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Clinical Outcomes of Patients with Unsuccessful Mechanical Thrombectomy versus Best Medical Management of Medium Vessel Occlusion Stroke in the Middle Cerebral Artery Territory

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Abstract

Background: Current randomized control trials are investigating the efficacy and safety of mechanical thrombectomy (MT) in patients with medium vessel occlusion (MeVO) stroke. Whether best medical management (MM) is more efficient compared to unsuccessful vessel recanalization during MT remains unknown.

Methods: This was a retrospective cohort study using data from 37 academic centers across North America, Asia, and Europe between September 2017 and July 2021. Only patients with occlusion of the distal branches (M2 and M3) of the middle cerebral artery territory were included. Unsuccessful MT was defined as modified Thrombolysis in Cerebral Infarction (TICI) score of 0-2a. Propensity score matching was employed to control for confounders. The primary outcome was functional independence, defined as a modified Rankin Scale (mRS) score of 0-2 at 90 days after treatment. Multivariable regression analysis was used to assess factors associated with the primary outcome.

Results: Of 2903 patients screened for eligibility, 532 patients were analyzed (266 per group) after PSM. The MM group had superior functional outcomes, with 32% achieving mRS 0-1 at 90 days compared to 21% in the MT group ($P = 0.011$). MM patients also exhibited significantly lower rates of sICH (3.4% vs. 16%, $P < 0.001$) and any hemorrhage (18% vs. 48%, $P < 0.001$). On multivariable regression, unsuccessful MT was associated with reduced odds of functional independence (OR 0.50, 95% CI 0.29-0.85, $P = 0.011$) and increased odds of sICH (OR 4.32, 95% CI 1.84-10.10, $P < 0.001$). Mortality rates were similar between groups (27% in MM vs. 29% in MT, $P = 0.73$).

Conclusion: Unsuccessful MT for MeVO was linked to worse outcomes than BMM. These findings highlight the risks of prolonged attempts and emphasize the importance of efficient procedural decision-making to reduce complications and improve patient outcomes.

Keywords: Mechanical Thrombectomy (MT); Medium Vessel Occlusion (MeVO); Stroke

Key Messages

What is already known on this topic

Mechanical thrombectomy (MT) is increasingly utilized to treat medium vessel occlusion (MeVO) strokes, with prior studies suggesting that successful MT can lead to better functional outcomes compared to best medical management (MM). However, recanalization rates during MT for MeVO vary significantly, and unsuccessful MT procedures may be associated with worse outcomes, as observed in large vessel occlusion strokes. It remains unclear whether patients with MeVO stroke who undergo unsuccessful MT have different outcomes compared to those managed with MM alone.

What this study adds

- This study demonstrates that in patients with MeVO strokes of the MCA territory, unsuccessful MT (defined as modified Thrombolysis in Cerebral Infarction [TICI] score of 0-2a) is associated with worse functional outcomes compared to MM.
- Unsuccessful MT was linked to reduced odds of achieving functional independence and increased odds of symptomatic intracranial hemorrhage (sICH), without a significant difference in mortality rates compared to MM.

How this study might affect research, practice or policy

The results highlight the importance of efficient procedural decision-making in the management of MeVO strokes. Recognizing the potential risks associated with unsuccessful MT, clinicians may need to carefully consider patient selection and procedural strategies to maximize recanalization success rates. These findings may influence clinical guidelines and inform future research to optimize MT techniques or develop criteria for when MT may be more beneficial than MM in MeVO stroke patients.

Introduction

Several ongoing randomized control trials seek to evaluate the benefit of mechanical thrombectomy (MT) for medium vessel occlusion (MeVO) stroke. Several retrospective studies have published promising data on the potential efficacy and safety of MT for patients with MeVO,[1–7] indicating that successful MT for MeVO stroke may result in better functional outcomes compared to patients who received best medical management (MM) only.

