FUNCTIONAL OUTCOMES OF PATIENTS WITH STROKE TREATED WITH THROMBECTOMY BY ASPIRATION

Abstract:

Purpose

To determine the time of procedure, the value of modified Thrombolysis in Cerebral Infarction and National Institute Health of Stroke Scale as predictors of the functional results of patients with stroke treated with mechanical thrombectomy by aspiration.

Methods

Observational, analytical and retrospective case series analysis of consecutive patients with internal carotid and cerebral media branch occlusions. Clinical outcome was measured with the modified Rankin Scale at 90 days after stroke. To analyse the differences between groups, the Chi^2 test was used for the qualitative variables.

Results

The sample size was 58 patients treated with thrombectomy by aspiration. We observed that the thrombectomy time determines the recanalization results; meanwhile, modified Thrombolysis in Cerebral Infarction is a predictor of modified Rankin Scale at discharge but not after 3 months. National Institute Health of Stroke Scale was determinant for modified Rankin Scale result.

Conclusions

Mechanical thrombectomy by aspiration proves to be an effective treatment of acute stroke, improving the patient's vital and functional prognosis. The thrombectomy time is a predictor of the result in relation to the degree of recanalization determined by the

modified Thrombolysis in Cerebral Ischemia. Also, the degree of recanalization predicts functional outcome at discharge but not at 3 months.

Keywords: Acute ischemic stroke, time, mechanical thrombectomy, outcomes, modified Rankin Scale.

INTRODUCTION

Results of several randomized clinical trials have shown the benefits of treatment with mechanical thrombectomy compared to the best medical therapy alone (alteplase), achieving better functional outcomes at 3 months in thein the intervention group than alteplase group. (1-7)

It is considered that successful reperfusion is the main driver to promote a good functional outcome. (8, 9) The modified degrees of Thrombolysis in Cerebral Infarction (mTICI), with "successful reperfusion", were considered the technical end point to be noted in each stroke intervention. (10, 11) Two studies have made a convincing case to establish the even greater technical success bar, (12, 13) where it was shown that patients with complete reperfusion (mTICI3) have less severe neurological deficits, shorter acute hospital stays and a better functional outcome at day 90 compared to patients with almost complete reperfusion (mTICI2b). (12, 13)

Results of several studies showed that the functional outcome after a stroke is a powerful predictor of long-term mortality, (14,15) therefore; we must promote the maximum functional independence of stroke survivors living at home through supervised and adapted nursing interventions and physical activities. It is well known that the time from the detection of the cerebrovascular event to the intervention room (window period) has a decisive influence on the functional outcome of the patient (16). Two modalities of mechanical thrombectomy were well know, on the one hand, the application of stent retrievers and on the other hand direct aspiration, but in 2019 the American Heart Association/American Stroke Association guidelines recommended to perform mechanical thrombectomy applying stent retrievers and this technique became the

preferred one. Later other studies compared thrombectomy with stent retriever and direct aspiration concluding that there were no differences in outcome results. (17)

Today, the concept of aspiration thrombectomy remains somewhat controversial, various studies such as COMPASS debate the choice of the mechanical thrombectomy modality by direct aspiration, showing less costs and faster procedure times (18-20) as well as higher recanalization rates (mTICI 2b-3) and fewer adverse events with the exception of cerebral malignant edema in patients with terminal internal carotid occlusion (19).

Thus, the aim of this study is to determine the functional outcomes in patients treated with thrombectomy by aspiration and as secondary objectives to correlate the time of thrombectomy, mTICI and National Institute Health of Stroke Scale as predictors of the functional results of patients with stroke.

MATERIALS AND METHOD

Study Design and patients

This is a retrospective study of consecutive patients with internal carotid and cerebral media (M1 and M2) branch occlusions, who underwent intra-arterial mechanical thrombectomy at our institution between February, 2015, and March, 2017.

Patient selection

Inclusion criteria were anterior or posterior circulation acute cerebral occlusion, age > 18 years, with NIHSS ≥ 6. All patients received intravenous thrombolysis before intervention and < 4.5 hours from symptom onset, following the guidelines of the Spanish Society of Neurology. (21) Thus, time from symptom onset to hospital arrival was < 4.5 hours.

Exclusion criteria were as follows: (a) presence of intracranial hemorrhage, (b) established cerebral infarction according to the Alberta Stroke Program Early CT Score (ASPECTS) < 6, (c) Pregnant patients, and (d) Patients allergic to contrast.

Variables and data collection

1. Pre-procedure data collection: two data tables were collected, the first with patient data, geographic location, cardiovascular risk factors and epidemiological data of the patient. The second one with the data corresponding to the cerebral arteries evaluation before the procedure.

2. Demographics: age; gender; start date of the study (dd/mm/yyyy).

3. NIHSS at admission, post-procedure and at discharge.

4. modified Rankin Scale (mRS) at discharge and at three months.

