Mechanical Thrombectomy for Acute Ischemic Stroke In A Mekong Delta Medical University Hospital

V.D. Nguyen¹, Tran Chi Cuong¹, Huu Tai Nguyen¹, Duy Linh Nguyen¹, Thi Nhu Truc Nguyen¹, Tri Thuc Dinh¹, Van Minh Le¹, Tri Nghia Phu¹, Hoang Thuan Nguyen¹, Dung Tien Doan¹, Ahmad Sobri Muda², Van Truyen Ngo¹

¹Department of Radiology, School of Medical Sciences, Universiti Sains Malaysia, 16150 Kubang Kerian, Kelantan, Malaysia
²Department of Radiology, Hospital Pengajar Universiti Putra Malaysia, 43400 Serdang, Selangor, Malaysia

*Corresponding author:
V.D. Nguyen, Department of Radiology, Can Tho University of Medicine and Pharmacy, Ho Chi Minh, Vietnam. Email: nvdang@ctump.edu.vn

DOI: https://doi.org/10.32896/tij.v3n2.10-19
Submitted: 18.04.2023
Accepted: 27.06.2023
Published: 31.06.2023

ABSTRACT:
Introduction: Mechanical thrombectomy has become increasingly indicated in the treatment of acute cerebral ischemic stroke. We report our 3-year outcomes of mechanical thrombectomy for ischemic stroke.

Method and subjects: A descriptive study was conducted cross-sectionally. Each patient with a National Institute of Health Stroke Scale (NIHSS) score of 10 or higher who presented to our hospital within eight hours of the onset of the first symptom would be considered. The mechanical thrombectomy procedure is performed with aspiration techniques or in combination with stent retrievers, with or without rescue angioplasty and stenting.

Results: From January 1st, 2018, to December 31st, 2020 (36 months), a total of 53 patients were included. Forty-four (44) patients had thrombectomy only, and another 9 patients had thrombectomy with stenting. The total technical success rates were 47/53 (88.6%). The death rate was 15/53 (28.3%). There were 31/53 patients (58.4%) who had significant recovery in motor movement, language, and cognition within 2 months.

Conclusion: Our revascularization rate of mechanical thrombectomy was 88.6% with 58.4% of patients showing improved outcomes.

Keywords: acute ischemic stroke, IV rTPA, intra-arterial thrombolysis, catheter-based thrombectomy, intra, and extracranial angioplasty, stenting.
INTRODUCTION

Acute ischemic stroke is a severe emergency condition with a high rate of mortality and morbidity. Treatments for ischemic stroke include intravenous thrombolysis and mechanical thrombectomy. There is clear evidence of mechanical thrombectomy with or without intra-arterial thrombolysis, benefits acute ischemic stroke patients in selected cases [1-3]. Rescue stenting with or without angioplasty has been increasingly used as an adjuvant treatment, especially in acute ischemic stroke with intracranial artery stenosis [4]. The three-year outcomes of mechanical thrombectomy as one of the treatments for acute ischemic stroke at a tertiary center, Can Tho University of Hospital Medicine and Pharmacy (CTUMP), in the Mekong Delta, were reported in this study.

METHODS

All patients with an intent to treat ischemic stroke who were admitted to the Can Tho University of Hospital Medicine and Pharmacy (CTUMP) between January 1st, 2018, and December 30th, 2020, and who presented within 8 hours and had an NIHSS grading scale of 10 or higher, were included in this cross-sectional, descriptive study. Since NIHSS less than 10 is recognized as a mild stroke in our local setting and the patient preferred conservative therapy over costly intervention, we chose an NIHSS of 10 or higher, although the majority of other milestone studies had a threshold NIHSS of 6. For the minor stroke group, we reviewed the patients later on to perform cerebral vascular stenosis screening with assessment of collaterals at once using carotid doppler ultrasound and/or CT angiography, MRI and angiography accordingly.

Exclusion criteria included ischemic stroke with hemorrhage, severe comorbidity that might cause fatalities such as myocardial infarction, very poor pre-morbid, and unstable vital signs. The ASPECT score was used to evaluate the patient’s prognosis but not to determine if mechanical thrombectomy was indicated. Blood samples were taken for renal function tests, alanine aminotransferase (ALT), aspartate aminotransferase (AST), blood glucose, and coagulation tests. Electrocardiography (ECG) was also conducted in the emergency room. Unless the patients had a well-established history of chronic renal failure, we did not wait for the renal function test for the contrasted CT scan. MRI was recommended for cooperative patients as well as those who had contraindications to iodinated contrast media. Any patient with even tiny blooming artefact in the infarcted areas which raised suspicion of hemorrhagic transformation or any type of coincident cerebral hemorrhage would not be included in the study group and most of them were refered for conservative management. The high bleeding risk would be acknowledged among these patient’s relatives and the interventionalists if the thrombectomy procedure were proceeded, since there could be a need for heparinization, antiplatelet during and after the procedure.

