



Original Article

Early neurological deterioration in acute ischemic stroke: A propensity score analysis

Zhi-Xin Huang^a, Qi-Zhang Wang^b, Ying-Yi Dai^a, Hai-Ke Lu^a, Xiao-Yu Liang^a, Huan Hu^a,
Xin-Tong Liu^{a,*}

^a Department of Neurology, Guangdong Second Provincial General Hospital, Guangzhou, Guangdong, China

^b Department of Neurology, Shenzhen Shajing Affiliated Hospital of Guangzhou Medical University, Shenzhen, Guangdong, China

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Abstract

Background: To investigate whether endovascular therapy (EVT) was one of the factors influencing the incidence of early neurological deterioration (END) in patients with acute ischemic stroke (AIS) as compared with intravenous thrombolysis alone.

Methods: This study was based on our single-center's database that included information on stroke patients hospitalised between January 2012 and September 2015. A total of 220 patients who underwent EVT after IV rt-PA, EVT or IV rt-PA alone. To reduce the lack of randomization, we conducted a propensity score analysis using the SPSS custom dialog. After matching was completed, the 2 groups (with END versus non-END) were compared between matched groups. Variables with a p value ≤ 0.1 by univariate analysis were candidates for inclusion in logistic regression analysis.

Results: Of 220 acute ischemic strokes attended, 213 patients were included (62.0%, 23.0% and 15.0% with circulation occlusion in the anterior, posterior and both branches, respectively). END was detected in 68 patients (31.9%). Multivariable analysis showed that END was positively associated with glucose level (OR, 1.40; 95%CI, 1.10–1.79; $p = 0.007$), uric acid level (OR, 1.01; 95% CI, 1.00–1.02; $p = 0.026$) and treatment methods (EVT: OR, 3.87; 95% CI, 1.32–11.35; $p = 0.014$). However, there was significant difference in baseline data (NIHSS and INR) between EVT group and non-EVT group.

Conclusion: Our findings suggest that hyperglycemia, hyperuricemia and EVT may be independently associated with END in AIS, even after controlling for possible confound factors. Further studies are warranted to confirm these results.

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Keywords: Acute ischemic stroke; Early neurological deterioration; Endovascular therapy

1. Introduction

Ischemic stroke (IS) takes no prisoners, which was the first leading cause of death and a major cause of long-term disability in many developing countries, especially China.¹

Intravenous thrombolysis (IVT) for patients presenting up to 4.5 h after symptom onset has been considered as the key step to reduce the risk of severe disability and mortality.² Unfortunately, <5% of acute ischemic stroke (AIS) patients received intravenous recombinant tissue-type plasminogen activator (rt-PA) in China mainly because most of stroke patients missed the proper time of treatment.³ Furthermore, recanalization rates following intravenous rt-PA are low especially for occlusions of acute intracranial large vessels or large clots (≥ 8 mm).⁴ With the advent of new treatment strategy in AIS, Endovascular therapy (EVT) has been proven to be an advantage of a higher recanalization and better functional

Conflicts of interest: The authors declare that they have no conflicts of interest related to the subject matter or materials discussed in this article.

* Corresponding author. Dr. Xin-Tong Liu, Department of Neurology, Guangdong Second Provincial General Hospital, 466, Middle Xingang Road, Guangzhou, 510317, Guangdong, China.

E-mail address: xintongliu@163.com (X.-T. Liu).

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outcome in anterior circulation stroke patients treated up to 6 h after symptom onset,⁵ whose benefits were further confirmed by four other randomized clinical trials, such as ESCAPE, EXTEND-IA, SWIFT PRIME and REVASCAT.^{6–9}

Early neurological deterioration (END) in the acute phase of IS usually leads to a marked increase in disability and mortality rates, after reperfusion treatment due to diverse mechanisms.¹⁰ Previous studies have shown that the predictors of END were as follows: diabetes,¹¹ hyperglycemia, neurological functional deficits at admission,¹² systolic BP,¹³ fibrinogen,¹⁴ and a delay until treatment.¹⁵ Nevertheless, studies on the influence of different treatments in END have been quite rare. Therefore, the aim of this retrospective study was to evaluate whether EVT was one of the factors influencing the incidence of END in patients with AIS as compared with intravenous thrombolysis alone.