5. mTICI post-procedure.

6. Aspiration pass: an aspiration "pass" corresponded to each time aspiration was tried.

7. Thrombectomy time.

Imaging evaluation

At admission and after a clinical evaluation by a neurologist, the majority of patients underwent a baseline CT scan, supra-aortic and cerebral CT angiography, and cerebral perfusion CT. The other patients underwent to MRI, the DWI sequence was used to determine ASPECTS score. The mTICI was used to determine recanalization with successful reperfusion (partial and complete) defined as score of 2b/3 at the end of all endovascular procedures. Post-operative imaging was performed between 24 and 36 hours using either CT or MRI with ASPECTS score recorded in the data base.

The ASPECTS analysis is performed on two axial sections of the CT, the first at the level of the thalamus and ganglia base (plane A) and the second adjacent to the upper edge of the ganglia of the base, without visualizing it (plane B). In both planes, the territory of the middle cerebral artery is divided into 10 regions, each valuing 1 point (M1-M10). Each affected area subtracts 1 point and the value of "normality" is set to 10 points.

Study Outcomes

Clinical outcome was measured with the mRS at 90 days after stroke. A good outcome was classified as mRS ≤ 2 and a poor outcome as mRS >3. Other secondary outcomes included the presence of hemorrhage on post-operative imaging, recorded according to the method used in the European Australasian Acute Stroke Study (ECASS) (22).

Statistical and Data Analysis

A descriptive analysis was carried out using measures of central tendency (mean (M) or median) and dispersion (standard deviation (SD) when it was considered appropriate for quantitative variables, and percentages for qualitative variables). To analyze the differences between groups, the Chi^2 test was used for the qualitative variables. A significance level of 0.05 was chosen to select the variables finally included in the binary logistic regression model. All analyses and calculations were performed using the statistical package PASW (v. 24.0; SPSS Inc., Chicago, Illinois).

Ethics Approval

The study was approved by the Research Ethics Committee from Santiago-Lugo on 09/20/2018 with registration code "2018/335".

RESULTS

The sample was of 58 patients treated since January 2015 to January 2018. A contingency table was made to observe the characteristics of the sample (table 1). The mean time for the first aspiration pass was 24.2' with a standard deviation of 15.9', for the second pass of 44.7' with a standard deviation of 23.7'; for the third pass 68.8' with a standard deviation of 31' and for the fourth pass of 81.4' with a standard deviation of 48.7'.

This study evaluated the relationship between the thrombectomy time and mTICI, NIHSS, mRS, age and sex; thrombectomy time was mTICI determinant at 95% CI (table 2). The correlation between mTICI and NIHSS, mRS, age and sex was evaluated. mRS at discharge were mTICI dependent at 95% CI (table 3).

NIHSS at admission and post-procedure were determinant to mRS at discharge and at 3 months at 95% CI (table 4). mRS at discharge was determinant to mRS at 3 months at 95% CI (table 5). Age and sex weren't significant.

DISCUSSION

A sample of 58 patients was studied; the mean age was 66.9 years. The results in relation to age compared with other studies are very similar. Durà Mata et al. determined an average age of 72.44 years with a standard deviation of 10.1 years; Sajobi et al. observed that the average age of their sample was 68.1 years; Kaesmacher et al. determined an age of 72.9 years with a standard deviation of 13.9 years and Xing et al. observed an average age of 69.2 years (14, 19, 23, 24)

The main randomized clinical trials determined a mean age between 66 to 71 years old, similar results compared to the sample of this work. (1-5, 7)

Age was associated independently with the outcome in the global cohort, although this association could not always be identified after adjusting for other predictive variables, results consistent with current scientific evidence. (25)

Regarding mTICI, about 70% of the sample reached mTICI 2-3. Kaesmacher et al. determined mTICI2b, mTICI2c and mTICI3 of 47.6%, 34.1% and 18.3%, respectively and Xing et al. compared direct aspiration group vs stent retriever group and determined eTICI2b-3 of 30% vs 27%, eTICI2c-3 of 26% vs 15% and eTICI3 of 22% vs 11%, results very similar to those found in this work. (19, 24)

The main randomized trials demonstrated about 80% of the sample achieved mTICI 2-3, similar results with this study. (2-5,7)

In comparison with scientific evidence, we observed that the reperfusion rates reported for new patients with stent retrievers for example the Trevo Pro with outcomes of 86% TICI 2 and 93% TICI 3 and Solitaire 88.8% have improved compared with Merci Retriever (Thrombolysis in myocardial infarction TIMI 2 or 3: MERCI 48.2% and Multi-MERCI 55% and the Penumbra system TIMI 2 or 3: 81.6%). In general, stent retrievers have shown better recanalization rates and clinical outcomes compared to Merci Retriever. (16, 26, 27)

