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Predictors of improved clinical outcome following mechanical thrombectomy on South Texas patients with posterior circulation stroke

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ABSTRACT

The South Texas population is well-acquainted with hypertension, Diabetes Mellitus Type 2 (DM2), and hyperlipidemia, all well-known risk factors for stroke¹. Both anterior and posterior circulation strokes can lead to detrimental life changes, and although posterior circulation, or vertebrobasilar, strokes make up about 20% of all ischemic strokes², their elusive characteristics often overlap with anterior circulation symptoms. In this study, we study factors that may influence the outcome of patients with posterior circulation stroke (PCS) following successful recanalization using mechanical thrombectomy. In this paper, the clinical outcome is evaluated by the primary endpoint, Modified Rankin Scale (mRS) at discharge. The outcomes (mild, moderate, severe) refer to the degree of severity of clinical impact. The current evidence that is available points towards a general poorer prognosis for recanalization of PCS than anterior circulation strokes (ACS)³. This paper seeks to investigate both patient related factors and treatment related factors that may influence the outcomes of cases PCS following mechanical thrombectomy and offers future direction that can improve our understanding of PCS.

Modified Rankin Scale (mRS)

0	No residual Symptoms
1	The patient has no significant disability; able to carry out all pre-stroke activities.
2	The patient has slight disability; unable to carry out all pre-stroke activities but able to look after self without daily help.
3	The patient has moderate disability; requiring some external help but able to walk without the assistance of another individual.
4	The patient has moderately severe disability; unable to walk or attend to bodily functions without assistance of another individual.
5	The patient has severe disability; bedridden, incontinent, requires continuous care.
6	The patient has expired (during the hospital stay or after discharge from the hospital).

Specifications Manual for Joint Commission National Quality Measures (v2018A)

INTRODUCTION:

Posterior Circulation Strokes (PCS) make up roughly around 20% of ischemic strokes, and even campaigns like F.A.S.T (face, arms, speech, time to call 911) are not fully encompassing of symptoms typically experienced with PCS, like dizziness, postural instability, and nausea². Mechanical thrombectomy has been historically used within 4.5hrs from door-to-needle time, as indicated for patients presenting with strokes. Research papers that have been published with the

intent of restoring faith in the use of mechanical thrombectomy for ischemic stroke patients have often been recorded for ACS. In this paper, we discuss the factors that may influence outcome of PCS following successful recanalization using the modified Rankin Scale at discharge as a primary endpoint.

MATERIALS AND METHODS:

The basis of this research is a retrospective cohort study, using a hospital-wide database used to track strokes, mechanical thrombectomies, as well as patient comorbidities, sex, and outcomes at discharge. All data was securely accessed through the encrypted medical system electronic medical records. A cohort of 68 patients, all of whom had undergone mechanical thrombectomy for posterior circulation stroke, were gathered. From those patients, the hospital-associated characteristics, like average door-to-needle time, in addition to IVTpA administration, were tracked and logged (see Table 1.) This portion of the investigation would be highly reliant on hospital logistics and procedural instruction for indications on mechanical thrombectomy. However, we also looked at individual characteristics, like sex, age, ethnicity, and comorbidities, to investigate the possibility of one or more of those being related to the outcome of PCS post-thrombectomy (see Table 2.)

The modified Rankin Scale was used as a primary endpoint to assess a patient's clinical status upon discharge. A score of 0-2 was interpreted as a mild disability, a score of 3-4 was considered moderate, and a score of 5-6 is listed as severe. For the sake of some relative risk statistical analysis in this paper, scores 3-6 and 3-4 were joined to produce a category of "worse outcome" while scores 0-2 were interpreted as "improved outcome" as it pertains to predicted quality of life.

RESULTS AND DISCUSSION:

When it comes to hospital-related factors, the data seems to suggest that although the average door-to-needle time from entrance to the hospital to the beginning of the intraoperative thrombectomy procedure vary between the three groups on the mRS scale, it was not enough to be deemed significant by statistical analysis. In addition, the variance between those patients given IVTpA and mRS outcome were not statistically significant (p -values $>.05$) Those patients who received IVTpA did not have a higher or lower risk at a worse outcome in terms of clinical stroke severity at discharge.

