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ORIGINAL ARTICLE

Outcome of mechanical thrombectomy for acute ischemic stroke and risk factors associated with mortality: A single center experience from Pakistan.

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ABSTRACT… Objective: To find out the outcomes of mechanical thrombectomy (MT) for acute ischemic stroke and risk factors associated with mortality. **Study Design:** Retrospective study. **Setting:** Department of Neurology, National Institute of Cardiovascular Disease (NICVD), Karachi, Pakistan. **Period:** October 2022 till January 2025. **Methods:** A total of 136 acute stroke patients management unit started functioning to caters patients requiring ntravenous thrombolysis (IVT) and MT. All patients who underwent MT for LVO from October 2022 till January 2025 were included. Inclusion criteria for MT was age >18 years, National Institutes of Health Stroke Scale (NIHSS) >6, ischemic cerebral signs on computed tomography (CT) scan by using Alberta Stroke Program Early CT Score (ASPECT) >6 and time from onset < 8 hours were included. Baseline demographics, risk factors, type of stroke, endovascular procedure and outcome were noted. Primary aim was to evaluate outcome (mortality and functional recovery). Secondary aim was predictors of mortality. **Results:** There were 136 patients who underwent MT, and baseline modified Rankin scale (MRS) and NIHSS were 4 and 14 respectively. Overall, 77.2% patients did achieve successful recanalization and we observed in hospital mortality of around 30.1%. Factors leading to poor recanalization were older age and high MRS score. Predictors of mortality were higher baseline MRS score, failed to achieve recanalization, procedural complication and reocclusion. **Conclusion:** This study demonstrates the important role of mechanical thrombectomy in the treatment of acute ischemic stroke. Older age, high MRS and ASPECT score remain factors associated with poor recanalization resulting in higher mortality.

Key words: Large Vessel Occlusion, Mortality, Stroke, Thrombectomy.

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INTRODUCTION

There is narrow window for timely reperfusion of cerebral vascular flow with acute stroke in order to salvage ischemic brain tissue not infarcted yet. Mechanical Thrombectomy (MT), an endovascular technique to remove blood clot under imaging guidance with the help of catheter. MT is indicated for large vessel occlusion (LVO) stroke but only 9 percent of patients are eligible for thrombectomy, moreover only few centers have sufficient expertise and resources.[1] Various clinical trials have shown overwhelming benefit of MT using stent retriever compared to thrombolysis in LVO stroke.[2-5] In SWIFT PRIME trail, improved functional outcome was noticed in MT and thrombolysis as compared to thrombolysis alone.[3] Another randomized controlled trial showed significant difference in the rate of functional independence in intervention group who had undergone intra cranial therapy although no difference was observed in mortality and intracranial bleed between two groups.[2]

Despite of higher rates of recanalization and reperfusion leading to improvement in functional independence rate, mortality at 90 days remains high up to 8.6%-21.2%.[6-8] Although clinical trials have proven superiority of mechanical thrombectomy over intravenous thrombolysis (IVT), very scanty data is available focusing outcome and risk factor of mortality especially from southeast Asia. A prospective cohort study from Egypt in patients with anterior circulation stroke who underwent MT have shown lower rate of successful recanalization is associated with significant risk for 30 day mortality.[9]

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Hio Li et al did a subgroup analysis of 622 patients of DIRECT-MT trail to evaluate 90 days mortality despite successful reperfusion identified smoking, higher baseline and post thrombectomy National Institutes of Health Stroke Scale (NIHSS) score, uncontrolled blood sugars and intracranial hemorrhage as significant risk factors of death.[8] Additional risk factors such as ASPECT score <9, unsuccessful recanalization, basilar artery stenting and antithrombotic medication prior to stroke were observed in few other observational studies.[6,10] There is paucity of data on outcome and risk factors associated with mortality especially from Pakistan, this study focuses on clinical outcome (in hospital all-cause mortality, NIHSS/modified Rankin scale (MRS) on discharge, and procedure related complications, and predictors associated with mortality.