However, recanalization rates of MeVO during MT range between 78-97%, depending on the occlusion location, recanalization technique, and patient characteristics.[2,8–11] Failure of vessel recanalization during MT may have detrimental consequences for patient outcomes.[12,13] Treatment success of MT for MeVO stroke may be limited by several factors, such as the anatomy of smaller distal vessel caliber, more tortuous access routes and thinner arterial walls, which can result in failure of recanalization. Thus, treatment intention needs to be balanced against the lower potential recanalization benefit due to smaller tissue-at-risk volumes as compared to proximal vessel occlusion MT.[4,14] In addition, there is considerable evidence that at least for patients with anterior circulation proximal large vessel occlusion, failed recanalization during MT (defined as Thrombolysis in Cerebral Infarction [TICI] score of 0-2a) may be harmful and result in less favorable functional outcomes compared to MM alone.[15] Whether this phenomenon also applies in the setting of middle cerebral artery MeVOs remains unknown. Additional data on the clinical course of patients with failed recanalization during MT is needed as it may hold implications for treatment decision making in this subgroup of stroke patients.

In this multicenter retrospective study, we aimed to assess and compare functional outcomes of patients with MeVO of the middle cerebral artery territory in whom vessel recanalization during MT could not be achieved vs. those who received MM alone for stroke management. We hypothesized that patients treated with MM would have better functional outcomes compared to patients in whom MT treatment was unsuccessful.

Methods

Study design

This was a retrospective multicenter international cohort study of MeVO patients treated by endovascular thrombectomy or MM.

Standard Protocol Approvals, Registrations, and Patient Consents

The study was approved by the local ethics committees at each participating site, complied with the Health Insurance Portability and Accountability Act and followed the guidelines of the Declaration of Helsinki. Patient informed consent was waived. This study is reported according to the STROBE guidelines.[16]

Data Availability Statement

The data supporting our findings are available from the corresponding author and after approval from the MAD-MT consortium upon reasonable request.

Patient inclusion, cohort, and clinical data

Demographics, characteristics, procedural details, and clinical outcomes of patients with acute ischemic stroke due to MeVO were collected from an international collaborative data set comprised from 37 academic medical centers in North America, Asia, and Europe in the MAD-MT consortium. [14,17–25,25–29] Data were prospectively collected between September 2017 and July 2021 and retrospectively reviewed. Inclusion criteria were as follows: 1) patients with acute ischemic stroke due to MeVO of the second (M2), or third (M3) or fourth (M4) segment of the middle cerebral artery confirmed using CT angiography or MR angiography.; 2) treatment of MeVO either by MT or MM alone with or without administration of intravenous thrombolysis (IVT) respectively; 3) available National Institutes of Health Stroke Scale (NIHSS) scores on admission and available modified Rankin Scale (mRS) scores 90 days after treatment; 4) available TICI scores for each patient. Patients with ICA or tandem occlusions were excluded. The specific inclusion and exclusion criteria are displayed in Figure 1.

At each participating center, local neurointerventionalists reviewed all cases before sending in their data. MT treatment success or failure was determined by the individual neurointerventionalist who performed the procedure. Decisions to terminate the procedure, even in cases of failure, were made at the discretion of the operator and aligned with the institution's protocol; however, specific reasons for termination were not recorded. Unsuccessful MT was defined as TICI of 0-2a at the end of the procedure. Decisions regarding treatment modalities and other periprocedural details such as MT access site (femoral or radial artery) and endovascular strategy (aspiration, stent retriever, combined or rescue techniques) were at the discretion of the individual operators. MM was defined as medical treatment alone (i.e., standardized care protocol for stroke which includes IVT where applicable, management of risk factors, and secondary prevention measures) excluding all patients with attempted MT or spontaneous recanalization on the first angiographic series. Baseline Alberta Stroke Program Early CT Score (ASPECTS) was determined on pre-treatment head non-contrast CT or MR images at each participating center.[30] Parenchymal hemorrhage after MT were classified on follow-up imaging according to the Heidelberg Bleeding Classification criteria based on the radiographic distinction between hemorrhagic infarction (HI) and parenchymal hematoma (PH).[31] Symptomatic intracranial hemorrhage (sICH) was defined as any bleeding on follow-up imaging after MT with neurological worsening (i.e., a minimum of ≥4 points increase of 24-hour National Institutes Health Stroke Scale compared with admission National Institutes Health Stroke Scale).[32]

Study Group Definitions

All included patients were dichotomized to MT versus MM only. In both groups, IVT was administered according to prevailing guidelines.