When it comes to ethnicity (see Table 3), relative risk was used in this retrospective cohort study to determine if being Hispanic itself was a factor for developing a worse outcome following thrombectomy for a posterior circulation stroke. In this case, Hispanics were compared to non-Hispanic whites, using an mRS scale of (0-2) as a positive outcome versus (3-6) as worse outcome. Seeing that as the scale increases, the clinical detriment of the patient also increases, with 6 being classified as "death." The data show that Hispanics were at a 1.18 times higher risk than their non-Hispanic counterparts to receive a poor outcome (mRS 3-6) on their mRS scale at discharge. The risk interpreted in the study does not take into consideration other reasons as to why Hispanics would have a higher risk. One can argue that the patient population is in itself one

in with a high density of Hispanics, and with a cohort number of 68, a sample size would have to increase the number in order to increase the power of the study.

Between males and females (see Table 4), the female sample had 1.3 times the risk of developing a worse mRS outcome than their male counterparts.

Comorbidities aren't mutually exclusive, and in fact many patients have more than one. We see that the prevalence of hypertension, hyperlipidemia, and diabetes mellitus type two are in fact consistent with the incidence rate of the Hispanic population in the Rio Grande Valley¹, and do not have a particular correlation with the outcome of poster circulation stroke severity. The NIHSS score on admission was positively correlated with the modified ranking scale at discharge. This seems to indicate that one of the greatest factors influencing the outcome of a posterior circulation stroke following a thrombectomy would be the severity at which the patient initially arrived with.

TABLE 1: Treatment factors relating to Modified Rankin Scale (mRS) at discharge

	0-2 (n=16)	3-4 (n=17)	5-6 (n=35)
Average Door to needle time	1h 24m	3h	1h 6m 0s 0ms
Received ivtPA	6.7% ± .258 (p=.062)	17.6% ± .393 (p=.789)	36.4% ± 489 (p=.066)

TABLE 2: Treatment factors relating to Modified Rankin Scale (mRS) at discharge

	0-2 (n=16)	3-4 (n=17)	5-6 (n=35)
Ethnicity			
Non-hispanic White	0.375	0.176	0.314
Hispanic	0.5	0.824	0.686
Sex			
Male	0.875	0.765	0.657
Female	0.125	0.235	0.342
NIHSS on admission	10.5	13.8	19.4
Comorbidities			
Hypertension	0.875	0.882	0.857
Afib	0.188	0.059	0.2
CAD	0.25	0.235	0.343
CHF	0%	0	0.089
Hyperlipidemia	0.5	0.471	0.543
DM2	0.375	0.353	0.514
Smoking (current)	0.188	0.118	0.171
History of Smoking	0.313	0.118	0.171

TABLE 3: Demographics relating to mRS outcome

	mRS 3-6	mRS 0-2	Total	Cumulative Incidence
Hispanic	38	8	46	38/56
Non-Hispanic White	14	6	20	14/20

TABLE 4: Sex relating to mRS outcome

	mRS 3-6	mRS 0-2	Total	Cumulative Incidence
Female	16	1	17	16/17
Male	36	14	50	36/50

CONCLUSION:

By having a better idea on factors that may affect the clinical outcome of a PCS following thrombectomy, we can focus on information that can be used for secondary prevention of another stroke. Because the study was a retrospective cohort study, only correlations and relative risk analyses were used. In addition, the modified Rankin scale lends itself to multiple interpretations of “poor” versus “good” outcomes and is arbitrary in nature. One of the most interesting findings in this study is a correlation between and NIHSS score and modified Rankin scale outcome because this may put into question the efficacy of a poster circulation stroke thrombectomy even if it is currently indicated in literature. That is to say, if the NIHSS score on admission is positively correlated with an increase in severity of mRS at discharge, meaning that the patients are presented with a worse and NIHSS score in fact had worse mRS scores as well, which is expected without intervention. However, all of these patients had undergone mechanical thrombectomy which in theory would lead to better outcomes as it is an active intervention. This is an area that may require future direction and analysis to determine if mechanical intervention versus no intervention of PCS will differ significantly. It will also be interesting to see why women were more likely to have increased risk of having worse outcomes for poster circulation stroke thrombectomy as opposed to males in future studies.

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³See, Alfred & Pandey, Dilip & Du, Xinjian (2020). Optimized Hemodynamic Assessment to Predict Stroke Risk in Vertebrobasilar Disease: Analysis From the VERiTAS Study. *Journal of the American Heart Association*. 9. 10.1161/JAHA.120.016406.