METHODS

A retrospective cohort study performed at National Institute of Cardiovascular Disease (NICVD), Karachi Pakistan after approval from ethical committee (IRB-69/2024). NICVD is one the largest cardiac center of Pakistan where acute stroke management unit started functioning to caters patients requiring IVT and MT. All patients who underwent MT for LVO from October 2022 till January 2025 were included. Inclusion criteria for MT was age >18 years, NIHSS >6, ischemic cerebral signs on CT scan by using Alberta Stroke Program Early CT (ASPECT) score >6 and time from onset < 8 hours were included. CT showing established infarct or bleed were considered not a candidate for MT and excluded from study.

Variables including demographics, comorbidities such as diabetes mellitus, hypertension, smoking, tobacco chewing, ischemic heart disease, previous history of stroke, atrial fibrillation, CT scan findings ASPECT and NIHSS score at baseline were noted. Duration of onset of weakness was noted and patients who presented > 4 hours of onset of weakness considered as late arrival. Site of occlusion was determined by radioimaging findings. Procedure related data such as duration of treatment procedure, thrombolysis in cerebral infarction (TICI) flow, periprocedural complications, NIHSS score post thrombectomy were noted. Patients were compared who achieved successful versus unsuccessful recanalization. The study was reviewed and approved by institutional ethical committee. Written informed consent not required due to retrospective nature of the study. Patients were followed up till discharge alive or in hospital death whichever comes first. NIHSS and MRS scale on discharge noted. Patients with MRS 0-3 scale as satisfactory while >3 were considered as unsatisfactory outcome.

Variables associated with risk factors of mortality compared between survivors and non survivors such as age, gender, comorbidities (hypertension, diabetes mellitus, ischemic heart disease etc.), procedure related data (time duration, reperfusion, vessel dissection, embolization into new vessel, central line access complication,), time from admission till discharge or death, complication (intra cerebral bleed, hospital acquired infection), NIHSS score at baseline and on discharge, MRS scale on discharge.

SPSS version 20 was used to analyze the data. Continues variables reported as mean + SD and categorical variables will be presented as frequencies and percentages. To compare the mean difference between groups for continues variables two sample t test will be used whereas chi square independent test or fisher exact test will be used to determine proportion difference between groups. P value <0.05 will be considered as significant for categorical variables.

RESULTS

A total of 136 patients who were diagnosed with acute ischemic stroke and underwent mechanical thrombectomy were enrolled in this study. The demographics and comorbidities are shown in Table-I. The mean age of the patients was 56.1+13.3 and 72.8% were male. Most frequent comorbidities were hypertension (78.7%) followed by diabetes mellitus (39%) and ischemic heart disease (29.4%). Around 31.6% were smoker and 8.1% had tobacco chewing history. Patients presented with middle cerebral (MCA) artery occlusion in 48.5%, intra cerebral (ICA) artery 17.6% and basilar in 5.9% of cases. Average duration of onset of weakness was (mean 3.2+1.5 hours). Mean baseline ASPECT, NIHSS

scores were 8.2+1 and 14.6+3.9 respectively. In 105 (77.20%) patients, successful canalization was achieved and procedure related complications were noted in 36.8% of patients. Average hospital stay was 4.5 days. 41 out of 136 (30.1%) were died during hospital stay. The mean duration of hospital stay was 4.5±3.1 days. Mortality was noted in 41 (30.1%) patients, 85 (62.5%) discharged, while 10 (7.4%) were referred.

Significantly higher diabetics presented early [45.8% versus 28.3% (p=0.041)], moreover mean NIHSS score was high in late presenters (15.5+4 versus 14+3.7, p 0.032). Middle cerebral artery occlusion presented lately (58.5% vs 42.2%) although did not reach statistically significant difference. A significantly higher number of patients achieved successful reperfusion in early as compared to late group (88% vs 60.4% p <0.001). No significant difference was observed in mortality in early versus late group. Univariate analysis found a higher mortality in patients whom successful canalization was not achieved (p<0.001). Unsuccessful recanalization was also significantly found in relatively older patients (p=0.006). Patients who failed to canalize during MT had higher MRS score at the time of presentation (p=0.018). This study did not find any difference in MT technique between successful and unsuccessful canalization. Details about the comparison of clinical characteristics of early (<4hours) and late (>4 hours) onset presentation, and unsuccessful versus successful recanalization are shown in Table-I.

