</sup>), a history of hemorrhagic diathesis or coagulation defect, median shift due to radiological mass effect, or high blood pressure (systolic >185 mmHg and diastolic >110 mmHg) despite treatment were not treated with endovascular method.

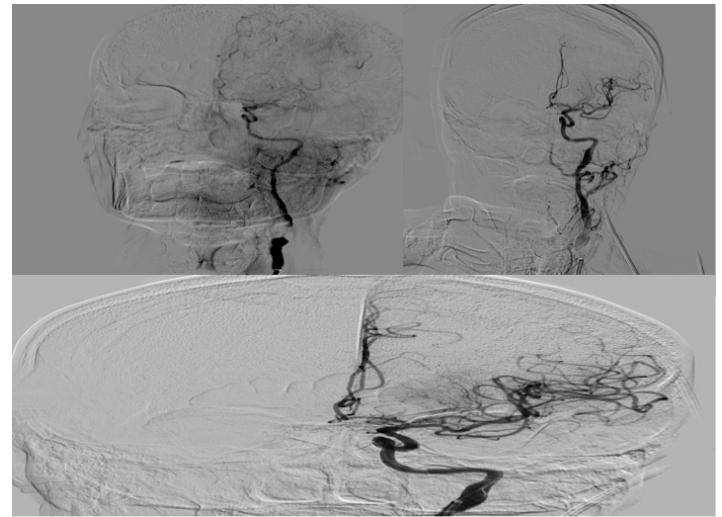


**Figure 1.** An 82-year-old male patient's CT examination revealed caudate, lentiform nucleus, and insular cortex hypodensities and ASPECT score was 7. There was no increase in hypodense areas on CT after successful mechanical thrombectomy the next day. Minimally subarachnoid hemorrhage seen in posterior parietal lobe (White arrow)

### Endovascular Procedure

The endovascular procedures were performed under local anesthesia except for 3 patients with severe aphasia. Some of the patients were treated with tPA during the transfer to our center or at the emergency services. Endovascular access was obtained by means of the standard femoral approach. 90-cm and 7-Fr guiding sheath was inserted with the distal end in the common carotid artery or subclavian artery. Then a 5,3 Fr

distal intracranial access catheter (Fargomax, Balt, France) was advanced to the petrocavernous ICA or vertebral artery V3 segment through the 7-Fr carotid sheath. A microcatheter (0.021 inches) over a microguidewire (0.014 inches) was used in all cases for catheterization of the intracranial vessel occlusion. After placement of the microcatheter distal to the thrombus, the microguidewire was replaced by an stent retriever device (Trevor XP ProVue, Stryker/Solitaire 2, Medtronic). In most cases, there was a 3–4-minute delay between delivery and retrieval of the SR. The SR and microcatheter were retracted together with continuous aspiration, with a 50-mL syringe connected to the hemostatic valve. This procedure was repeated until the occlusion was removed (Figure 2).



**Figure 2.** In the same patient, prethrombectomy angiography shows a critical internal carotid artery stenosis and thrombus in the left MCA M1 segments. Firstly, an internal carotid artery stent was inserted and then MCA thrombectomy performed using stent retriever technique. After thrombectomy, TIC1 score 3 recanalization was obtained

### Radiological and Clinical Evaluation

The recanalization success during the procedure was assessed based on the TIC1 score. The TIC1 grades 2b and 3 were considered as successful. Periprocedural complications were recorded. The duration from the symptom onset to vascular access and to recanalization was calculated. Functional outcome of the patients was assessed by a neurologist at the 3rd month and those with a modified Rankin Scale (mRS) score of ≤2 points were considered as 'good clinical outcome'.

### Statistical analyzes

Statistical analyzes were performed using SPSS version 20 software. The suitability of variables to normal distribution was examined by visual and analytical methods. Numerical variables are presented as mean ± standard deviation.

### Results

Stent retriever mechanical thrombectomy was performed in 49 patients presented with acute ischemic stroke caused by occlusion of a large vessel. The mean age of the patients was 62.8 years with an age range from 32 to 85 years. The occlusion site was the

MCA-M1 in 22 patients, the ACA-A1 in 3 patients, the ICA distal branch (total occlusion) in 9 patients, the BA in 7 patients, the PCA in 4 patients, and the ICA-MCA tandem lesion in 4 patients. General anesthesia was used in only three patients. 34 patients had received intravenous t-PA before undergoing thrombectomy. The pre-procedural median ASPECT score was 9 (range 7-10). The mean time-to-treatment duration was 280 min, and mean time-to-reperfusion was 340 min. (Table 1) Successful recanalization was achieved in 34 patients (69%); 13 of them had a TICI 2b flow and 21 had a TICI 3 flow. Mean NIHSS score was 19 (range 15-22) on admission. 23 patients (46,9%) had an mRS score of  $\leq 2$  points at the 3rd-month follow-up. The overall mortality rate was 30% (n=15) at the end of 90 days. After endovascular thrombectomy, symptomatic intracranial hemorrhage was observed in 9 patients, groin hematoma in 5 patients, which did not require additional treatment, and pseudoaneurysm in femoral artery in 3 patients (Table 2).

