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Investigating the Therapeutic Outcomes of the Endovascular Thrombectomy Method in Patients with Acute Ischemic

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Abstract

Introduction: Stroke is the fifth reason for mortality and the first most common neurological disease leading to disability in the United States. The harm can be minimized if the blood flow is restored early (reperfusion therapy). Various treatment methods are used for stroke, such as endovascular thrombectomy. In this study we evaluated the outcomes of the endovascular thrombectomy method in patients with acute ischemic stroke, based on mRS score.

Methods: The outcomes were measured on 66 male and female patients (36 female and 30 male patients) with acute ischemic stroke, based on the mRS score. A convenience census sampling method was applied. The data were calculated, including age, gender, blood pressure, diabetes, smoking, and the mRS score. Data were analyzed using the Wilcoxon and Mann-Whitney tests.

Results: In this research, 45.5% of the cases were men, and 55.5% were women. In general, the mean mRS after 1, 3, and 12 months were 30.97, 3.4, 3.30, and 3.20, with a standard deviation of 0.74, 2.10, and 2.28, respectively. The response to thrombectomy treatment (mRS between zero and two), had a significant difference with 2 in all three time periods.

Discussion and Conclusion: Based on the difference between the results and the criterion (mRS maximum of 2) in three times of 1, 3, and 12 months (2.97, 1.30, and 1.20, respectively), the mRS score was outside our optimal range in all three times.

Keywords

Ischemic stroke; Disability; Endovascular Thrombectomy; Blood pressure; Reperfusion therapy

Introduction

The mortality and prevalence of stroke have significantly decreased due to the reduction of smoking and the improvement of the treatment of hypertension, dyslipidemia, and diabetes. However, the prevalence of stroke has increased in younger people (less than 55 years old) (1). Brain tissue can remain healthy in cases of ischemic stroke if blood flow is restored rapidly. Therefore, the most important treatment for ischemic stroke is to remove the clot. (2). Until 2015, the standard emergency treatment for acute ischemic stroke was intravenous alteplase. In a cohort study by International Society of Neurological Disorders and Stroke, the disability rate decreased by 30% in the patients who received alteplase within three hours of the onset of symptoms (3). Later, it increased to four and a half hours (4). However, alteplase's effectiveness in treating strokes caused by blockage of large vessels, including the proximal part of the M1 segment of the middle cerebral artery and the terminal part of the carotid, was relatively low. The rate of flow restoration was 4 to 30% (5), so the use of endovascular methods was advanced to improve these ratios. The initial results of treating acute ischemic stroke with mechanical thrombectomy were disappointing. However, with the progress of using newer equipment, selection of patients, and shorter duration of patient transfer, endovascular treatment became a more standard treatment for acute ischemic stroke.

In 2015, five non-selective clinical studies on the thrombectomy method in the treatment of acute ischemic stroke proved the usefulness of this treatment (6). The widespread use of mechanical thrombectomy may be limited to two problems in the clinic: 1- 10% of ischemic strokes are caused by a blockage in the proximal of a large artery in the anterior blood supply system. The patient must refer early enough (within the first six to twenty-four hours of the onset of symptoms) to be qualified to receive the thrombectomy treatment (7). 2- Only a few stroke centers have the necessary equipment and specialists to perform this method (8). Although qualified cases (stroke caused by anterior blood flow blockage) can receive standard alteplase treatment when they refer to a qualified hospital to perform thrombectomy, they are then transferred to a center with endovascular thrombectomy facilities (9).

Criteria for mechanical thrombectomy for patients who refer during the first six to twenty-four hours after the onset of symptoms include: Presence of contraindications or failure of treatment with alteplase- the presence of a stable defect that potentially causes disability- no disability OR significant disability before stroke (mRS maximum of 1)- initial infarction involves less than 1/3 of the middle cerebral artery in CT angiography(CTA) or MR angiography(MRA), and the intracranial occlusion of the internal carotid artery, or the M1 segment of the middle cerebral artery (10).

In a study by Beumer et al. (2015), the results revealed significant usefulness in endovascular treatment in terms of 90-day outcomes. Also, there were no remarkable differences between the two groups regarding symptomatic intracranial bleeding and mortality (11). In Goyal et al. (2015) study, the mortality rate after 90 days was 19% in the group receiving medical treatment and 10.4% in the group receiving endovascular treatment (12).

The study by Jovin et al. (2015) revealed that the occurrence of symptomatic intracranial bleeding (90 days after treatment) was 1.9% in both groups (13). the study conducted by Savor et al. (2015) revealed the results of the significant use of thrombectomy treatment in such a way that after 90 days, the favorable outcome

(mRS between zero and two) was 35% in the control group (receiving only alteplase) and 60% in the second group (who underwent thrombectomy in addition to alteplase). The incidence of symptomatic intracranial bleeding was 3% in the first group and 0% in the second group (14).