During the mechanical thrombectomy procedure, thrombus aspiration was performed using various aspiration catheter systems available in the market, and manual aspiration was done using 50ml syringes with a vacuum effect armed with the piston inserted into the aspirating syringes. The aspiration would be repeated up to three times until the occluded vessels were fully revascularized. If the occlusion was not opened after 3 passes, only then a stent retriever from one of the available systems would be employed. If revascularization is not achieved after another up to 4 passes with the combination of stent retriever and aspiration catheter, or if the procedure has lasted more than 8 hours, the procedure will be terminated.

If there is evidence of significant stenosis after revascularization, angioplasty is performed using a gateway balloon of sizes between 2 mm to 2.5 mm × 15 or 20 mm. The balloon was inflated within the stenotic segment for 30 seconds to one minute and if the stenoses recoiled, an intracranial stent will be deployed after angioplasty using the Wingspan stenting system during the acute stage. To facilitate the rescue stenting, dural antiplatelet therapy would be indicated on angiosuite table with 4 pills of duoplyvin 75/100 administered via nasogastric tube (the alternatives were slopidogrel...
300mg x 1 pill plus 4 pills of aspirin 81mg). The dual antiplatelet would be maintained with 1 pill of 75/100 per day for at least 4 months afterwards. In the patients with stenosis at ICA origin and tandem lesions, carotid angioplasty and stenting were performed either before or after the mechanical thrombectomy, during the acute stage. General anesthesia (GA) was administered if the patients were incorporative. A team of neuro-interventionalists, anesthetists, neurologists, and medical doctors would monitor the patients in the post-procedure clinic. Following discharge, patients were scheduled for follow-up appointments at one, three, and six months. We mainly used plain CT and CT angiography for the patient follow-up. MRI could be indicated when we want to assess the brain parenchyma. After 6 months, the patients could be indicated for angiography.

RESULTS
A total of 53 patients were recruited from January 2018 to 30th of December 2020. The male-to-female ratio was 1.54:1, while the patient's age was between 38 to 90 with a mean of 64 years. The NIHSS score ranged from 12 to 25. Approximately 95% of the patients were admitted after 4 hours from the onset of their stroke. There are 98% of patients with comorbidity of either hypertension, diabetes, atrial fibrillation, mitral valve stenosis and insufficiency, atrioventricular block type 1, dyslipidemia, or a combination. Forty-four patients underwent mechanical thrombectomy (Table 1) with catheter-based aspiration, with or without stent retrievers.

There were nine patients who had rescue stenting, in which, four patients had intracranial stenting of MCA stenosis. Meanwhile, four patients had ICA rescue stenting and one patient had basilar artery stenting during the acute stage of mechanical thrombectomy.

The technical success rate for all procedures was 47/53 (88.6%) with the TICI perfusion scale from grade 2B (14%) to grade 3 (86%). There were 6 cases of unsuccessful procedures (TICI from 2a to below) and all 6 patients died within 2 weeks due to various causes related to the stroke. There were 10 cases (18.8%) with hemorrhagic transformation in both the successful and unsuccessful groups.

The total death rate was 15/53 of patients (28.3%) including all of those with unsuccessful procedures (6/53) and some patients from the successful revascularization group (9/53). The causes of death were statistically related to multiple comorbidities, including progressive cerebral edema (p<0.001), cerebral hemorrhagic transformation (p=0.02), pneumonia (p<0.001), diabetes with uncontrollable serum glucose (p=0.043), and progressive renal failure (1/53; p<0.001). Pneumonia occurred in more than half (10/15) of the dead patients with a strong statistical relation. There were 31/53 patients (58.4%) with successful revascularization, having significant recovery in muscle movement, language, and cognition after 2 weeks.

DISCUSSION
A plain CT scan is an initial study that could provide information on the early stages of cerebral ischemia such as dense MCA sign, effacement of sulci of the insula, effacement of the cerebral hemisphere sulci, and loss of corticomedullary differentiation and helps to rule out hemorrhagic stroke [1]. CT angiography would be indicated to identify the occluded location of the cerebral arteries. MRI is highly sensitive in the detection of acute cerebral ischemia, especially diffusion-weighted sequence. However, MRI can be time-consuming and not readily available in many centers.

A review of 157 patients who underwent mechanical thrombectomy using the Penumbra thrombectomy system within 8 hours of onset, showed that partial or total revascularization rates could be obtained in 87% of the cases. Meanwhile, the complication rate was 5.7%. Successful revascularization in 88.6% was reported in our study, while 58.4% of the patients had significant improvement in symptoms within 2 weeks to 2 months where NIHSS score decreased more than 8 points compared to baselines at admission. These success rates were dependent on the thrombus features such as rigidity and size. The technical success was also dependent on the vessel status like tortuosity, underlying atherosclerosis, and
small calibers of the affected arteries; thus, the occluded sites might not be successfully approached.

