Original Research

PROGNOSTIC FACTORS RELATED TO CLINICAL OUTCOME FOLLOWING THROMBECTOMY IN ISCHEMIC STROKE

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ABSTRACT

Acute ischemic stroke continues to be one of the leading causes of disability and death and is a financial burden to an already taxed health care system. Early intra-arterial treatment with mechanical thrombectomy devices is safe and effective for reducing disability and is superior to standard treatment with intravenous thrombolysis alone for the treatment large artery occlusion stroke. Nevertheless prognostics factors need to be systematically analyzed in the context of these new therapeutic strategies. The aim of this study was to analyze prognostic factors related to clinical outcome following thrombectomy in ischemic stroke.

Methods: *This single - center prospective study included 84 patients with large vessel occlusion stroke, in the anterior and the posterior circulation. Sexes, age, time to recanalization were prospectively collected. Clinical outcome was assessed post treatment, day one and discharge by means of a NIHSS. Three months mRS evaluation was performed by an independent neurologist. The probability of good outcome at 3 months was assessed by forward stepwise logistic regression using baseline NIHSS score, Glasgow score (GCS) at entrance, hyperglycemia, dyslipidemia, NIHSS at discharge, ASPECT score, collateral scale, TICI scale and time to recanalization. All variables significantly associated with the outcome in the univariate analysis were entered in the model. The significance of adding or removing a variable from the logistic model was determined by the maximum likelihood ratio test. Odds - ratio (OR) and their 95% confidence intervals were calculated.*

Results: *At 3 months 55.2% of patients had a mRS 0 - 2. Baseline NIHSS score (p = 0.001), hyperglycemia (p = 0.024), dyslipidemia (p = 0.016), ASPECT score at entrance (p = 0.005), Good collateral status (p = 0.046) were all factors significantly associated with 3 month clinical outcome. Collateral scale, TICI scale and time to final TICI were not correlated to 3 months outcome. Baseline NIHSS score (OR, 2.539; 95% CI, 1.278 - 5.049; p = 0.008), hyperglycemia (OR, 29.841; 95% CI, 1.050 - 848.183; p = 0.047), emerged as independent predictors of outcome at 3 months. Overall embolic complication rate was 5%, and symptomatic intracranial hemorrhage was 3.5%.*

Conclusions: *There are multiple factors that determine the predictors of clinical outcome in patients who undenwent endovascular treatment. High NIHSS and hyperglycemia at admission were the two factor independently associated with a bad outcome at 90 days.*

Keywords: *Stroke, Large vessel occlusion, Endovascular thrombectomy, Prognosis.*

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I. INTRODUCTION

Large vessel occlusions (LVOs), variably defined as blockages of the proximal intracranial anterior and posterior circulation, account for approximately 24% to 46% of acute ischemic strokes [1]. Commonly refractory to intravenous tissue plasminogen activator (tPA), LVOs place large cerebral territories at ischemic risk and cause high rates of morbidity and mortality without further treatment [2]. Over the past few year, endovascular procedures have become a standard of care for acute ischemic strokes caused by large vessel occlusion. Despite early recanalization some stroke patients demonstrate no or limited neurological improvement [3]. Therefore, patient selection is mandatory to have a good clinical outcome and for the avoidance of futile recanalization no matter what endovascular approach is used. The aim of our study is to carried out a broad multifactorial analysis on the effect of various parameters on our 3 month clinical outcome including technical, clinical and imaging parameters. Identifying predictors of the outcome may help us to improve the outcome after acute stroke endovascular treatment (EVT).

II. MATERIALS AND METHODS

2.1. Study population

All patients were evaluated by a stroke neurologist and underwent cranial CT scanning without contrast and met either of the following two criterias:

- Patients presenting with moderate - to - large strokes (NIHSS ≥ 10) in the setting of an angiographically (digital subtraction angiography) proven occlusion of a proximal intracranial artery (e.g., internal carotid artery, middle cerebral artery M1 and/or M2 segments, and basilar or vertebral arteries) were potential candidates for EVT.

- EVT was initiated within 24 h of symptom onset for the anterior circulation stroke and the basilar thrombosis.