A total of 41 (30.15%) in-hospital deaths were observed. Risk factors associated with mortality were a high baseline MRS score (p=0.003), failed recanalization during MT (p<0.001), procedural complication (p<0.001) and reocclusion (p<0.001), and the details are given in Table-II.

DISCUSSION

This is one of the largest single center data on clinical characteristics and predictors of poor outcome of mechanical thrombectomy for acute ischemic stroke due to large vessel occlusion (LVO). Although our cohort comprised of younger population (mean age 56.1) years but majority of patients had comorbidities such as hypertension (78.7%), diabetes mellitus (39%) and ischemic heart disease (29.4%). This study observed a high NIHSS and MRS score at baseline, showing severe stroke and functional disability on presentation. Post mechanical thrombectomy, NIHSS improved, and around 26.5% of patients had a good clinical outcome (MRS score <2) on discharge from hospital. In previous studies, a good functional recovery was reported of around 36-67% at 90 days follow up.[11,12]

In this study, the rate of all-cause mortality was 30.1% relatively similar to previous data which showed mortality ranges from 13.6% to 34.0%.[9,11,13] High baseline MRS score, unsuccessful recanalization, reocclusion and procedural complications were found be important predictors associated with high in hospital mortality. Very few studies focused on risk factors of mortality after mechanical thrombectomy for acute ischemic stroke. Farghaly et al in a prospective cohort study showed low rates of successful canalization is an independent predictor of 3 months mortality after endovascular treatment of acute ischemic stroke.[9] Another study done by Linfante et al reported symptomatic intracerebral hemorrhage along with recanalization failure is associated with high death rate.[14]

In contrast to the present findings, a retrospective study done by Yao et al including 65 patients found low ASPECT, higher baseline NIHSS score and older age were independent risk factors of unsatisfactory (MRS score > 3) outcome and mortality.[15] Another study on posterior circulation LVO reported high baseline NIHSS score, longer onset to thrombolysis and groin puncture time is associated with higher 90 days mortality.[16] This study also assessed factors linked with poor recanalization. Relativley older age and higher MRS score on arrival were seen significantly associated with poor reperfusion and recanalization. In a multicenter study, a longer median duration of procedure is frequently associated with poor recanalization.[17] In this study, successful recanalization was achieved in patients who presented early (<4 hours). This finding is consistent with the previous data as in a systemic review and meta-analysis reported age and time from onset to recanalization was associated with successful recanalization.[18]

TABLE-I

Comparison of clinical characteristics, risk factors and outcome of patients with respect to early versus late presenting stroke, and successful and unsuccessful recanalization undergoing mechanical thrombectomy

