

Experience in Mechanical Thrombectomy for Acute Stroke Treatment during Pandemic: A Single Center Report

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ABSTRACT

Objective: The COVID-19 disease affected most hospitals with its rapid spread and increased number of severe cases. Thus, delays in acute ischemic stroke care and a decline in hospitalization and interventions, such as endovascular thrombectomy, have been reported. With the present study, we aimed to evaluate baseline patient characteristics and determine the impact of pandemics on MT-related outcomes.

Materials and methods: The hospital database was scanned for the patients diagnosed with acute ischemic stroke and treated via mechanical thrombectomy. The patients enrolled in the study were evaluated for their demographic features, infarct characteristics, clinical neurological scores (NIHSS and mRS) on admission and discharge, the TICI results, and the clinical course of the disease.

Results: 250 patients were diagnosed with acute ischemic stroke during the Sep.2020-Oct.2021 period. Of the 158 patients were eligible for mechanical thrombectomy. Among the patients who underwent MT, 8 (5.06%) were diagnosed with COVID-19. While the median NIHSS score on admission was 12 (± 4.16), the final post-procedural NIHSS score on discharge was 6 (± 5.00). The most commonly occluded artery was MCA in 128 (81.01%) patients. While 76 (%48.10) of the patients resulted in procedural success with a TICI 3 score, a post-procedural intracranial hemorrhage was observed in 35 (22%) patients. A total of 90 (%56.96) patients were discharged with a good neurological outcome, while 32 (%20.25) had a lethal result. The outcome data of some patients (32 (%20.25) in particular) could not be obtained. Those patients needed to be referred to another ICU after the MT procedure because of the present hospital's lack of ICU beds.

Conclusion: The rate of COVID-19 infection was low among stroke patients who underwent MT. Moreover, all patients who underwent intervention due to a lack of intensive care beds could not be followed up in our hospital and had to be referred to an external center.

Keywords: Stroke, mechanical thrombectomy, COVID-19

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INTRODUCTION

In treating ischemic brain tissue that has not already been infarcted—including tissue that has not yet been infarcted—reperfusion therapy is the approved method for restoring cerebral blood flow to the tissue. Reperfusion can only be achieved in a short time since the benefit decreases with time. Intravenous recombinant tissue plasminogen activator (alteplase, tPA) is the first-line treatment for acute ischemic stroke patients. The prerequisite is that the treatment is initiated within 4.5 hours of the onset of clearly defined symptoms. The effectiveness of alteplase depends on time, so it is important to begin treatment as soon as possible. Regardless of whether mechanical thrombectomy is being considered, patients who qualify for intravenous administration of alteplase should be treated as soon as possible (1).

When the anterior circulation is obstructed by a large vessel which happens after an acute ischemic stroke, mechanical thrombectomy (MT) is indicated. Within 24 hours of their baseline neurologic status, the patients can receive alteplase intravenously regardless of whether they have received alteplase for a previous ischemic stroke. Two concerns may prevent mechanical thrombectomy from becoming widely used.

The first and foremost thing to understand is that only about 10% of acute ischemic stroke patients have large vessels occluded in the anterior circulation prior to presenting for mechanical thrombectomy within the first six hours following their stroke. A mechanical thrombectomy may be appropriate for about 9 percent of patients presenting within 6 to 24 hours.

The second problem is that only a limited number of stroke centers have the necessary expertise and resources to carry out the procedure. Suppose a patient is admitted to a hospital that does not offer thrombectomy. In that case, they can receive standard treatment using intravenous tPA. A tertiary stroke center can be referred to those with anterior circulation strokes to provide intra-arterial thrombectomy (2, 3). The present study is a report from such a tertiary stroke center hospital.

The pandemic had many consequences and caused problems with the number of vacant intensive care beds in hospitals with an increase in severe cases (4). Moreover, it is unclear how prevalent COVID-19 is among patients treated with MT (5).

With the present study, we aimed to investigate the baseline characteristics of patients treated with MT during the pandemic and determine if the outcomes affected by the pandemic changed. In addition, we also aimed to evaluate the incidence of COVID-19 infection during MT among patients.

MATERIAL and METHODS

Recruitment and Data Collection

We performed a retrospective analysis based on the hospital database. Medico-administrative data and electronic medical records were collected to benchmark demographics, procedural intervention, clinical performance, and outcomes. The study report collected the following characteristics: patients' demography, comorbidities, medications, COVID diseases, the door-to-needle time, clinical presentation and ongoing course of ischemia, and the after-procedure complications (parenchymal hemorrhage or gastrointestinal hemorrhage), post-procedural recanalization rates, discharge, and mortality.