If the patient had atrial fibrillation (AF), making it is likely the patient would have thromboembolism, and we are more inclined to use the aspiration technique first, for the mechanical thrombectomy procedure. In some situations, balloon dilatation of the stenotic arteries could make the vessel caliber bigger and ease the cannulation of the aspirating catheter. In rare occasions, the above technique is not successful for catheter advancement, direct puncture to the carotid artery could be considered [7]. The incidence of significant hematoma causing compression may happen in up to 7% of the direct carotid puncture and infarction caused by direct cannulation of the carotid arteries was recorded in 8.7% of subjects [8] We had performed in one case access for thrombectomy via direct carotid puncture, and the procedure was done successfully with TICI 3.

The benefit of acute stenting during thrombectomy had been reported with good technical feasibility and favorable outcomes [9]. In our study, there were four patients with severe stenosis of the carotid artery origin, with tandem MCA occlusion, four patients with MCA thrombus occlusion over stenoses, and one patient with thrombus over stenosis at the basilar artery. All the cases had obtained good flows. Five patients recovered well, and three deaths were recorded due to combined morbidities. The positive results were encouraging but need further studies in larger groups. Multiple studies have shown that balloon angioplasty is a safe and effective adjuvant therapy in patients with intracranial occlusion and prevents re-occlusion of the artery and permits distal infusion of thrombolysis [10].

Mechanical thrombectomy is considered one of the effective treatment options for ischemic stroke. Using endovascular intervention procedures, blood flow was revascularized in 88.6% of our cases. There were more than half of the patients achieved significant clinical improvement. Successful revascularization is a crucial initial step to salvage the patients and help obtain a better prognosis. A variety of techniques, such as catheter exchanges, angioplasty of the stenotic sites, and direct carotid punctures, could be used to achieve technical success. Post-procedure care should be multidisciplinary management which necessitates cooperation between neuro-interventionists, ICU staff, anesthetics, and medical physicians to obtain a good outcome.

CONFLICT OF INTEREST
Ahmad Sobri Muda received consulting honoraria from Philips Medical in 2021 and speaker honoraria from Balt Interventional in 2020.

ACKNOWLEDGEMENT
The authors would like to thank Farid Bajuri (https://orcid.org/0000-0003-1517-7282) for their help in formatting the article for submission.

FUNDING
The authors received no external funding for this work.

DATA AVAILABILITY STATEMENT
Further inquiries can be made to the corresponding author.

REFERENCES
5. Althaus K, Dreyhaupt J, Hyrenbach S, Pinkhardt EH, Kassubek J, Ludolph AC. MRI


FIGURE LEGENDS:

Figure 1: Image of a patient with occluded left MCA (1a, arrow) and the left MCA after successful thrombectomy by catheter-based aspiration (1b, arrow)
Figure 2: The DSA images showed a tandem lesion at the left MCA (2a, arrow) which was occluded. The left MCA after thrombectomy using Catch View stent retriever (2b, arrow). The left ICA origin stenosis (2c, white arrowhead). The left ICA stenosis after stenting (2d, arrow) using Carotid Wallstent.
Figure 3: Dense MCA sign on non-contrast-enhanced CT scan image (arrow)
Figure 4: MRI and DSA images of the patient with ischemic stroke. DWI sequence (4a, arrow) showed restricted areas at the left frontal region. TOF sequence (4b, arrow) showed occlusion of the left MCA. DSA image showed occluded left MCA (4c, arrow). DSA image after aspiration revascularization (4d, arrow) showed good flow to the left MCA.
### TABLE LEGENDS:

Table 1: This table illustrates the outcomes of various methods of thrombectomy procedures.

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Number of patients</th>
<th>Technical results</th>
<th>Clinical recovery</th>
</tr>
</thead>
<tbody>
<tr>
<td>Catheter-based aspiration</td>
<td>32</td>
<td>30 successful</td>
<td>21 recovered well</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4 unchanged</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>5 deaths</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1 death</td>
<td></td>
</tr>
<tr>
<td>Thrombectomy</td>
<td></td>
<td>2 unsuccessful</td>
<td>1 worsening cognition after 2 weeks and died after 2 months</td>
</tr>
<tr>
<td>Stent retriever</td>
<td>5</td>
<td>4 successful</td>
<td>3 recovered well</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1 unchanged</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1 death</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1 unsuccessful</td>
<td>3 recovered well</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3 deaths</td>
<td></td>
</tr>
<tr>
<td>Aspiration and retriever</td>
<td>7</td>
<td>5 successful</td>
<td>1 unchanged</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1 death</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>3 unsuccessful</td>
<td>3 deaths</td>
</tr>
<tr>
<td>Thrombectomy with angioplasty and stenting</td>
<td>9</td>
<td>9 successful</td>
<td>5 recovered well</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1 unchanged</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>3 deaths (1 vertebral stent, 1 MCA stent, 1 ICA stent)</td>
<td></td>
</tr>
</tbody>
</table>