Outcome Measures

The primary outcome was functional independence (mRS 0-2), with secondary outcomes including excellent outcome (mRS 0-1) and mortality. Safety outcomes were types of intracerebral hemorrhage (ICH) and sICH, defined in accordance with "The Heidelberg Bleeding Classification".[31]

Statistical Analysis

We used descriptive statistics to compare baseline, treatment, and outcome variables between the two treatment groups. Continuous variables were reported as median and interquartile range (IQR) and compared between groups using Mann-Whitney U test. Categorical variables were reported as counts plus percentages and compared between groups using chi-squared test or Fisher's exact test in instances where cell counts were fewer than five.

Propensity score matching (PSM) was used to control for potential confounders[33,34]. Propensity scores were estimated using logistic regression and optimal matching algorithm were employed with a 1:1 ratio. Variables likely to affect the outcomes according to previous studies [22,35–37] were included in the PSM, which included age, sex, baseline NIHSS, pre-admission mRS scores, history of antiplatelet and anticoagulant medication use, pertinent comorbidities (diabetes mellitus, hypertension, hypercholesterolemia and atrial fibrillation), and occlusion location. Covariate balance post-PSM was assessed using the standardized mean difference, with <0.1 indicating effective balance. A *P*-value of 0.05 or less was considered statistically significant. A multivariable model was conducted to adjust for any residual imbalances between the two groups post-PSM. This model included adjustments for sex, age, high blood pressure, high cholesterol, diabetes, atrial fibrillation, mRS before stroke, baseline NIHSS, ASPECTS, IVT administration and occlusion site.

R statistical software (version 4.3.0, R Project for Statistical Computing) and Rstudio statistical software (version 2023.03.0+386, Rstudio) were used for statistical analyses and data visualization.

Results

Baseline Characteristics

A total of 2903 patients were screened for inclusion in the study. Consequently, 978 patients were analyzed, including 651 patients who received MM and 327 patients who underwent MT. (Figure 1) The proportion of male patients was similar in both groups (50% in MM vs. 45% in MT, $P = 0.17$). The median age was 75 years for MM and 76 years for MT ($P = 0.94$). (Table 1) Following propensity score matching, 532 patients were included, with 266 in each group. Post-matching, baseline characteristics were well-balanced between the groups, as indicated by SMD less than 0.1 (Tables 1 and 2).

Intravenous Thrombolysis

Prior to matching, 53% of the overall cohort received IVT, with a higher percentage in the MM group (60% in MM vs. 38% in MT, $P < 0.001$). The median onset to IVT needle time was significantly longer in the MM group compared to the MT group (204 minutes vs. 135 minutes, $P < 0.001$). After matching, the administration of IVT was similar between the groups (42% in MM vs. 43% in MT, $P = 0.82$).

Thrombectomy Procedure

Use of GA was present in 28% of patients in the MT group. The first-line technique used during MT was stent retriever in 18%, aspiration in 16%, and both in 66% of patients. (Table 2).

The side of occlusion and other variables showed no significant differences between the matched groups (Table 2).

Clinical Outcomes

After matching, the median NIHSS on day one remained significantly lower in the MM group (8) compared to the MT group (13, P < 0.001). NIHSS shift also showed a more favorable outcome for MM (-1 vs. 1, P < 0.001). At 90 days, 26% of patients achieved mRS of 0-1, with the MM group again showing better outcomes (32% vs. 21% in MT, P = 0.011). (Figure 2) The 90-day mortality rate was similar between the groups (27% in MM vs. 29% in MT, P = 0.73). The incidence of sICH was significantly lower in the MM group (3.4% vs. 16%, P < 0.001), as was the overall rate of any intracerebral hemorrhage (18% vs. 48%, P < 0.001) (Table 3).

Multivariable Regression Analysis

Unsuccessful MT (mTICI 0-2a) was significantly associated with lower odds of achieving functional independence at 90 days (mRS 0-2) (OR, 0.50 [95% CI, 0.29-0.85]; p = 0.011) and excellent outcomes (mRS 0-1) (OR, 0.52 [95% CI, 0.29-0.92]; p = 0.025). In addition, the odds of sICH were significantly higher in the unsuccessful MT group (OR, 4.32 [95% CI, 1.84-10.10]; p < 0.001). Mortality at 90 days was not significantly different between unsuccessful MT and BMM (OR, 1.18 [95% CI, 0.67-2.05]; p = 0.57). For additional details for all variables in the multivariable analysis, refer to Table 4.