The NIHSS on admission was more severe for men than for women, and the most common distribution in both sexes was mild-moderate. The results of the neurological functionality at discharge and the degree of disability at discharge and at 3 months have been worse in men than in women. It is confirmed that stroke affects men more than women. (28)

In relation to neurological functionality at admission, Jain et al. indicated in their sample that 35.5% had moderate neurological deficit and 37.7% severe; Törnbon et al. detected

that 35% of their sample had a moderate neurological deficit and Jagini and Suresh detected a moderate neurological deficit in 80.77% of their sample, results similar to our study. (28, 29, 30) Xing et al. determined the NIHSS at admission between 18-21 points (stent retriever group-direct aspiration group). (19) In comparison with the main randomized trials The NIHSS mean was situated between 12-18 points. (1-7)

The mean of the NIHSS post-procedure was about 7.9 with a SD of 6.7 points. The mean of the mRS at discharge was 3.6 and about 26% of the simple reached mRS 0-2. The mean of the mRS at 3 months was 2.4. We observed a significant improvement in functional independence and a decrease in the proportion of patients with mRS>2 in comparison with the mRS at discharge. Jagini and Suresh (2018) determined mRS 0-2 in about 75% of the simple and about 25% mRS>2.(26) Other study demonstrated about 25% of their simple had reached at least 1 or 2 points in the mRS value between the 3-12 months later stroke. (31) Finally, Xing et al. observed in the group treated with direct aspiration vs stent retriever group mRS 0-1 in 11% vs 5%, mRS 0-2 in 15% vs 9% and mRS 3-5 in 10% vs 16%. (19)

In our sample about 25% of the participants reached mRS score between 0-1 and about 50% mRS score between 0-2. The study DEFUSE 3 determined about 50% of their sample obtained mRS 0-1 and about 80% mRS 0-2. The HERMES meta-analysis showed in about 25% and 10% (intervention vs alteplase) mRS 0-1 and about 46% and 25% (intervention vs control) mRS 0-2. Our results were similar to the main randomized trials but DEFUSE 3 showed better functional outcomes tan the main randomized trials due to technical improvements in thrombectomy. (6,7)

Mortality at 3 months was about 20% and since discharge was about 4%, similar results than the main randomized trials which determined mortality between 15 to 30%, and Xing

et al. which determined mortality about 15% (direct aspiration group) vs 17.4% (stent retriever group). (6,7, 19) Durà Mata et al. (2010), showed mortality at 3 years about 30% and mortality since admission to discharge about 21%. (14) Rost et al. (2016) in a review, determined mortality about 20% in USA and United Kingdom. (32)

The mean of thrombectomy time was 65.2minutes, similar compared with Xing et al. of direct aspiration group (46 minutes) vs stent retriever group (83 minutes). (19) In this study, time of thrombectomy was determinant of mTICI and mTICI determined mRS at discharge. NIHSS was mRS at discharge and at 3 months determinant. mRS at discharge determined mRS at 3 months results at 95% CI. Age and sex weren't significant.

Other articles determined that direct aspiration thrombectomy showed a lower rate of adverse events with the exception of malignant cerebral edema (19) and less cost of endovascular treatment using direct aspiration at the first pass than stent retriever thrombectomy (20)

Future research will be necessary in order to standardize information, since the thrombectomy time and NIHSS, mTICI and mRS record will be able to provide valuable information in the acute phase of care to promote better recovery of the patient, as same as USA, where it has been in place in certified stroke centres.

LIMITATIONS

The direct comparison between the published studies is difficult or, sometimes, impossible due to the variation between the selection criteria, number of patients and homogeneous patient management protocols. Furthermore, we cannot extrapolate results of a treatment offered for patients with certain inclusion criteria to others. Our population was a hospital cohort in a specific community hospital setting. A larger sample and a multi-site study are needed to test causality and predictive capacity and to generalize.

Finally, the retrospective nature of this analysis introduces potential biases (selection bias due to loss of follow-up and misclassification bias) that should be addressed in prospective studies.

CONCLUSION

Mechanical thrombectomy proves to be an effective treatment of acute stroke, improving the patient's vital and functional prognosis. The thrombectomy time is a predictor of the result in relation to the degree of recanalization determined by the mTICI scale. The degree of recanalization measured with the mTICI predicts the mRS at discharge. NIHSS determined mRS at discharge and at 3 months.

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Table 1. Contingency table of the characteristics of the sample.