	Early Presentation n=83	Late Presentation n=53	P-Value	Unsuccessful Recanalization n=31	Successful Recanalization n=105	P-Value
Gender						
Male	61 (73.5%)	38 (71.7%)	0.818	19 (61.3%)	80 (76.2%)	0.101
Female	22 (26.5%)	15 (28.3%)		12 (38.7%)	25 (23.8%)	
Age (years), mean+SD	54.8±13.0	58.2±13.6	0.118	61.1±12.6	54.7±13.2	0.006
Age > 55 years	34 (41%)	29 (54.7%)	0.117	10 (32.3%)	63 (60%)	0.006
Comorbidities						
Diabetes mellitus	38 (45.8%)	15 (28.3%)	0.041	10 (32.3%)	43 (41%)	0.383
Hypertension	68 (81.9%)	39 (73.6%)	0.247	25 (80.6%)	82 (78.1%)	0.761
Smoking	25 (30.1%)	18 (34%)	0.638	11 (35.5%)	32 (30.5%)	0.598
Tobacco chewing	5 (6%)	6 (11.3%)	0.269	4 (12.9%)	7 (6.7%)	0.263
Obesity	12 (14.5%)	11 (20.8%)	0.339	4 (12.9%)	19 (18.1%)	0.498
Ischemic heart disease	26 (31.3%)	14 (26.4%)	0.54	9 (29%)	31 (29.5%)	0.958
Previous myocardial infarction	24 (28.9%)	16 (30.2%)	0.874	10 (32.3%)	30 (28.6%)	0.692
Dyslipidemia	14 (16.9%)	8 (15.1%)	0.784	8 (25.8%)	14 (13.3%)	0.097
Congestive heart failure	17 (20.5%)	13 (24.5%)	0.579	7 (22.6%)	23 (21.9%)	0.939
Atrial fibrillation	20 (24.1%)	10 (18.9%)	0.473	6 (19.4%)	24 (22.9%)	0.679
Valvular heart disease	13 (15.7%)	6 (11.3%)	0.476	4 (12.9%)	15 (14.3%)	0.845
Antiplatelet pretreatment	25 (30.1%)	18 (34%)	0.638	11 (35.5%)	32 (30.5%)	0.598
Anticoagulation pretreatment	10 (12%)	6 (11.8%)	0.961	1 (3.2%)	15 (14.6%)	0.088
Admission's National Institutes of Health Stroke Scale score, mean+SD	14.0±3.7	15.5±4	0.032	15.3±3.9	14.4±3.9	0.24
Admission's Alberta Stroke Program Early CT Score, mean+SD	8.3±1.1	8.1±0.8	0.44	8.2±0.7	8.2±1.1	0.734
Admission's modified Rankin Scale score, mean+SD	4.4±0.6	4.5±0.7	0.231	4.7±0.5	4.4±0.6	0.018
Location of Arterial Occlusion						
Middle cerebral artery	35 (42.2%)	31 (58.5%)	0.063	15 (48.4%)	51 (48.6%)	0.986
Left middle cerebral artery	19 (22.9%)	17 (32.1%)	0.236	9 (29%)	27 (25.7%)	0.713
Internal carotid artery	12 (14.5%)	12 (22.6%)	0.222	8 (25.8%)	16 (15.2%)	0.175
left Middle cerebral artery	3 (3.6%)	5 (9.4%)	0.16	3 (9.7%)	5 (4.8%)	0.307
Left anterior cerebral artery	-	3 (5.7%)	0.028	0 (0%)	3 (2.9%)	0.341
right internal carotid artery	9 (10.8%)	7 (13.2%)	0.676	5 (16.1%)	11 (10.5%)	0.391
right middle cerebral artery	16 (19.3%)	14 (26.4%)	0.328	6 (19.4%)	24 (22.9%)	0.679
Basilar	4 (4.8%)	4 (7.5%)	0.51	2 (6.5%)	6 (5.7%)	0.878
Procedure Complication						
Perforation	2 (2.4%)	2 (3.8%)	0.646	2 (6.5%)	2 (1.9%)	0.188
Intracranial bleed	18 (21.7%)	15 (28.3%)	0.38	8 (25.8%)	25 (23.8%)	0.82
Reocclusion	6 (7.2%)	7 (13.2%)	0.248	7 (22.6%)	6 (5.7%)	0.005
Outcome						
Mortality	23 (27.7%)	18 (34%)	0.21	24 (77.4%)	17 (16.2%)	< 0.001
Discharged	56 (67.5%)	29 (54.7%)		6 (19.4%)	79 (75.2%)	
Referred	4 (4.8%)	6 (11.3%)		1 (3.2%)	9 (8.6%)	

TABLE-II

Differences in clinical characteristics, risk factors and type of interventions between survivors and non-survivors.