Patients with known coagulopathy or systemic bleeding disorder, stroke time onset > 24h; and a prestroke score on the mRS ≥ 2, which could affect the outcome, were excluded from the analysis.

Patients with an evidence of intracranial hemorrhage or major ischemic infarction (acute ischemic change in more than a third of the middle cerebral artery territory or having an Alberta Stroke Program Early CT score of < 5) were excluded from EVT. For posterior circulation strokes, patients with extensive brainstem lesions (e.g., bilateral pons or mesencephalic involvement) were excluded from EVT.

2.2. Study parameter

We performed a retrospective study of patients with acute ischemic stroke who underwent EVT between January 2018 and January 2021, at Stroke Center - Hue Central Hospital. 84 acute ischemic stroke patients were included in the analysis.

We evaluated the clinical, paraclinical characteristic at the time of admission, after EVT technique, discharge and 3 months from the time of admission:

- Clinical examination: general and neurological examination, modified Rankin Scale scores at 3 months.

- Paraclinical information: collecting data from brain CT, MRI, DSA, paracinical scale, workflow timing.

2.3. Statistical analysis

The analysis was performed using Microsoft Excel 2010 and SPSS 25.0.

III. RESULTS

The participants were relatively old, along with many risk factor for vascular disease such as hypertension, dyslipidemia, smoke, diabetes. Especially, hypertension and dyslipidemia were the among the most common risk factors **(table 1)**.

Table 1: Participant's clinical characteristics and paraclinical information.

Characteristics		Result (N = 84)
Male:Female		2.1:1
Age, (mean ± SD)		66.87 ± 13.9
Hypertension, n (%)		61 (72.6%)
Dyslipidemia, n (%)		48 (57.1%)
atrial fibrillation, n (%)		24 (28.5%)
Hyperglycemia, n (%)		24 (28.5%)
Smoking, n (%)		33 (39.2%)
NIHSS(median, range)		19.7(19; 11-30)
GCS(mean ± SD)		10.54 ± 1.82
Worklow timing	mean time between symptom onset and hospitalization	2h 52 min
	mean time between symptom onset and final TICI	4h 56 min

All patients was performed CT, mean ASPECTS score on CTscan imaging was 9 (7 - 10).

Sixty - eight (80 %) of 84 patients had anterior circulation stroke (ICA, 33 (39%); M1, 22 (26%); M2, 11 (13%); A1, 2 (2%)). Sixteen patients (20%) had basilar thrombosis leading to posterior circulation stroke.

Collateral status: 29 (35%) of 84 patients had good collateral status, 29 (35%) of 84 patients had moderate collateral status and 26 (30%) of 84 patients had poor collateral status.

A total of 84 patients were included in this study, 30 in the Combined therapy, and 54 in the Standalone Thrombectomy group. Recanalization TICI3 - 2B was achieved in 87%. Adverse embolic events occurred in 10% of the procedure, and symptomatic intracranial hemorrhages were reported in 2% **(Figure 1)**. At 3 months 55.2% of patients had a good outcome (mRS 0 - 2). Overall embolic complication rate was 5%, and symptomatic intracranial hemorrhage was 3.5% **(Figure 2)**.