	N	%	Mean	SD
Sex				
Men	41	70.7		
Women	17	29.3		
Age			66.9	14.5
< 65	14	24.1		
65-80	37	63.8		
> 80	7	12.1		
Location				
Internal carotid	17	29.3		
Cerebral media	41	70.7		
Number of aspirations				
1	1	1.7		
2	17	29.3		
3	18	31		
4	12	20.7		
mTICI				
0	15	25.9		
1	3	5.2		
2a	6	10.3		
2b	10	17.2		
3	24	41.4		
mRs at discharge			3.6	1.7
0	3	5.2		
1	5	8.6		
2	7	12.1		
3	10	17.2		
4	13	22.4		
5	10	17.2		
6	10	17.2		
mRs at 3 months			2.6	1.6
0	6	12.5		
1	6	12.5		
2	14	29.2		
3	5	10.4		
4	12	25		
5	3	6.3		
6	2[I]	4.2		
NIHSS at admission			15.1	6.1
Minor stroke	1	1.7		
Moderate stroke	2	3.4		
Moderate-important stroke	30	51.7		
Important stroke	12	20.7		
Severe stroke	13	22.4		
NIHSS post-procedure			7.9	6.7
No stroke symptoms	8	16.7		

Minor stroke	5	10.4							
Moderate stroke	7	14.6							
Moderate-important stroke	19	39.6							
Important stroke	8	16.7							
Severe stroke	1	2.1							
					Q1	Q2	Q3	LL	UL
Thrombectomy Time			65.2	40.3	39.3	57.5	89.3	10	220
0-40	18	31							
41-58	13	22.4							
58-93	14	24.1							
>93	13	22.4							

SD: Standard deviation; LL: Lower limit; UL: Upper limit.

Table 2. Correlation between thrombectomy time and NIHSS, mTICI, mRS, age and sex with Chi^2 test

	Thrombectomy time, n (%)				p-value
	0-40	41-58	58-93	>93	
mTICI (n)					0.017
0 (15)	1 (6.7)	6 (40)	5 (33.3)	3 (20)	
1 (3)	0 (0)	0 (0)	1 (33.3)	2 (66.7)	
2a (6)	1 (16.7)	1 (16.7)	1 (16.7)	3 (50)	
2b (10)	3 (30)	2 (20)	5 (50)	0 (0)	
3 (24)	13 (54.2)	4 (16.7)	2 (8.3)	5 (20.8)	
n= 58	18 (31)	13 (22.4)	14 (24.1)	13 (22.4)	
NIHSS post-procedure (n)					*0.89*
No stroke symptoms (8)	4 (50)	1 (12.5)	2 (25)	1 (12.5)	
Minor stroke (5)	1 (20)	1 (20)	1 (20)	2 (40)	
Moderate stroke (7)	2 (28.6)	3 (42.9)	0 (0)	2 (28.6)	
Moderate-important stroke (19)	6 (31.6)	5 (26.3)	5 (26.3)	3 (15.8)	
Important stroke (8)	2 (25)	3 (37.5)	1 (12.5)	2 (25)	
Severe stroke (1)	1 (100)	0 (0)	0 (0)	0 (0)	
n= 48	16 (33.3)	13 (27.1)	9 (18.8)	10 (20.8)	
mRS at discharge (n)					*0.7*
0 (3)	1 (33.3)	0 (0)	1 (33.3)	1 (33.3)	
1 (5)	2 (40)	2 (40)	1 (20)	0 (0)	
2 (7)	3 (42.9)	1 (14.3)	1 (14.3)	2 (28.6)	
3 (10)	3 (30)	2 (20)	2 (20)	3 (30)	
4 (13)	3 (23.1)	6 (46.2)	2 (15.4)	2 (15.4)	
5 (10)	4 (40)	2 (20)	2 (20)	2 (20)	
6 (10)	2 (20)	0 (0)	5 (50)	3 (30)	
n= 58	18 (31)	13 (22.4)	14 (24.1)	13 (22.4)	
mRS at 3 months (n)					*0.75*
0 (6)	2 (33.3)	1 (16.7)	2 (33.3)	1 (16.7)	
1 (6)	2 (33.3)	1 (16.7)	1 (16.7)	2 (33.3)	
2 (14)	3 (21.4)	6 (42.9)	1 (7.1)	4 (28.6)	
3 (5)	3 (60)	0 (0)	0 (0)	2 (40)	
4 (12)	4 (33.3)	4 (33.3)	3 (25)	1 (8.4)	
5 (3)	1 (33.3)	1 (33.3)	1 (33.3)	0 (0)	
6 (2)	1 (50)	0 (0)	1 (50)	0 (0)	
n= 48	16 (33.3)	13 (27.1)	9 (18.8)	10 (20.8)	
Sex (n)					*0.18*
Men (41)	12 (29.3)	12 (20.3)	10 (24.4)	7 (17.1)	
Women (17)	6 (35.3)	1 (5.9)	4 (23.5)	6 (35.3)	
n= 58	18 (31)	13 (22.4)	14 (24.1)	13 (22.4)	
Age					*0.98*
< 65 (14)	4 (28.6)	3 (21.4)	4 (28.6)	3 (21.4)	
65-80 (37)	11 (29.7)	9 (24.3)	9 (24.3)	8 (21.7)	
> 80 (7)	3 (42.9)	1 (14.3)	1 (14.3)	2 (28.5)	
n= 58	18 (31)	13 (22.4)	14 (24.1)	13 (22.4)	

Not significant (CI: 95%) in italics.