Discussion

In this multicente r retrospective study of acute ischemic stroke patients due to MeVO of the 2nd, 3rd and 4th segment of the middle cerebral artery, we found that good functional outcomes were more frequently observed in patients who received MM compared to the group of patients in whom successful vessel recanalization could not be achieved during MT. In addition, patients who underwent MM demonstrated early neurological improvement more often and exhibited a lower (better) median NIHSS 24h after treatment initiation, which implies faster neurological recovery in this group of subjects. Our findings shed new light on ischemic stroke patients with distal medium vessel occlusions. To our knowledge, this is the first study that reports on the clinical course of patients with MeVO stroke and unsuccessful MT treatment. Our study underlines the importance of vessel recanalization and its implications for patient outcomes once the treatment decision for MT has been made.

Our findings are in line with a recent study by Rex and colleagues, who reported similar observations regarding the comparison of MM vs. unsuccessful MT in patients with anterior circulation large vessel occlusion stroke from the HERMES (Highly Effective Reperfusion Using Multiple Endovascular Stroke Trials) collaboration.[15] However, in contrast to our study, Rex et al., defined poor recanalization during MT as a TICI score of 0-1; but their data also showed a comparable trend towards higher (worse) NIHSS scores 24 hours after treatment initiation and worse functional outcomes after 90 days in the MT group. Interestingly, the authors did not find any difference in (symptomatic) intracranial bleeding following either treatment regimes, concluding that neurological deterioration following poor recanalization could not be attributed to the occurrence of hemorrhage. This finding differs from our analysis, as we observed a significantly lower number of patients with symptomatic ICH after MM treatment (3.4%), whereas 16% of patients with unsuccessful MT were found to have sICH during follow-up.

Nevertheless, the occurrence of post-treatment hemorrhage has frequently been found to be associated with worse clinical outcomes in several thrombectomy studies and it is thus conceivable that it also affects neurological recovery and long-term functional outcomes of MeVO patients. [38–42]

Rex et al. further pointed out that other demographic and clinical parameters such as onset to treatment time, baseline ASPECTS, procedural complications and baseline neurological condition may also affect the clinical course of these patients. This is in accordance with the findings of the presented study and other previous investigations by the MAD-MT collaborators.[14,17–22,24–26,43,44] In the current investigation, we observed a significant association between baseline NIHSS scores, NIHSS shift and long-term functional outcomes after 90-days (Table 1 and 2), while in an aforementioned previous MAD-MT study we observed a direct link between periprocedural complications and worse functional outcomes in MeVO patients.[19] Last, treatment success of MT for ischemic stroke may be limited by several other factors, such as the anatomy of cerebral vessels, more tortuous access routes, endovascular damage created by mechanical manipulation and subsequent vessel wall injury potentially increasing the risks of dissection, perforation and vasospasm upon mechanical manipulation, which can result in failure of recanalization.[15] It is conceivable that these parameters all may have particular implications for the treatment of MeVO stroke, as increasingly smaller vessel diameters, progressive vessel tortuosity and thinner arterial walls may increase the risk of recanalization failure especially in more distal arterial branches of the cerebral vascular circuitory.[9,38,45]

Noteworthy, in the unmatched cohort, MM patients had lower (better) admission NIHSS scores and more distal (M3) MeVOs compared to patients who underwent MT. This finding is important, since treatment decision making between both treatment options (MM vs. MT) is traditionally based on the anticipated success rate of MT (i.e., the ability to reach the clot and safely remove it from the target vessel) and the severity of clinical symptoms. Thus, it is conceivable that the decision in favor for MT treatment in our cohort was made more often in patients who presented with a severe or clinically relevant neurological deficit while considering the potential risks and also the possibility of failure of the procedure. In contrast, this finding alone may not explain the significant difference in 90-day mRS scores between the MM and MT group, as several other factors, such as recanalization success during MT, periprocedural and postprocedural complications, anesthesia regime or pre-stroke neurological status may also influence the clinical course of these patients. Whether adjunct intravenous thrombolysis administration may have an effect on clinical and procedural outcomes in MeVO strokes is still a matter of debate.[46] Of note, a recent multicenter study found that combined intravenous thrombolysis and MT compared with MT alone may not be beneficial with respect to patient outcomes[26]Another study on that topic found that MTMT does not significantly improve neurological outcomes compared to best medical management alone and was associated with a higher risk for hemorrhagic complications.[14] The upcoming randomized control trials will shed more light on this important topic.