Currently, the standard treatments for stroke are thrombolytic (alteplase) and endovascular thrombectomy. In this study, the endovascular thrombectomy method, as a relatively novel method applied for ischemic stroke treatment, was used, and its effectiveness in ischemic stroke patients was based on mRS Score.

Methods

This is a cross-sectional-analytical study. The study's statistical population involved all patients with ischemic stroke who were referred to Imam Khomeini and Golestan hospitals, from 2015 to 2020. All of them were examined in the first twenty-four hours after the onset of symptoms, and were candidates for endovascular thrombectomy treatment. The inclusion criteria of the study were: a definitive diagnosis of ischemic stroke by imaging studies and neurologist confirmation, parental consent and cooperation, and referral within 8 hours from the onset of symptoms. The exclusion criteria were the cases where the lesion site was not available due to the complexity of the vascular anatomy, the patient's lack of consent and cooperation, referral after eight hours from the onset of symptoms, and cases that received other treatments for ischemic stroke.

A convenience sampling method was selected. The patients were treated with the diagnosis of ischemic stroke after imaging studies and the neurologist's confirmation. Overall, 66 patients with ischemic stroke were treated with the thrombectomy method. 36 patients were female, and 30 were male.

Results

The desired information, including age, gender, and history of hypertension and smoking, were extracted from the patient's medical records in the form of a checklist. Phone calls were used to follow up on the patient's status 1, 3, and 12 months after thrombectomy.

The scoring system of 1 mRS was used after one month, three months, and 12 months to evaluate the treatment response. In this system:

1. A patient without symptoms receives a score of zero,
2. A patient who does not have a clear disability and, despite some symptoms, can perform all his or her activities receives a score of 1
3. A patient with a mild disability who can take care of himself or herself without help, it is not able to perform all his or her previous activities receives a score of 2,
4. A patient with a moderate disability who needs some help but can walk without help receives a score of 3.
5. A patient with moderate to severe disability who cannot do their work or walk without help receives a score of 4.
6. A patient with a severe disability who requires constant nursing care or hospitalization gets a score of 5.
7. In case of death, a score of 6 is given to the person.

This study's desired mRS score was considered from zero to two. The data, including age, gender, blood pressure, diabetes, smoking, and calculated mRS score, were entered into Spss-26 software.

After analyzing the mentioned data, U-Whitney and Wilcoxon tests were used in the inferential section. Code of ethics of IR.AJAUMS.REC.1400.230 was received to implement the project.

54.5% of cases were women, and 45.5% were men. The age group of 51 to 60 years, with a frequency of 27.3% has the highest frequency, and the age group of 81 to 90 years, with 1.12% has the lowest frequency. The mean age was 61.05, with a standard deviation of 16.05, and the age range was from 20 to 88 years. 71.2% of the respondents suffered from hypertension. Based on the results, 13 respondents (19.7%) have type 2 diabetes. Most respondents (77.3%) were not smokers (table 1).

Comparison	Mean differences	Z-value	sig
1-month mRS score with a 3-month mRS score	1.67	57.5	0.001
1-month mRS score with 12-month mRS score	1.77	5.47	0.001
3-month mRS score with a 12-month mRS score	0.106	1.97	0.052

Table 1: Wilcoxon test to compare the mRS scores at different times

The Wilcoxon test results revealed a remarkable difference between the mRS scores after three months and 12 months compared to 1 month. The mean mRS score was 4.97 after one month. This score was reduced to 3.30 after three months, indicating a reduction of 1.67 units, and this difference was statistically significant.

The mean score of mRS after 12 months reached 3.20, indicating a reduction of 1.77 units compared to 1 month. This reduction in mRS score after 12 months was also significant.

The reduction of mRS score was significant after three months and 12 months, compared to 1 month.

However, only a 0.106 difference was observed between the two times of 3 months and 12 months, which was not statistically significant and showed that the mRS score was almost equal in the two times of 3 months and 12 months.

Comparison	Mean	Difference with criterion	sig
1-month mRS score	1.67	5.57	0.001
3-month mRS score	1.77	5.47	0.001
12-month mRS score	0.106	1.94	0.52

Table 2: One-sample Wilcoxon test to compare mRS scores with criterion 2

The mRS score was higher than two all three times; After one month, three months, and 12 months, it was 4.97, 3.30, and 3.20, respectively. It was higher than two in all three times and significantly different with 2. The mRS score was outside the optimal range of 0 to 2 all three times.

