Journal of Statistics on Health Decision

EXTENDED ABSTRACT

Prognostic predictors in stroke patients undergoing thrombectomy with recanalization

Vanusa Rocha[1], Vera Afreixo[2], Tiago Gregório[3,4], Andrea Cabral[5]

[1]Faculty of Science and Technology - University of Cape Verde, Cape Verde
[2]CIDMA - Center for Research & Development in Mathematics and Applications, University of Aveiro, Portugal
[3]Internal Medicine Service, Hospital Center of Vila Nova de Gaia and Espinho/EPE; MEDCIDS;
[4]Faculty of Medicine, University of Porto, Portugal
[5]Neurology Service, Hospital Center of Vila Nova de Gaia, Portugal

Introduction:

Stroke is a major cause of morbidity and mortality. Thrombectomy is a highly effective and approved treatment for patients with ischemic stroke and large vessel occlusion of the anterior circulation [1] . However, despite effective recanalization, a considerable proportion of patients remains with significant neurological damage. The aim of this study was to evaluate outcome predictors in ischemic stroke patients undergoing thrombectomy with effective recanalization.

Methods:

A consecutive sample of patients with acute ischemic stroke due to large vessel occlusion, submitted to endovascular treatment with effective recanalization at a comprehensive stroke center in the north of Portugal was analyzed. Clinical, demographic, and laboratory variables (age, gender, hypotension, diabetes mellitus, heart disease, dyslipidemia, previous CVA, cardioembolic stroke, systolic blood pressure, diastolic blood pressure, glycemia, initial NIH Stroke Scale (NIHSS) and D-dimer) were obtained from the initial evaluation. The outcome of interest was good functional outcome defined as a value of 0-2 on the modified Rankin scale at 3 months. A descriptive analysis was performed using absolute and relative frequencies for qualitative variables and mean and standard deviation or median and interquartile range for quantitative variables. The normality of quantitative variables was available by the Shapiro-Wilk test. Variables with a p 0.20 in the univariable logistic regression analysis were included in a logistic regression model to determine the independent predictors [2]. Performance of multivariable model displayed as area under the receiver operating curve (AUC) and corresponding 95 % confidence interval. Residual analysis and the diagnosis of influential cases was performed through the graphical analysis. Only two observations were candidate outliers, but these were included in the final model, their removal did not improve the significance and quality of the model fit. Values of $p<0.05$ were considered statistically significant. All analyses were performed with R software (version 4.0.3).

Results:

A total of 116 patients were included in the analysis, and 63 had a favorable outcome. In the univariable analysis, age, diabetes, blood glucose, and stroke severity measured by the NIHSS scale showed an association with unfavorable outcome. In multivariable analysis, only age and NIHSS scale were statistically significant (Table 1).

Discussion:

Despite effective recanalization, a significant proportion of patients in this cohort failed to achieve functional independent (46%, n=53). Univariate analysis demonstrated that older age, diabetes, elevated blood sugar and higher NIHSS score were associated with lower odds of achieving functional independence at 3 months. These results are in accordance to the literature [3]. In multivariate analysis, however, only age and NIHSS maintained the association. This suggests that the association between diabetes/glycemia and unfavorable outcome is due, at least in part, to a confounding effect, as diabetes is more frequent in elderly patients [4]. This study has an important limitation that should be acknowledged: time to recanalization was not available for analysis, and this factor has been shown to be a major predictor of outcome in stroke [5].

Keywords:
Stroke, thrombectomy, modelling

Corresponding author:
Vanusa Rocha
vanusa.rocha@docente.unicv.edu.cv

Conflict of interest:
The authors declare no conflict of interests

First published: 20JUL2022

Table 1 - Logistic regression analysis of predictors of favorable outcome

	Univariate Logistic Regression		Multivariate Logistic Regression	
Characteristics	**OR (95% CI)**	***p***	**OR (95% CI)**	***p***
Age (years)	0.93 (0.89 – 0.96)	0.0002	0.92 (0.86 – 0.97)	0.003
Gender (Male)	0.82 (0.39 – 1.72)	0.6010	–	–
Hypertension	0.47 (0.19 – 1.08)	0.0828	1.49 (0.38 – 6.01)	0.563
Diabetes mellitus	0.16 (0.06 – 0.41)	0.0002	0.27 (0.06 – 1.07)	0.070
Heart disease	0.73 (0.34 – 1.56)	0.4200	–	–
Dyslipidemia	0.51 (0.24 – 1.07)	0.0760	0.39 (0.12 – 1.11)	0.085
Previous CVA	0.50 (0.18 – 1.31)	0.1630	0.39 (0.09 – 1.45)	0.166
Cardioembolic stroke	0.55 (0.24 – 1.19)	0.1339	1.90 (0.60 – 6.34)	0.278
SBP	0.99 (0.97 – 1.01)	0.2970	–	–
DBP	1.01 (0.98 – 1.03)	0.6020	–	–
Glycemia	0.98 (0.97 – 0.99)	0.0024	0.99 (0.97 – 1.00)	0.107
Initial NIHSS	0.82 (0.39 – 1.72)	<0.001	0.10 (0.83 – 0.96)	0.002
D-dimer	0.89 (0.75 –1.00)	0.0894	0.97 (0.76 – 1.19)	0.818

CI: confidence interval; SBP: Systolic blood pressure; DBP: Diastolic blood pressure

In conclusion, age and higher NIHSS score are important predictors of poor functional outcome despite recanalization in stroke patients submitted to thrombectomy. More therapeutic options are required for these patients to optimize outcome.

Acknowledgements:

This research was supported by FCT and CIDMA, through projects UIDB/04106/2020 and UIDP/04106/2020 and Fundação Calouste Gulbenkian.

References:

1. Turc G, Bhogal P, Fischer U, Khatri P, Lobotesis K, Mazighi M, et al. European Stroke Organisation (ESO)- European Society for Minimally Invasive Neurological Therapy (ESMINT) guidelines on mechanical thrombectomy in acute ischemic stroke. J Neurointerv Surg. 2019;11(6):535–8. http://dx.doi.org/10.1136/neurintsurg-2018-014569
2. Hosmer DW, Lemesshow S. Applied Logistic Regression. 2nd-ed. ed. Wiley Inc, editor. New York; 2000.
3. Saposnik G, Kapral MK, Liu Y, Hall R, O'Donnell M, Raptis S, et al. IScore: A risk score to predict death early after hospitalization for an acute ischemic stroke. 2011;123(7):739–49. https://doi.org/10.1161/CIRCULATIONAHA.110.983353
4. Ismail L, Materwala H, Al Kaabi J. Association of risk factors with type 2 diabetes: A systematic review. Comput Struct Biotechnol J [Internet]. 2021;19:1759–85. https://doi.org/10.1016/j.csbj.2021.03.003
5. Tsivgoulis G, Saqqur M, Sharma VK, Brunser A, Eggers J, Mikulik R, et al. Timing of recanalization and functional recovery in acute ischemic stroke. J Stroke. 2020;22(1):130–40. https://doi.org/10.5853/jos.2019.01648