Table 3. Correlation between mTICI and NIHSS, mRS, age and sex.

	mTICI, n (%)					p-value
	0	1	2a	2b	3	
NIHSS post-procedure (n)						*0.128*
No stroke symptoms (8)	2 (25)	1 (12.5)	0 (0)	1 (12.5)	4 (50)	
Minor stroke (5)	0 (0)	1 (20)	2 (40)	0 (0)	2 (40)	
Moderate stroke (7)	1 (14.3)	0 (0)	0 (0)	1 (14.3)	5 (71.4)	
Moderate-important stroke (19)	6 (31.6)	0 (0)	2 (10.5)	4 (21.1)	7 (36.8)	
Important stroke (8)	5 (62.5)	0 (0)	1 (12.5)	0 (0)	2 (25)	
Severe stroke (1)	0 (0)	0 (0)	0 (0)	1 (100)	0 (0)	
n= 48	14 (29.2)	2 (4.2)	5 (10.3)	7 (14.6)	20 (41.7)	
mRS at discharge (n)						0.038
0 (3)	0 (0)	1 (33.3)	0 (0)	1 (33.3)	1 (33.3)	
1 (5)	2 (40)	0 (0)	0 (0)	0 (0)	3 (60)	
2 (7)	0 (0)	1 (14.3)	1 (14.3)	0 (0)	5 (71.4)	
3 (10)	1 (10)	0 (0)	2 (20)	5 (50)	2 (20)	
4 (13)	7 (53.8)	0 (0)	0 (0)	0 (0)	6 (46.2)	
5 (10)	4 (40)	0 (0)	2 (20)	1 (10)	3 (30)	
6 (10)	1 (10)	1 (10)	1 (10)	3 (30)	4 (40)	
n= 58	15 (25.9)	3 (5.2)	6 (10.3)	10 (17.2)	24 (41.4)	
mRS at 3 months (n)						*0.28*
0 (6)	1 (16.7)	1 (16.7)	0 (0)	1 (16.7)	3 (50)	
1 (6)	1 (16.7)	1 (16.7)	0 (0)	0 (0)	4 (66.7)	
2 (14)	4 (28.6)	0 (0)	3 (21.4)	4 (28.6)	3 (21.4)	
3 (5)	0 (0)	0 (0)	1 (20)	0 (0)	4 (80)	
4 (12)	7 (58.3)	0 (0)	1 (8.3)	1 (8.3)	3 (25)	
5 (3)	1 (33.3)	0 (0)	0 (0)	0 (0)	2 (66.7)	
6 (2)	0 (0)	0 (0)	0 (0)	1 (50)	1 (50)	
n= 48	14 (29.2)	2 (4.2)	5 (10.4)	7 (14.6)	20 (41.7)	
Sex (n)						*0.15*
Men (41)	11 (26.8)	3 (7.3)	5 (12.2)	9 (22)	13 (31.7)	
Women (17)	4 (23.5)	0 (0)	1 (5.9)	1 (5.9)	11 (64.7)	
n= 58	15 (25.9)	3 (5.2)	6 (10.3)	10 (17.2)	24 (41.4)	
Age						*0.45*
< 65 (14)	4 (28.6)	2 (14.3)	2 (14.3)	2 (14.3)	4 (28.6)	
65-80 (37)	11 (29.7)	1 (2.7)	3 (8.1)	7 (18.9)	15 (40.5)	
> 80 (7)	0 (0)	0 (0)	1 (14.3)	1 (14.3)	5 (71.4)	
n= 58	15 (25.9)	3 (5.2)	6 (10.3)	10 (17.2)	24 (41.4)	

Not significant (CI: 95%) in italics.

Table 4. Correlation between NIHSS at admission or post-procedure and NIHSS at discharge, mRS, sex and age.