The link between early NIHSS shift and good functional outcomes in acute ischemic stroke patients treated by thrombectomy has been studied.[47–51] Early improvement of neurological symptoms is thought to reflect compensated or limited ischemic damage to the brain predominantly based upon timely blood flow restoration by successful treatment measures, which can range from medically induced blood pressure elevation to administration of intravenous thrombolysis with or without subsequent MT. Noteworthy, there is a strong association between successful vessel recanalization during MT and early neurological improvement; and this association was found to be independent from baseline neurological impairment, pre-treatment neurological status and other demographic and procedural factors.[51,52] The findings of our study underline that stroke patients in whom successful vessel recanalization could not be achieved are less likely to exhibit a favorable early neurological recovery and consequently good long-term functional outcomes. These findings again stress the need for a proper vessel recanalization during MT once the decision for treatment has been made, which is in accordance with previous reports.[12,38,39] Moreover, Additionally, the unsuccessful MT group's inferior outcomes may be attributed to two primary factors. Initially, procedural complications, including ICH and vessel perforation. Vessel perforation can result in major mechanical damage, which can lead to catastrophic clinical deterioration.[19] Likewise, sICH after reperfusion has been demonstrated to significantly increase mortality and decrease functional independence.[23,53] The second issue is that protracted procedural times, which are frequently linked to failed MT, may have a negative impact on perfusion. This is because extended durations are associated with lower rates of salvageable brain tissue as a result of an ischemic core-perfusion mismatch.[54–65]

This study has important limitations. First, the retrospective study design leads to selection bias and reduces the generalizability of our findings. Some centers only contributed data on patients who received MT, which is likely to further increase selection bias. Second, some baseline characteristics (admission NIHSS, occlusion location) were imbalanced between MT and MM patients, which might introduce bias. We did not measure infarct growth, which may be a mechanism by which patients with unsuccessful recanalization during MT have worse outcomes compared to patients who are medically managed.[66] Third, collateral status was not directly assessed within each group as several centers did not collect these data. We aimed to adjust our results by adding these baseline characteristics as covariates in the multivariable regression models and performed propensity score matching. Importantly, the degree of reperfusion in the MM group was not captured, and the presence of patients with good reperfusion may bias the analysis against MT. Furthermore, site-specific data were unavailable, precluding analyses of inter-site variations. Stroke etiology was also not comprehensively analyzed due to limited data availability. As MeVOs naturally occur also in other vascular territories, further studies are needed to assess the clinical course of these patients especially in the setting of unsuccessful vessel recanalization during MT. Future research should also explore predictors of poor outcomes in failed MT, such as procedural time limits and attempt thresholds, to guide clinical decision-making and minimize risks.

Conclusion

In this study of acute ischemic stroke patients with MeVO of the middle cerebral artery, we found that patients who received MM alone exhibited better early neurological recovery and more favorable long-term functional outcomes compared to those patients in whom successful vessel recanalization during MT could not be achieved. These findings suggest that prolonged or repeated thrombectomy attempts without achieving successful recanalization may increase risks. Therefore, timely recognition and early termination of unsuccessful procedures may be important to reduce complications and improve patient outcomes.

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Informed Consent and Ethical Approval

Ethical committee that approved the establishment of this consortium: ERASME Hospital Ethics Committee, Ref No. 2021/312. Informed consent from patients was waived due to retrospective study design. The data supporting this study's findings are available from the corresponding author upon reasonable request.

Contributorship

T.F, V.Y, H.S, A.D, A.G contributed to the conception and design of the work.