	Death n=41	Alive or discharged n=95	P-Value
Gender			
Male	28 (68.3%)	71 (74.7%)	0.438
Female	13 (31.7%)	24 (25.3%)	
Age (years), mean+SD	59.7±11.8	54.6±13.6	0.061
Age > 55 years	17 (41.5%)	56 (58.9%)	0.061
Comorbidities			
Diabetes mellitus	18 (43.9%)	35 (36.8%)	0.438
Hypertension	36 (87.8%)	71 (74.7%)	0.088
Smoking	13 (31.7%)	30 (31.6%)	0.988
Tobacco chewing	5 (12.2%)	6 (6.3%)	0.249
Obesity	5 (12.2%)	18 (18.9%)	0.335
Ischemic heart disease	9 (22%)	31 (32.6%)	0.210
Previous myocardial infarction	12 (29.3%)	28 (29.5%)	0.981
Dyslipidemia	8 (19.5%)	14 (14.7%)	0.488
Congestive heart failure	6 (14.6%)	24 (25.3%)	0.170
Atrial fibrillation	12 (29.3%)	18 (18.9%)	0.183
Valvular heart disease	5 (12.2%)	14 (14.7%)	0.695
Antiplatelet pretreatment	12 (29.3%)	31 (32.6%)	0.699
Anticoagulation pretreatment	6 (14.6%)	10 (10.8%)	0.523
Admission's National Institutes of Health Stroke Scale score, mean+SD	14.6±4.1	14.6±3.8	0.951
Admission's Alberta Stroke Program Early CT Score, mean+SD	7.9±1.4	8.3±0.7	0.017
Admission's modified Rankin Scale score, mean+SD	4.7±0.5	4.3±0.6	0.003
Location of Arterial Occlusion			
Middle cerebral artery	16 (39%)	50 (52.6%)	0.145
Left middle cerebral artery	8 (19.5%)	28 (29.5%)	0.227
Internal carotid artery	7 (17.1%)	17 (17.9%)	0.908
left Middle cerebral artery	3 (7.3%)	5 (5.3%)	0.640
Left anterior cerebral artery	0 (0%)	3 (3.2%)	0.250
right internal carotid artery	4 (9.8%)	12 (12.6%)	0.633
right middle cerebral artery	8 (19.5%)	22 (23.2%)	0.638
Basilar	5 (12.2%)	3 (3.2%)	0.638
Success Canalization	17 (41.5%)	88 (92.6%)	<0.001
Procedure Complication	26 (63.4%)	24 (25.3%)	<0.001
Perforation	1 (2.4%)	3 (3.2%)	0.820
Intracranial bleed	13 (31.7%)	20 (21.1%)	0.183
Reocclusion	11 (26.8%)	2 (2.1%)	<0.001
A Direct Aspiration First Pass Technique	10 (24.4%)	31 (32.6%)	0.337
Solumbra technique	13 (31.7%)	30 (31.6%)	0.988
Stent retiever	4 (9.8%)	5 (5.3%)	0.333
Plain old balloon angioplasty	0 (0%)	2 (2.1%)	0.349
Combination of Procedure	7 (17.1%)	19 (20%)	0.690

This study observed procedure related complication of around 36.8%, most frequent was intra cerebral hemorrhage (ICH) in 24.3%. This study did not find ICH to be associated with unsuccessful recanalization or higher mortality.

Intracerebral hemorrhage is considered a potentially catastrophic complication after mechanical thrombectomy reported in approximately 40% of cases with LVO after MT.[19,20] Lee et al in a retrospective study reported 38.5% of ICH with baseline ASPECT <7, stroke onset to groin puncture >280 minutes and stent retrieval passes >3 predict IC.[21]

There are some limitations of this study. It is a retrospective observational study from a single center. Sample size is small and bias in statistical analysis might exist. Lastly due to retrospective review, we could only see follow up till discharge or death during hospital stay. A multicenter prospective study with adequate sample size and prolong follow up is needed to corroborate our observation.

CONCLUSION

MS was involved in conceptualization, analysis and overall study design. SF, NM and MH were involved in data collection, in review and editing. IAL was involved in analysis and overall supervision.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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AUTHORSHIP AND CONTRIBUTION DECLARATION	
1	**Mehreen Shamim:** Concept, writing, analysis.
2	**Mubashir Hussain:** Data collection.
3	**Nisha Modi:** Data collection.
4	**Irfan Amjad Lutfi:** Supervision.