	NIHSS at admission n (%)						
	No stroke symptoms	Minor stroke	Moderate stroke	Moderate-important stroke	Important stroke	Severe stroke	p-value
NIHSS post-procedure (n)							*0.38*
No stroke symptoms (8)	0 (0)	1 (12.5)	0 (0)	5 (62.5)	0 (0)	2 (25)	
Minor stroke (5)	0 (0)	0 (0)	0 (0)	4 (80)	1 (20)	0 (0)	
Moderate stroke (7)	0 (0)	0 (0)	1 (14.3)	2 (28.6)	3 (42.9)	1 (14.3)	
Moderate-important stroke (19)	0 (0)	0 (0)	1 (5.3)	12 (63.2)	2 (10.5)	4 (21.1)	
Important stroke (8)	0 (0)	0 (0)	0 (0)	5 (62.5)	3 (37.5)	0 (0)	
Severe stroke (1)	0 (0)	0 (0)	0 (0)	0 (0)	1 (100)	0 (0)	
n= 48	0 (0)	1 (2.1)	2 (4.2)	28 (58.3)	10 (20.8)	7 (14.6)	
mRS at discharge (n)							0.007
0 (3)	0 (0)	1 (33.3)	0 (0)	2 (66.7)	0 (0)	0 (0)	
1 (5)	0 (0)	0 (0)	0 (0)	4 (80)	0 (0)	1 (20)	
2 (7)	0 (0)	0 (0)	1 (14.3)	3 (42.9)	2 (28.6)	1 (14.3)	
3 (10)	0 (0)	0 (0)	0 (0)	4 (40)	3 (30)	3 (30)	
4 (13)	0 (0)	0 (0)	0 (0)	11 (84.6)	1 (7.7)	1 (7.7)	
5 (10)	0 (0)	0 (0)	1 (10)	4 (40)	4 (40)	1 (10)	
6 (10)	0 (0)	0 (0)	0 (0)	2 (20)	2 (20)	6 (60)	
n= 58	0 (0)	1 (1.7)	2 (3.4)	30 (51.7)	12 (20.7)	13 (22.4)	
mRS at 3 months (n)							0.008
0 (6)	0 (0)	1 (16.7)	0 (0)	5 (83.3)	0 (0)	0 (0)	
1 (6)	0 (0)	0 (0)	0 (0)	3 (50)	2 (33.3)	1 (16.7)	
2 (14)	0 (0)	0 (0)	1 (7.2)	7 (50)	3 (21.4)	3 (21.4)	
3 (5)	0 (0)	0 (0)	0 (0)	3 (60)	1 (20)	1 (20)	
4 (12)	0 (0)	0 (0)	0 (0)	8 (66.7)	4 (33.3)	0 (0)	
5 (3)	0 (0)	0 (0)	1 (33.3)	2 (66.7)	0 (0)	0 (0)	
6 (2)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	2 (100)	
n= 48	0 (0)	1 (2.1)	2 (4.2)	28 (58.3)	10 (20.8)	7 (14.6)	
Sex (n)							*0.49*
Men (41)	0 (0)	0 (0)	1 (2.4)	23 (56.1)	8 (19.5)	9 (22)	
Women (17)	0 (0)	1 (5.9)	1 (5.9)	7 (41.2)	4 (23.5)	4 (23.5)	
n= 58	0 (0)	1 (1.7)	2 (3.4)	30 (51.7)	12 (20.7)	13 (22.4)	
Age							*0.36*
< 65 (14)	0 (0)	1 (7.1)	0 (0)	7 (50)	3 (21.4)	3 (21.4)	
65-80 (37)	0 (0)	0 (0)	1 (2.7)	18 (48.6)	8 (21.6)	10 (27)	

> 80 (6)	0 (0)	0 (0)	1 (14.3)	5 (71.4)	1 (14.3)	0 (0)
n= 58	0 (0)	1 (1.7)	2 (3.4)	30 (51.7)	12 (20.7)	13 (22.4)