T.F, V.Y, H.S, D.L, B.M, N.A, M.E, M.D, K.N, N.H, S.S, A.K, J.K, S.G, L.S, L.Y, B.T, R.R, J.H, N.C, A.R, J.F, S.S, A.P, C.D, M.C, L.R, J.F, P.H, R.R, M.A, P.K, T.M, J.S, T.O, A.M, P.J, A.B, F.C, J.S, T.N, R.V, A.B, D.A, N.G, M.M, V.C, B.G, C.S, C.H, G.M, H.S, C.G, D.L, A.P, A.A, I.T, E.K, M.W, B.L, A.P, V.P, A.D, A.G were involved in the acquisition of data, and data analysis and interpretation.

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Tables

Table 1. Baseline Characteristics of the included patients before and after matching

	Before PSM				After PSM			
	MM	**MT**			**MM**	**MT**		
Variable	N = 651	N = 327	**SMD**[1]	**P**[2]	N = 266	N = 266	**SMD**[1]	**P**[2]
Male, n (%)	323 (50)	147 (45)	0.09	0.17	121 (45)	116 (44)	0.04	0.66
Age, Median (Q1, Q3)	75 (65, 84)	76 (65, 84)	0.02	0.94	76 (65, 85)	77 (67, 84)	-0.06	0.57
Hypercholesterolemia, n (%)	337 (52)	88 (28)	0.49	<0.001	91 (34)	88 (34)	0	0.97
Hypertension, n (%)	444 (68)	202 (62)	0.14	0.045	179 (67)	169 (64)	0.08	0.36
Site of initial occlusion, n (%)			0.36	<0.001			0	>0.99
Medium (M2)	505 (78)	296 (91)			235 (88)	235 (88)		
Distal (M3, M4)	146 (22)	31 (9.5)			31 (12)	31 (12)		
Diabetes, n (%)	147 (23)	70 (21)	0.03	0.68	50 (19)	61 (23)	0.1	0.24
Atrial fibrillation, n (%)	242 (37)	111 (34)	0.07	0.32	96 (36)	90 (34)	0.05	0.59
Current smokers, n (%)	130 (20)	44 (13)	0.18	0.012	41 (15)	38 (14)	0.03	0.71
Previous use of antiplatelet drugs, n (%)	222 (42)	95 (31)	0.22	0.003	76 (33)	80 (32)	0.02	0.81
Previous use of anticoagulant drugs, n (%)	73 (16)	57 (22)	0.15	0.055	44 (20)	50 (24)	0.08	0.42
Pre-stroke mRS, n (%)			0.22	0.14			0.07	0.98
0	282 (62)	181 (62)			97 (61)	151 (63)		
1	59 (13)	37 (13)			20 (13)	30 (13)		
2	26 (5.7)	31 (11)			15 (9.5)	24 (10)		
3	57 (13)	29 (9.9)			18 (11)	23 (9.6)		
4	28 (6.2)	14 (4.8)			8 (5.1)	11 (4.6)		
5	2 (0.4)	0 (0)			0 (0)	0 (0)		
ASPECTS, Median (Q1, Q3)	9.00 (8.00, 10.00)	9.00 (7.00, 10.00)	0.27	<0.001	9.00 (8.00, 10.00)	9.00 (7.00, 10.00)	-0.02	0.79
Baseline NIHSS, Median (Q1, Q3)	8 (4, 15)	13 (7, 18)	-0.43	<0.001	12 (7, 18)	13 (6, 18)	0.01	0.85

[1] Standardized Mean Difference

[2] Pearson's Chi-squared test; Wilcoxon rank sum test; Fisher's exact test

Table 2. Periprocedural details of the included patients before and after matching