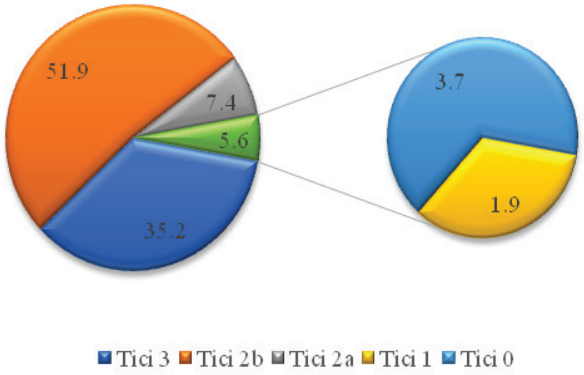


Figure 1: TICI score' result

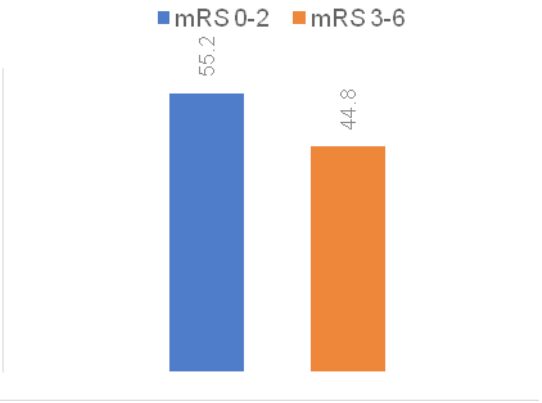


Figure 2: modified Rankin Scale scores at 3 months

Baseline NIHSS score (p = 0.001), hyperglycemia (p = 0.024), dyslipidemia (p = 0.016), ASPECT score at entrance (p = 0.005), Good collateral status (p = 0.046) were all factors significantly associated with 3 month clinical outcome **(Table 2)**. Collateral scale, TICI scale and time to final TICI were not correlated to 3 months outcome. Baseline NIHSS score (OR, 2.539; 95% CI, 1.278 - 5.049; p = 0.008), hyperglycemia (OR, 29.841; 95% CI, 1.050 - 848.183; p = 0.047), emerged as independent predictors of outcome at 3 months **(Table 3)**.

Table 2: Predictors of clinical outcome.

Variable		P	OR	95% Confidence Interval	
				Lower	Upper
Age		0.322	1.021	0.980	1.064
Sex		0.668	0.778	0.247	2.451
Timeissues	Onset to hospitalization	0.793	0.977	0.819	1.164
	Onset to final TICI	0.448	1.062	0.908	1.243
NIHSS		0.001	2.304	1.433	3.706
glasgow		0.066	0.734	0.528	1.020
ASPECTS		0.005	0.121	0.028	0.626
Good Collateral		0.046	0.208	0.044	0.974
TICI scale		0.747	-	-	-
Vascular risk factors	Hypertension	0.314	0.511	0.139	1.885
	Diabetes	0.024	6.375	1.273	31.920
	Dyslipidemia	0.016	4.286	1.309	14.032
	Atrial fibrillation	0.316	0.550	0.171	1.771
	Smoking	0.820	1.143	0.361	3.615

Table 3: Results of logistic regression to find independent predictors of bad clinical outcome.

Variable	B	P	OR	95% Confidence Interval	
				Lower	Upper
NIHSS	0.932	0.008	2.539	1.278	5.049
ASPECTS	- 1.148	0.378	0.317	0.025	4.081
Dyslipidemia	0.794	0.448	2.212	0.285	17.180
Diabetes	3.396	0.047	29.841	1.050	848.183
Constant	- 6.628	Predicted Percentage Correct: 92.6%			

IV. DISCUSSION

This study including analysis the predictors off clinical outcomes of patiens being treated with thrombectomy. We have identified that a baseline NIHSS score and hyperglycemia are independent predictors of bad clinical outcome (Table 3). A favorable baseline CT (highly ASPECT score) is associated with good clinical outcome. In addition, diabetes factor have a negative impact on clinical outcome.

The men's proportion in our study (61%) was higher than women's. that was quite similar to some studues, such as Dao V.P (63%) [4], MR CLEAN (57.9%) [3].