**Table 1.** Characteristics related to patients and procedures

Number of Patient	49
Mean Age	62.8 (32-85)
Sex male/female	22/27
Median NIHSS Score	19 (15-22)
Median ASPECT score	9 (7-10)
Prior IV thrombolysis	35 (71%)
Symptoms-groin puncture	280
Symptoms-recanalization	340

**Table 2.** Patient and procedural outcome after mechanical thrombectomy with stent retriever

Number of Patient	ICA terminus (n: 9)	ICA/MCA Tandem (n: 4)	MCA M1 (n: 22)	ACA A1 (n: 3)	PCA P1 (n: 4)	BA (n: 7)
Recanalization TICI>2a	6 (66%)	2 (66%)	18 (81%)	2 (66%)	2 (50%)	4 (57%)
mRS $\leq 2$ at 90 day	4 (44%)	2 (50%)	12 (54%)	2 (66%)	1 (25%)	2 (28%)
Mortality	3 (33%)	1 (25%)	4 (18%)	1 (33%)	1 (25%)	5 (72%)
Symptomatic IH	2 (22%)	-	3 (13%)	1 (33%)	1 (25%)	2 (42%)
Subarachnoid hemorrhage	1	1	3	1	-	1
Groin Hematoma	1	1	2	-	1	-
Femoral artery Pseudoaneurysm	1	1	-	-	1	-

## Discussion

The intravenous r-tPA treatment has been recommended up to the first 4.5 hours of acute ischemic stroke. However, systemic and/or intracranial hemorrhage risk and inadequate recanalization rates in large vessel occlusions with IV thrombolytic treatment have led to the search for alternative or complementary therapies in this patient group [12,13]. Especially in randomized prospective clinical trials published after 2014, such as MR CLEAN, ESCAPE EXTEND IA, REVASCAT, and SWIFT PRIMA have shown that thrombectomy treatment with new-generation endovascular techniques in patients with acute ischemic stroke caused by large vessel occlusions provides higher recanalization and reperfusion rates compared to IV-rTPA and associated with better clinical outcome [7-11]. The randomized IMS III trial [12] compared the clinical outcome of the endovascular treatment after IV thrombolytic therapy, and reported adverse outcomes. However, later published EXTEND and SWIFT PRIMARY trials have demonstrated the benefits of combining endovascular treatment with IV therapy in patients receiving thrombolytic therapy. In that study, 71% of the patient population had been previously given IV thrombolysis. In the remaining 30% who had not received IV thrombolysis before the procedure, intra-arterial r-tPA was used before the intervention in

order to increase the efficacy of thrombectomy. The recanalization rates with the TICI grades of 2b/3 observed in the aforementioned randomized trials ranged from 59 to 88%. These studies have examined the anterior circulation. In our study, successful recanalization rate was 69%. In our study, however, we did not only include the occlusions involving anterior circulation. In previous studies evaluating only anterior circulation occlusions, 'good clinical outcomes' at the end of the third month have been reported between 32% and 71%, and there were differences in patient selection criteria of these trials in comparison with our study. Because our study population included both anterior and posterior cerebral circulation, the proportion of patients with mRS scores  $\leq 3$  at the 3rd month was 46%. In our patients, distal ICA occlusion was present in 9 patients and total BA occlusion in 7 patients. In such lesions, successful recanalization rate was lower, and the mortality rate was relatively higher since the thrombus burden is higher in the ischemic strokes caused especially by the occlusions in distal ICA and BA. A number of studies examining the outcome of mechanical thrombectomy have reported different recanalization success rates, clinical outcomes and mortality rates. The differences in clinical outcomes and rates of recanalization are thought to be due to the inclusion of heterogeneous patient groups in previous studies; NIHSS, ASPECT scores, age, embolic source,

and IV thrombolytic therapy before thrombectomy are thought to affect the success of the procedure [13-15]. Nevertheless, the recanalization rates and clinical outcomes found in our study were consistent with the literature.

### Conclusion

In patients presenting with acute ischemic stroke, mechanical thrombectomy with stent retriever devices has been found to produce high rate of recanalization and good clinical outcome.

### Conflict of interests

*We declare that we have no conflict of interest.*

### Financial Disclosure

*This study received no financial support.*

### Ethical approval

*This retrospective study was approved by the institutional Review Board of our institution.*

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