	Before PSM				After PSM			
	MM	**MT**			**MM**	**MT**		
Variable	N = 651	N = 327	**SMD**[1]	**P**[2]	N = 266	N = 266	**SMD**[1]	**P**[2]
Given IVT, n (%)	386 (60)	123 (38)	0.45	<0.001	110 (42)	113 (43)	0.02	0.82
First line technique, n (%)			0.99	<0.001			1	<0.001
Stentretriever	-	53 (18)			-	37 (16)		
Aspiration	-	46 (16)			-	41 (17)		
Both	-	193 (66)			-	160 (67)		
Side, n (%)			0.04	0.55			0.09	0.38
Right	204 (45)	139 (43)			73 (47)	111 (42)		
Left	246 (55)	183 (57)			83 (53)	151 (58)		
Mothership versus Drip and Ship, n (%)			0.02	0.8			0.08	0.37
Drip and ship	205 (40)	111 (39)			107 (46)	97 (41)		
Mothership	313 (60)	176 (61)			128 (54)	137 (59)		
Onset to Arterial Puncture (min), Median (Q1, Q3)	-	278 (180, 471)			-	269 (174, 419)		
Arterial Puncture to Recanalization Time (min), Median (Q1, Q3)	-	43 (29, 70)			-	43 (29, 74)		
Onset to Recanalization (min), Median (Q1, Q3)	-	355 (257, 571)			-	338 (247, 543)		
Onset to IVT needle Time (min), Median (Q1, Q3)	204 (124, 275)	135 (92, 179)	0.45	<0.001	236 (128, 324)	135 (91, 185)	0.57	<0.001
SBP, Median (IQR)	154 (135, 169)	150 (131, 170)	0.08	0.5	154 (135, 171)	150 (131, 170)	0.12	0.4
DBP, Median (IQR)	82 (71, 96)	85 (72, 96)	-0.06	0.47	82 (72, 94)	85 (72, 96)	-0.06	0.55
Temperature (Celsius), Median (IQR)	36.60 (36.30, 36.90)	36.50 (36.10, 36.90)	0.23	0.15	36.70 (36.20, 37.00)	36.50 (36.20, 36.90)	0.17	0.32
HR, Median (IQR)	78 (68, 92)	80 (70, 94)	-0.12	0.24	79 (70, 94)	80 (69, 93)	0.01	0.78
Glucose (mg/dL), Median (IQR)	119 (105, 150)	117 (103, 146)	0.13	0.33	121 (105, 150)	117 (102, 145)	0.06	0.35
Anesthesia, n (%)								
CS/LA	-	211 (74)			-	166 (72)		
GA	-	74 (26)			-	66 (28)		
Puncture site, n (%)								
Femoral	-	177 (95)			-	144 (97)		

Radial	-	9 (4.8)	-	5 (3.4)
Total Number of Passes, Median (Q1, Q3)	-	2.00 (1.00, 3.00)	-	2.00 (1.00, 3.00)

[1] Standardized Mean Difference

[2] Pearson's Chi-squared test; Wilcoxon rank sum test; Fisher's exact test

Table 3. Outcome before and after matching

	Before Matching				After Matching			
	Overall	**MM**	**MT**		**Overall**	**MM**	**MT**	
Variable	N = 978	N = 651	N = 327	**P**[1]	N = 532	N = 266	N = 266	**P**[1]
Day one NIHSS, Median (IQR)	7 (2, 16)	4 (1, 9)	14 (7, 20)	<0.001	11 (5, 19)	8 (3, 17)	13 (6, 20)	<0.001
NIHSS shift, Median (IQR)	0 (-4, 3)	-2 (-5, 0)	0 (-3, 6)	<0.001	0 (-4, 4)	-1 (-4, 0)	1 (-4, 6)	<0.001
90-day mRS 0-1, n (%)	298 (37)	243 (47)	55 (19)	<0.001	106 (26)	58 (32)	48 (21)	0.011
90-day mRS 0-2, n (%)	390 (48)	306 (59)	84 (29)	<0.001	151 (36)	80 (44)	71 (31)	0.006
90-day Mortality, n (%)	174 (22)	87 (17)	87 (30)	<0.001	117 (28)	50 (27)	67 (29)	0.73
sICH, n (%)	63 (7.9)	17 (3.5)	46 (15)	<0.001	46 (11)	6 (3.4)	40 (16)	<0.001
ICH (any type), n (%)	208 (29)	72 (17)	136 (47)	<0.001	140 (37)	26 (18)	114 (48)	<0.001
ICH (by type), n (%)								
HI1	107 (15)	29 (6.9)	78 (27)	<0.001	73 (20)	13 (9.3)	60 (26)	<0.001
HI2	30 (4.3)	17 (4.1)	13 (4.5)	0.76	18 (4.8)	6 (4.3)	12 (5.1)	0.71
PH1	18 (2.6)	10 (2.4)	8 (2.8)	0.74	7 (1.9)	1 (0.7)	6 (2.6)	0.26
PH2	15 (2.1)	7 (1.7)	8 (2.8)	0.31	11 (2.9)	3 (2.1)	8 (3.4)	0.55
SAH	29 (4.1)	6 (1.4)	23 (8.0)	<0.001	25 (6.7)	2 (1.4)	23 (9.8)	0.002