Comparison	Female mean	Male mean	Mean difference	Z-value	sig
1-month mRS score	94.4	5	056.0	06.1	287.0
3-month mRS score	64.2	10.4	46.1	53.2	011.0
12-month mRS score	53.2	4	47.1	10.2	036.0

Table 3: Mann-Whitney test to compare the mRS scores in males and females

The results of the Mann-Whitney test: The score of mRS after one month was 4.94 in females and 5 in males, which had a nonsignificant difference of 0.056 units. The mRS score after three months was 2.64 in females and 4.10 in males, which was a significant difference. The mRS score after three months was significantly lower in women than in men. Also, the mRS score after 12 months was 2.53 in females and 4 in males, which was a significant difference. The mRS score after 12 months in females was significantly lower than in males.

The results revealed that the mean difference between the two groups increased in 3 months and 12 months compared to 1 month. To examine the relationship between the occurrence of ischemic stroke and mRS SCORE, due to the small sample size (66 people), they were divided into two equal groups with a median score which was 60.50. The mRS scores were compared between the two age groups of younger and older. The number of people in each group is 33 people.

Comparison	Younger age mean	Older age group	Mean difference	Z-value	sig
1-month mRS score	73.4	21.5	485.0	2.82	0.005
3-month mRS score	2.42	4.18	1.76	3.47	0.001
12-month mRS score	2.36	4.03	1.67	2.87	0.004

Table 4: Mann-Whitney test to compare mRS scores in the age groups

The Mann-Whitney test results detected that the mean mRS score after one month was 4.73 in the younger age group and 5.21 in the older age group, indicating a difference of 0.485 units.

The results showed that the mRS score in younger people was significantly lower after one month. The mRS score was 2.42 in the younger group and 4.18 in the older group after three months, indicating a significant difference.

After three months, the younger group had a significantly lower mRS score than the older group. In addition, after 12 months, the mRS score was 2.36 in the younger group and 4.03 in the older group, indicating a significant difference. After 12 months, the mRS score of the younger age group was significantly lower than that of, the older age group. In comparison to one month, the mean difference between the two groups increased at three and twelve months.

Comparison	Mean of diabetic group	Mean of the nondiabetic group	Mean difference	Z-value	sig
1-month mRS score	5.23	4.19	0.325	2.52	0.129
3-month mRS score	54.4	3	54.1	2.37	018.0
12-month mRS score	4.62	2.85	1.77	2.58	0.010

Table 5: Mann-Whitney test to compare the mRS scores between people with type 2 diabetes and other people

The results of the Mann-Whiten test revealed that the mean mRS score after one month was 4.91 in the nondiabetic group and 5.23 in the diabetic group, indicating a nonsignificant difference of 0.325. After three months, the mRS score for the nondiabetic group was 3, and for the diabetic group it was 4.54, indicating a significant difference. After three months, the mRS score of the nondiabetic group is significantly lower than that of the diabetic group.

In addition, the mRS score at 12 months was 2.85 in the nondiabetic group and 4.62 in the diabetic group, representing a significant difference. After 12 months, the mRS score of the nondiabetic group was significantly lower than that of the diabetic group. In comparison to one month, the mean difference between the two groups was greater at three and twelve months.

Comparison	Mean of hypertension	Mean of non-hypertension	Mean difference	Z-value	Sig
1-month mRS score	5.04	4.76	0.253	2.646	0.518
3-month mRS score	3.72	2.26	1.46	2.86	0.005
12-month mRS score	3.64	2.11	1.56	2.86	0.004

Table 6: Mann-Whitney test to compare the mRS scores between people with hypertension and other people

The Mann-Whitney test revealed that the mean mRS score after one month was 4.79 in the group without hypertension and 5.04 in the group with hypertension, indicating a nonsignificant difference of 0.253. After three months, the mRS score in the non-hypertension group was 3.73 and in the hypertension group it was 2.26, showing a significant difference. The results also revealed that after three months, the mRS score in the non-hypertension group was significantly lower than in the hypertension group. In addition, the mRS score after 12 months was 2.26 in the group without hypertension and 3.64 with hypertension, indicating a significant difference. The results also demonstrated that the mRS score in the non-hypertension group 12 months after treatment was significantly lower than in the hypertension group. In comparison to one month, the mean difference between the two groups increased at three and twelve months.

Comparison	Mean of smokers	Mean of non-smokers	Mean difference	Z-value	sig
1-month mRS score	4.96	4.98	0.047	0.605	0.545
3-month mRS score	3.33	3.29	0.039	0.252	0.801
12-month mRS score	3.33	3.16	0.176	0.197	0.844

Table 7: Mann-Whitney test to compare the mRS scores between smokers and non-smokers

The results of the Mann-Whitney test showed that the mean score of mRS all three times was the same between the two groups of smokers and non-smokers, and no significant difference was observed. According to the results, the mean score of mRS after one month, three months, and 12 months between the two groups of smokers and non-smokers were the same.

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