Characteristics of the patients

The patients admitted to the tertiary acute stroke center and diagnosed with an acute ischemic stroke were identified. A one-year data was scanned retrospectively (Sep.2020-Oct.2021). All the consecutive patients over 18 who underwent MT or MT plus emergency stenting were selected.

Clinical assessment

The patient's modified Rankin Scale (mRS) and National Institute of Health Stroke Scale (NIHSS) scores were assessed by a specialist neurologist at admission on the 24th hour and discharge.

Imaging evaluation

Both initial radiological evaluations of the CT were performed by a senior radiologist, as well as evaluation of recanalization of primary artery occlusion and global reperfusion of the distal vascular bed with thrombolysis in cerebral infarction (TICI) scores. The reperfusion is defined as grade 0: no perfusion; grade 3: complete reperfusion of the previously occluded target artery's ischemic territory without occlusions in its distal branches.

Procedures: The MT procedure was performed by either a senior radiologist or an experienced neurologist.

A simple CT scan and a CT angiography were performed on all patients who presented with severe stroke symptoms within the first few hours after symptom onset. An angiography unit was immediately consulted for endovascular MT treatment for patients with large artery occlusions on CTAs. The endovascular interventions were performed via Solitare medical biomedical[®], Trevo biyotem[®], and Appero acandis[®].

Statistical analyzes: Descriptive data and the tables were created with the MS Excel program. Data are given median (minimum-maximum) for continuous variables and frequency (percentage) for categorical variables.

Study Limitations: This study's two significant limitations are the retrospective single-center design and the short-term clinical follow-up.

RESULTS

The hospital where the present study was conducted is the most significant stroke center in Western Thrace and Northern Marmara. Acute ischemic stroke patients admitted to our hospital were given IV tissue plasminogen activator (IV rt-PA) in 102 of 250 patients with appropriate indications and MT in 158 of the 250 patients. ADAPT (A Direct Aspiration First Pass Technique) was the most commonly used method for MT.

Among the 158 patients who underwent MT and were included in the study, the rt-PA was administered intravenously to 10 patients before MT and intraarterial to 8 patients during MT.

In our cohort of stroke patients undergoing MT, we saw just 8 cases of COVID-19 infection (5.06%). The 3 (9.37%) of the 32 patients who died after the procedure were infected.

There was a referral of 36 (22.78%) of the patients to another hospital for ICU follow-up after the MT procedure. There is a lack of data for outcomes such as NIHSS and mRS scores on discharge and mortality for those patients.

The features of the patients undergoing MT and the procedure's outcomes are defined in detail in Table 1.

Table 1. Characteristics of patients undergoing mechanical thrombectomy for acute ischemic stroke.

	All Cases (n=158)
Age (median, years)	65 (± 15.26)
Male sex (n, %)	86 (54.5%)
Symptom onset to admission time (median, in minutes)	84 (± 25.13)
Door-to-needle time (median, in minutes)	84 (± 34.66)
MIHSS score on admission	
Median (\pm SD)	12 (± 4.16)
Mean	12 (1-25)
NIHSS score on 24th hour	
Median (\pm SD)	10 (± 4.79)
Mean (min-max)	10 (0-20)
NIHSS score during discharge	
Median	6 (± 5.00)
Mean (min-max)	6 (0-20)
mRS score during discharge (median)	
Median (\pm SD)	2 (2.00)
Mean (min-max)	2 (0-9)
Occlusion site (n, %)	
MCA	128 (81.01%)
ICA	10 (6.32%)
ICA+MCA	3 (1.89%)
Bacillary artery	5 (3.16%)
LSC lenticulostriate arteries	5 (3.16%)
Cerebellum	3 (1.89%)
ACA	3 (1.89%)
Thalamus	1 (0.63%)
Post-procedural intracranial hemorrhage (n, %)	35 (22%)
Need for decompression (n, %)	16 (10%)
Revascularization results (n, %)	
TICI 0	14 (8.86%)
TICI 1	6 (3.79%)
TICI 2a	6 (3.79%)
TICI 2b	36 (22.78%)
TICI 2c	20 (12.65%)
TICI 3	76 (48.10%)
Post-procedural outcomes (n, %)	
Discharge	90 (56.96%)
Referral to another neurological center for IUC	36 (22.78%)
Mortality	32 (26.22%)

MIHSS (National Institute of Health Stroke Scale), mRS (modified Rankin Scale), ICA (Internal carotid artery), MCA (Middle cerebral artery), ACA (Anterior carotid artery), LSC (Lenticulostriate arteries), TICI (Thrombolysis in cerebral infarction score).