[1] Pearson's Chi-squared test; Wilcoxon rank sum test; Fisher's exact test

Table-4: Multivariable Logistic regression for primary and secondary outcomes

	90 days mRS 0-2		*90 days Mortality*		*sICH*		*90 days mRS 0-1*	
Characteristic	OR (95% CI)[1]	p-value	OR (95% CI)[1]	p-value	OR (95% CI)[1]	p-value	OR (95% CI)[1]	p-value
EVT with mTICI 0-2a	0.50 (0.29 to 0.85)	0.011	1.18 (0.67 to 2.05)	0.57	4.32 (1.84 to 10.1)	<0.001	0.52 (0.29 to 0.92)	0.025
Male	1.15 (0.66 to 2.01)	0.63	1.08 (0.61 to 1.92)	0.78	0.69 (0.35 to 1.36)	0.28	1.13 (0.64 to 1.98)	0.67
Age	0.97 (0.95 to 1.00)	0.018	1.05 (1.02 to 1.08)	<0.001	1.01 (0.98 to 1.04)	0.5	0.97 (0.95 to 0.99)	0.012
Hypercholesterolemia	0.82 (0.48 to 1.41)	0.48	1.40 (0.77 to 2.53)	0.27	0.41 (0.17 to 0.97)	0.044	0.88 (0.48 to 1.62)	0.68
Site of initial occlusion	0.88 (0.40 to 1.96)	0.75	1.07 (0.47 to 2.42)	0.88	1.09 (0.37 to 3.24)	0.87	0.94 (0.38 to 2.32)	0.89
Hypertension	0.52 (0.29 to 0.94)	0.03	1.28 (0.66 to 2.50)	0.47	1.55 (0.71 to 3.39)	0.27	0.72 (0.39 to 1.33)	0.29
Diabetes	0.76 (0.38 to 1.51)	0.42	1.34 (0.67 to 2.69)	0.4	0.77 (0.31 to 1.89)	0.56	1.20 (0.55 to 2.63)	0.65
Atrial fibrillation	0.72 (0.41 to 1.27)	0.26	1.40 (0.77 to 2.55)	0.27	0.57 (0.25 to 1.32)	0.19	1.05 (0.58 to 1.91)	0.87
Previous use of anticoagulant drugs	1.12 (0.48 to 2.59)	0.79	0.71 (0.33 to 1.54)	0.39	0.98 (0.36 to 2.67)	0.98	0.77 (0.34 to 1.76)	0.53
Given IVT	1.35 (0.76 to 2.40)	0.3	0.68 (0.38 to 1.21)	0.19	0.61 (0.30 to 1.24)	0.17	1.04 (0.60 to 1.79)	0.89
Baseline NIHSS	0.84 (0.80 to 0.88)	<0.001	1.15 (1.10 to 1.21)	<0.001	1.01 (0.96 to 1.06)	0.67	0.85 (0.81 to 0.89)	<0.001
Pre-stroke mRS (0-2)	1.94 (0.71 to 5.31)	0.19	0.34 (0.14 to 0.86)	0.024	1.00 (0.36 to 2.76)	>0.99	2.11 (0.52 to 8.51)	0.28
ASPECTS	1.10 (0.93 to 1.29)	0.27	0.91 (0.77 to 1.08)	0.28	0.89 (0.72 to 1.10)	0.29	1.12 (0.91 to 1.39)	0.28
ICH (any type)	0.50 (0.24 to 1.04)	0.062	1.29 (0.65 to 2.58)	0.46	-		0.58 (0.30 to 1.12)	0.1

[1] OR = Odds Ratio, CI = Confidence Interval

Figure Legends

Figure 1: Patients flow diagram

Figure 2: Bar graph demonstrates the distribution of the distinct modified Rankin Scale (mRS) scores achieved in the Medical Treatment compared to the mechanical thrombectomy group (Thrombolysis in Cerebral Infarction [TICI] score of 0-2).