	NIHSS at discharge n (%)						
	No stroke symptoms	Minor stroke	Moderate stroke	Moderate-important stroke	Important stroke	Severe stroke	p-value
mRS at discharge (n)							0
0 (3)	3 (100)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	
1 (5)	4 (80)	1 (20)	0 (0)	0 (0)	0 (0)	0 (0)	
2 (7)	1 (14.3)	1 (14.3)	4 (57.1)	1 (14.3)	0 (0)	0 (0)	
3 (10)	0 (0)	3 (30)	2 (20)	5 (50)	0 (0)	0 (0)	
4 (13)	0 (0)	0 (0)	1 (7.7)	9 (69.2)	3 (23.1)	0 (0)	
5 (10)	0 (0)	0 (0)	0 (0)	4 (40)	5 (50)	1 (10)	
n= 48	3 (100)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	
mRS at 3 months (n)							0.006
0 (6)	5 (83.3)	1 (16.7)	0 (0)	0 (0)	0 (0)	0 (0)	
1 (6)	2 (33.3)	1 (16.7)	3 (50)	0 (0)	0 (0)	0 (0)	
2 (14)	1 (7.1)	2 (14.3)	3 (21.4)	6 (42.9)	2 (14.3)	0 (0)	
3 (5)	0 (0)	1 (20)	1 (20)	2 (40)	1 (20)	0 (0)	
4 (12)	0 (0)	0 (0)	0 (0)	8 (66.7)	3 (25)	1 (8.3)	
5 (3)	0 (0)	0 (0)	0 (0)	1 (33.3)	2 (66.7)	0 (0)	
6 (2)	0 (0)	0 (0)	0 (0)	2 (100)	0 (0)	0 (0)	
n= 48	8 (16.7)	5 (10.4)	7 (14.6)	19 (39.6)	8 (16.7)	1 (2.1)	
Sex (n)							*0.45*
Men (35)	4 (11.4)	4 (11.4)	4 (11.4)	16 (45.7)	6 (17.1)	1 (2.9)	
Women (13)	4 (30.8)	1 (7.7)	3 (23.1)	3 (23.1)	2 (15.4)	0 (0)	
n= 48	8 (16.7)	5 (10.4)	7 (14.6)	19 (39.6)	8 (16.7)	1 (2.1)	
Age							0.2
< 65 (12)	3 (25)	1 (8.3)	0 (0)	4 (33.3)	4 (33.3)	0 (0)	
65-80 (30)	5 (16.7)	3 (10)	4 (13.3)	14 (46.7)	3 (10)	1 (3.3)	
> 80 (6)	0 (0)	1 (16.7)	3 (50)	1 (16.7)	1 (16.7)	0 (0)	
n= 48	8 (16.7)	5 (10.4)	7 (14.6)	19 (39.6)	8 (16.7)	1 (2.1)	

Not significant (CI: 95%) in italics.

Table 5. Correlation between mRS at discharge or at 3 months and mRS at 3 months, sex and age.

mRS at discharge n (%)

	0	1	2	3	4	5	6	p
mRS at 3 months (n)								0
0 (6)	3 (50)	3 (50)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	
1 (6)	0 (0)	2 (33.3)	4 (66.7)	0 (0)	0 (0)	0 (0)	0 (0)	
2 (14)	0 (0)	0 (0)	3 (21.4)	7 (50)	4 (28.6)	0 (0)	0 (0)	
3 (5)	0 (0)	0 (0)	0 (0)	2 (40)	2 (40)	1 (20)	0 (0)	
4 (12)	0 (0)	0 (0)	0 (0)	0 (0)	6 (50)	6 (50)	0 (0)	
5 (3)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	3 (100)	0 (0)	
6 (2)	0 (0)	0 (0)	0 (0)	1 (50)	1 (50)	0 (0)	0 (0)	
n= 48	3 (6.3)	5 (10.4)	7 (14.6)	10 (20.8)	13 (27.1)	10 (20.8)	0 (0)	
Sex								*0.13*
Men (41)	1 (2.4)	4 (9.8)	3 (7.3)	7 (17.1)	10 (24.4)	10 (24.4)	6 (14.6)	
Women (17)	2 (11.8)	1 (5.9)	4 (23.5)	3 (17.6)	3 (17.6)	0 (0)	4 (23.5)	
n= 58	3 (5.2)	5 (8.6)	7 (12.1)	10 (17.2)	13 (22.4)	10 (17.2)	10 (17.2)	
Age								*0.39*
<65 (14)	1 (7.1)	2 (14.3)	1 (7.1)	1 (7.1)	3 (21.4)	4 (28.6)	2 (14.3)	
65-80 (37)	2 (5.4)	3 (8.1)	3 (8.1)	7 (18.9)	10 (27)	5 (13.5)	7 (18.9)	
>80 (7)	0 (0)	0 (0)	3 (42.9)	2 (28.6)	0 (0)	1 (14.3)	1 (14.3)	
n= 58	3 (5.2)	5 (8.6)	7 (12.1)	10 (17.2)	13 (22.4)	10 (17.2)	10 (17.2)	

mRS at 3 months n (%)

	0	1	2	3	4	5	6	p
Sex								*0.28*
Men (35)	4 (11.4)	4 (11.4)	9 (25.7)	2 (5.7)	11 (31.4)	3 (8.6)	2 (5.7)	
Women (13)	2 (15.4)	2 (15.4)	5 (38.5)	3 (23.1)	1 (7.7)	0 (0)	0 (0)	
n= 48	6 (12.5)	6 (12.5)	14 (29.2)	5 (10.4)	12 (25)	3 (6.3)	2 (4.2)	
Age								*0.61*
<65 (12)	3 (25)	1 (8.3)	3 (25)	1 (8.3)	4 (33.3)	0 (0)	0 (0)	
65-80 (30)	3 (10)	3 (10)	9 (30)	3 (10)	8 (26.7)	2 (6.7)	2 (6.7)	
>80 (6)	0 (0)	2 (33.3)	2 (33.3)	1 (16.7)	0 (0)	1 (16.7)	0 (0)	
n= 48	6 (12.5)	6 (12.5)	14 (29.2)	5 (10.4)	12 (25)	3 (6.3)	2 (4.2)	