DISCUSSION

The literature has documented a link between COVID-19 disease, stroke, and worse outcomes after stroke for patients with COVID-19 disease (including strokes with large vessel occlusions) throughout the COVID-19 outbreak (6). In the current pandemic, vascular pathologies, including stroke, hospital crowding, and shortage of intensive care beds, are all increasing. We assumed that it would be valuable to review and present the baseline statistics about acute ischemic stroke patients and those who underwent MT during the pandemic to contribute to the literature with the data of a tertiary care neurology center hospital.

In the present study, 158 patients were hospitalized with ischemic stroke and treated with MT. Few of them (8 patients) were diagnosed with COVID-19 infection. The majority were discharged after the intervention with a good neurologic state.

Endovascular therapy is a highly effective treatment option in the appropriate patient group. According to medical literature, MT appeared beneficial in all the pre-specified subgroups, including cases aged both >80 and <80 years, males and females, subjects with moderate or severe strokes, and patients treated or not with intravenous thrombolysis (7, 8). The reported rates for successful intervention and reasonable revascularization after MT are over 90% (7, 8). In our study, the patients with TICI scores >2 were 87.34% of the patients (n=138), which is quite similar to the literature rates. However, after successful innervation, the patients' discharge rate was 56.96% (n=90). Due to the lack of an intensive care unit at our hospital, 22.78% (n=36) of the patients were referred to another neurology intensive care unit after the intervention. The low rate we detected is obviously because of the lack of data on the 2.78% (n=36) patients referred to another center due to a shortage in ICU beds.

MT intervention led to significantly reduced disability as indicated by an improvement of the mRS score to 2 at discharge time and NIHSS scores from 12 points to 6 points from admission to discharge time. The success rates of our endovascular interventions are consistent with those reported in the literature. In a meta-analysis of multiple trials, with pooled data for over 1000 cases, the rate of mRS and NIHSS scores presented significantly better functional independence results for the group treated with MT than the control group (9).

According to our study, 84 minutes was the median time from the onset of symptoms to the first instance of reperfusion after the symptom onset. Before pandemics, the previous trials reported the median door-to-needle time as 241 minutes (9). In a multicentric report conducted during pandemics noted the duration as 138 minutes in patients who underwent MT under general anesthesia and 100 minutes for those who underwent MT awake (4). We report the present data from a well-organized, qualified tertiary-care neurology center. That would be the cause of the better outcome in our study.

Our COVID-19 prevalence among the patients was not so far different from the World literature; some multicentric and international studies have reported the prevalence as 2.8%-3.3%, while we have 5.06% of the patients with comorbid COVID-19 infection (4, 5, 10, 11). The mortality rate among the patients treated with the endovascular intervention was 9.37%; that is, 3 out of 32 patients resulting in death were infected with COVID-19. According to the literature, the mortality rate among COVID-19 infected patients treated with MT for acute ischemic stroke ranged from 29.8% to 33.3% (4, 5, 10, 11). In-hospital mortality among acute ischemic stroke patients who received endovascular treatment ranged from 12.4%-24.1% in patients without COVID-19 (4, 10). According to our study, the total in-hospital mortality of the patients treated with MT was 26.22% (n=32 patients) and 23.77% (n=29 patients) in patients without COVID-19.

Again, we should emphasize that the in-hospital mortality rate does not reflect all the patients we have treated because of the patients referred to other hospitals.

CONCLUSION

Hospitals have altered stroke triage protocols to protect their providers in response to the COVID-19 pandemic. However, there has not been a systematic assessment of workflow changes' effects on stroke patients receiving MT. In addition to the acceptable risks associated with endovascular therapy, the ongoing pandemic has also introduced negative consequences to the time involved in the process. Some of these are the reasons why the patients have to be referred after the procedure and cannot be followed up by the treating physician due to the high patient volume at the hospital, the long time it takes for the patients to receive treatment from the time they arrive at the hospital, or the occupancy of the intensive care beds.. As in every crisis period, there are lessons and experiences to be learned as a neurology team in this pandemic process.

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Author Contributions: MSA, KT, AÖ, MC, TG: Study conceptualization, protocol planning, clinical data collection, clinical data analysis and supervision. MSA: manuscript writing/editing.

Ethical approval: All procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and/or with the Helsinki Declaration of 1964 and later versions. Informed consent or substitute for it was obtained from all patients for being included in the study. Study was approved by the regional scientific ethics committee: Ethical Principles for Medical Research Involving Human Subjects (2022.04.117)

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