2. Methods

2.1. Study subjects

This retrospective single center case study was designed to analyze the risk factors of END in patients with AIS in our stroke center, which provides neurological care to the population of Southeast China. Exclusion criteria comprised (1) renal or hepatic disease, unstable angina, ventricular aneurysm, myocardial infarction, heart failure, malignant disease, vascular malformations, aneurysm, hemorrhagic stroke and brain surgery; (2) patients with a previous history of carotid endarterectomy or carotid artery stenting; (3) patients with other causes & undetermined causes. All eligible patients within 4.5 h after symptom onset were intravenously administered with rt-PA (0.9 mg/kg) and then immediately transferred to the digital subtraction angiography (DSA) room for repeating imaging. Additional EVT was performed in the patients according to the following criteria: catheter-accessible persistent occlusion of internal carotid artery (ICA), M1 of the middle cerebral artery (MCA) on follow-up DSA after rt-PA therapy. EVT alone was carried out in patients with an occlusion in the proximal anterior or posterior circulation that could be treated between 4.5 and 8 h or 4.5–24 h, respectively, after symptom onset.

A total of 220 subjects were enrolled from the consecutive patients who underwent EVT after IV rt-PA, EVT or IV rt-PA alone in our center between January 2012 and September 2015. According to the different treatment methods, patients were divided into two groups: EVT group (EVT plus IV rt-PA, or EVT alone) and rt-PA group (IV rt-PA alone). They were thoroughly investigated for demographics and baseline clinical characteristics. The prevalence of certain cardiovascular risk factors identified at the baseline has been previously described.¹⁶ Neurological deficits were estimated using the National Institutes of Health Stroke Scale (NIHSS) score by two neurologists, who were blind of DSA images and baseline clinical characteristics. In the presence of inconsistent scores, a consensus was reached via discussion. The study protocol was approved by the Ethical Committee of our center. The

authors of this study did not interact with the participants in any way. Moreover, authors had no access to information that could identify individual participants during or after data collection.

2.2. Definition of END

In this study, We defined END as an increment of NIHSS score ≥ 2 points within 72 h 1–3 times a day after admission according to a previous recommended definition; this was a restrictive criterion less influenced by subjective observation, enabling differentiation from the late deterioration mostly due to systemic complications such as aspiration pneumonia or to stroke recurrence.¹⁷

2.3. Statistical analysis

Statistical analysis was performed using SPSS software, version 18.0 (SPSS Inc., Chicago, IL). To reduce the lack of randomization, we conducted a propensity score analysis using the SPSS custom dialog. Before matching, comparisons were performed using independent sample t tests, Kruskal–Wallis tests, Mann–Whitney U tests, or analysis of variance for normal distributed continuous variables, and the chi-square test or Fisher's exact test for categorical variables, as appropriate. Then, the propensity score was developed by using a logistic regression model in which the following variables were entered: Total cholesterol (TC), high-density lipoprotein (HDL), low-density lipoprotein (LDL), homocysteine, uric acid. After estimation of the propensity score, we matched participants using a simple 1:4 nearest neighbor matching. After matching is completed, the 2 groups (with END versus non-END) were compared between matched groups. Variables with a p value ≤ 0.1 by univariate analysis were candidates for inclusion in logistic regression analysis. A selection process was used to develop the final multivariable model, and adjusted odds ratios (ORs) and 95% confidence intervals (CIs) were calculated as estimates of relative risk. Moreover, baseline patient characteristics between IV rt-PA group and EVT group were assessed with logistic regression. A two-tailed p value < 0.05 was considered statistically significant.

3. Results

3.1. Patient characteristics

Between January 1 2012 and September 31 2015, among 220 patients with AIS, 7 patients with incomplete clinical data were excluded from this study, 189 patients underwent IV rt-PA for AIS, and other 24 (11.3%) were treated with EVT. Finally, a total of 213 patients were enrolled into the study: 132 (62.0%), 49 (23.0%) and 32 (15.0%) with circulation occlusion in the anterior, posterior and both branches, respectively. The median time from symptom onset to treatment was 3.3 h (interquartile range [IQR] 1.9). 68 of 213 subjects (31.9%) had END, 145 of which served as non-END

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