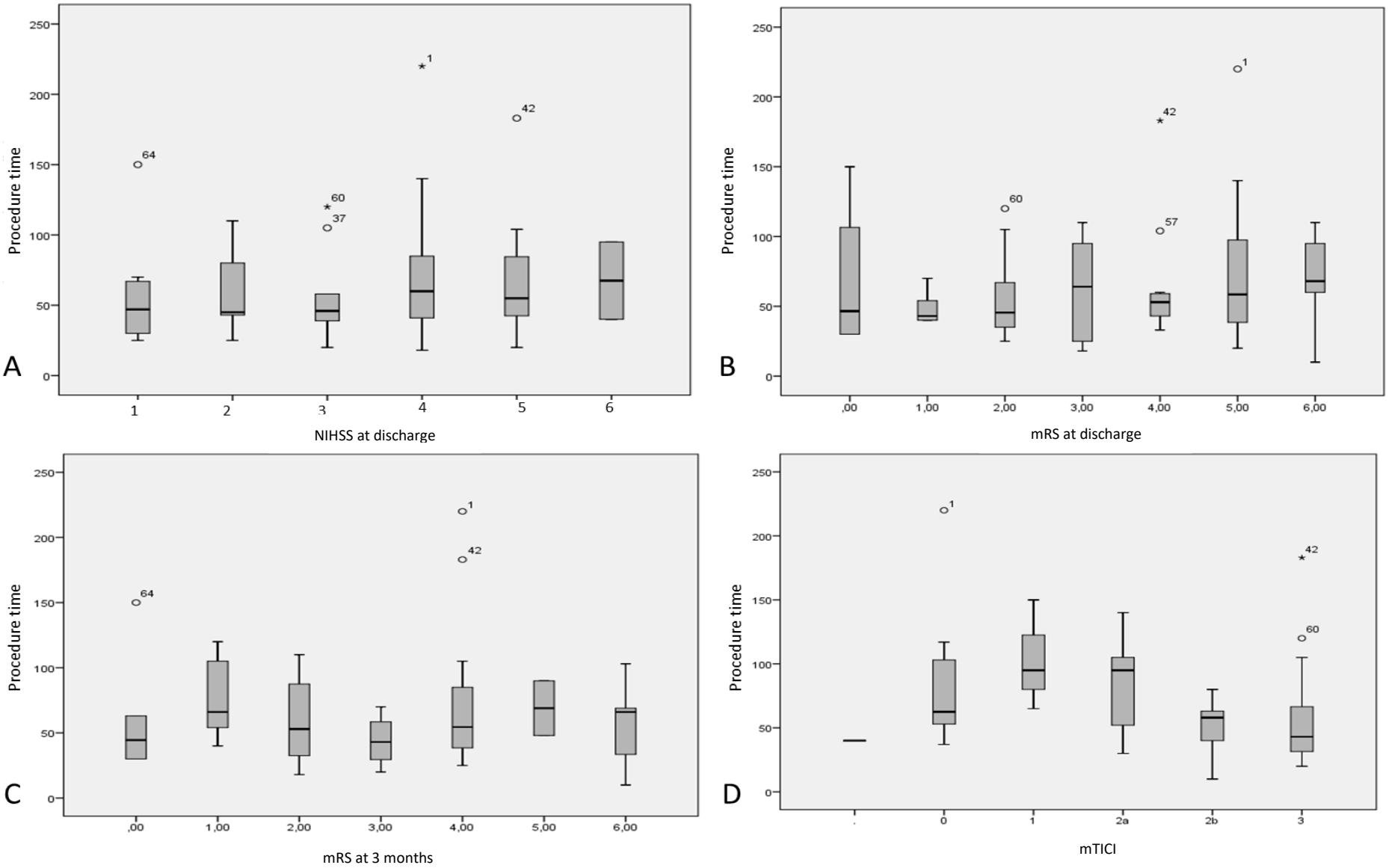

Figure 1. Relationship between the total time of the procedure and NIHSS, mRS and mTICI. *Time in minutes.*

Figure 1.A: 1: No stroke symptoms; 2: Minor stroke, 3: Moderate stroke, 4: Moderate-important stroke 5: important stroke; 6: severe stroke. Figure 1.B and C: 00: No symptoms, 1.00: No significant disability, 2.00: Slight disability, 3.00: Moderate disability, 4.00: Moderately severe disability, 5.00: Severe disability and 6.00: death. Figure 1.D: 0: without perfusion; 1: slight anterograde perfusion that distresses exceeds the occlusion zone; 2a: anterograde reperfusion <50% of the vascular territory involved; 2b: anterograde reperfusion> 50% of the vascular territory involved; 3: 100% anterograde reperfusion of the compromised vascular territory.