Rapid recanalization is regarded the fundamental

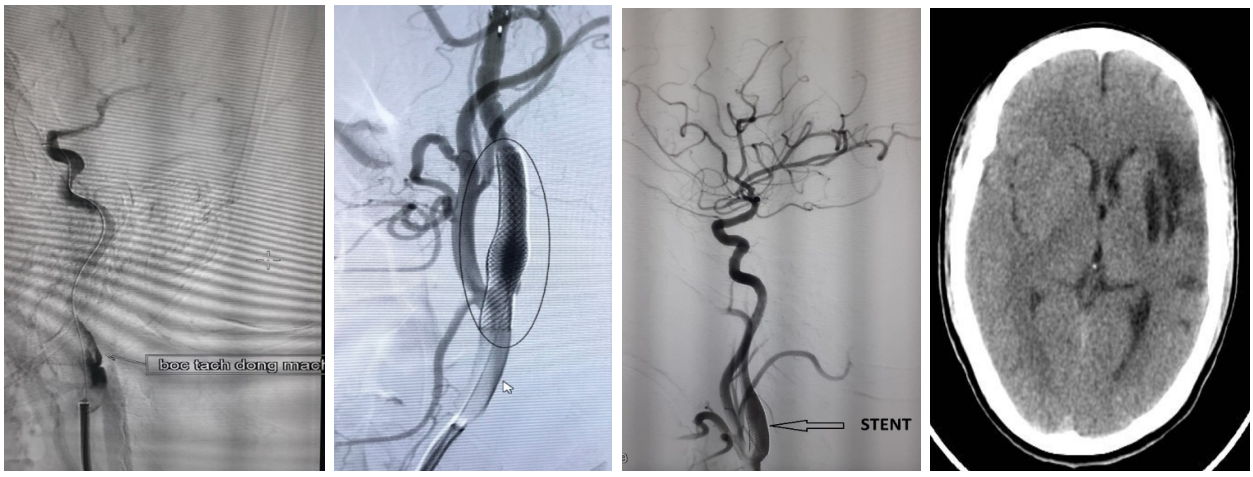
endpoint and the most significant factor in determining clinical outcome. IMS 2 [5] and Recanalize [6]studies demonstrated a strong correlation between time to recanalization and clinical outcome. Interestingly however, in our study there was no correlation between time to recanalization and the 3 month clinical outcome (p = 0.448). Abou - Chebl [7] postulated that although time is certainly one of the most important criteria for clinical outcome, the collateral blood supply in proximal vessel occlusion has a key influence on clinical outcome. The collaterals of a given patient directly influence the rate of conversion of penumbra into necrotic core.

Trial of ORG 10172 in Acute Stroke Treatment (TOAST) Investigatorsverified in a prospective clinical trial that NIHSS had good predictive value for the long - term prognosis of stroke. In a study on the predictive value of early NIHSS assessment on the prognosis of ischemic stroke, Kwakkel et al [8] revealed that the assessment using NIHSS at different time points within a few days after the onset of acute stroke could strongly predict the prognosis at 3 and 6 months after stroke. Young et al [9] also revealed that the baseline NIHSS score was the best early predictor of functional outcome in patients with ACI. Our study 'results revealed that NIHSS scores increased, the risk of in - hospital mortality revealed an upward trend and mortality risk increased.

Adams revealed that [10] less than 20% of patients with > 15 points of NIHSS score had a relatively satisfactory prognosis. In addition, Schlegel et al [11] revealed that NIHSS could predict the outcome of a patient; that is, patients with a score of ≥ 5 points of NIHSS score has a great possibility to discharge, patients with a score of 6 to 13 points of NIHSS score need to be treated in a rehabilitation hospital, and patients with a score of ≥ 13 points of NIHSS score has a large possibility of receiving long - term care in the hospital.

Hyperglycemia is already a well recognized as major hemorrhagic risk factor following IV therapy but rarely a contraindication in daily practice. It is also known to be related to impaired metabolism during ischemic stroke. In the our study this parameter demonstrated a significiant and independent predictor of bad outcome (Table3, OR, 29.841; 95% CI, 1.050-848.183; p = 0.047).

High NIHSS and hyperglycemia at admission were the two factor independently associated with a bad outcome at 90 days as reported by V. Costalat.



(a) (b) (c) (d)

Figure 3: (a) Angiogram shows a dissection left carotid artery. (b) Deployed Stent. (c) After stenting, the vessel is recanalized to a TICI 3 state. (d) Control CT scan shows right hemispheric striatocapular infarction and multiple parietal small embolic infarctions. At 3 months, the patients had a good outcome.

V. CONCLUSION

This study has allowed rapid and safe recanalization with 3 months good outcome of 55.2%. It is important to achieve quick and higher rates of recanalization to improve good outcome. There are multiple factors that determine the predictors of clinical outcome in patients who undenwent endovascular treatment. High NIHSS and hyperglycemia at admission were the two factor independently associated with a bad outcome at 90 days.

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