Original Research

The effects of pharmaceutical thrombolysis and multi-modal therapy on patients with acute posterior circulation ischemic stroke: Results of a one center retrospective study

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HIGHLIGHTS

- Multi-modal therapy may be the first choice for APCIS patients with a delayed admission time.
- Stent placement and thrombectomy device using may lead to high recanalization rate and the favorable outcome rate.
- The effect of balloon angioplasty for such patients needs further exploration.

ARTICLE INFO

ABSTRACT

Background: The treatment method for acute ischemic stroke is rapidly developing, and the effects of endovascular modalities, when used alone or in combination, needs to be studied. We aimed to identify the difference between pharmaceutical thrombolysis and multi-modal therapy (MMT) used in acute posterior circulation ischemic stroke (APCIS) patients and also to detect the predictors for successful recanalization and favorable outcomes.
Methods: A retrospective analysis of patients with APCIS who received thrombolytic pharmaceuticals and MMT from 2011 to 2016 was performed at the stroke center. Demographic information, therapeutic methods and the results were recorded. Logistic regression model was constructed in variables to determine the predictors of outcome.
Results: A total of 124 patients were included in this study, the mean age was 59.6 ± 9.5 years and the mean admission National Institutes of Health Stroke Scale (NIHSS) was 15.1 ± 6.6. Recanalization was achieved in 87 (70.2%) patients and favorable outcomes were observed in 65 (52.4%) patients. Patients treated with MMT demonstrated a higher recanalization rate, especially the use of stent placement and thrombectomy device, which were also related to the favorable outcome three months post-stroke. Logistic regression showed that stent placement and thrombectomy were the predictors of recanalization, and a favorable outcome was associated with coronary artery disease, MMT methods as well as recanalization.
Conclusion: MMT methods, especially stent placement and thrombectomy device may be the first recommended for patients with a delayed admission time, and it may have the advantage of better perfusion and neurological outcomes.

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1. Introduction

Stroke is the leading cause of disability; it affects millions of people annually and is a burden to the family [1,2]. Approximately 20–25% of all the ischemic strokes occur in the posterior

circulation, known as vertebrobasilar arterial system [3]. It is difficult to distinguish the symptoms of acute posterior circulation ischemic stroke (APCIS) in the acute stage, possibly because of the complexity of the vertebrobasilar artery and brainstem anatomy [3,4]. Achieving thrombolysis in such a disease is the first aim of the treatment.

Intravenous recombinant tissue-type plasminogen activator (rt-PA) could be the first choice for patients with posterior circulation stroke who meet the eligibility criteria that is mainly restricted to the 4.5 h of symptom onset time window [5,6]. Acute endovascular thrombolysis, a viable option, has been used in acute basilar occlusion to achieve reperfusion, thus reducing the mortality and the disability cost [3]. However, the effects of intra-arterial thrombolysis (IAT) is still in dispute. The hypothesis that the delayed initiation of treatment of IAT combined with the easily manipulated and rapidly accessed intravenous thrombolysis may lead to more effective recanalization compared to IVT or IAT alone has not been proved [6,7].

Multi-modal therapy (MMT), including intracranial angioplasty balloon, stent placement, mechanical thrombectomy and the combination treatment, has been applied in acute stroke patients and may be effective in saving ischemic penumbra [8,9]. There are limited available data on the effects of multi-modal therapy method used in posterior circulation patients. This study compared the use of pharmacologic therapy and MMT on APCIS and also tried to establish the prognosis factors for recanalization and favorable outcome of APCIS patients.

2. Patients and methods

2.1. Patients and treatment

The study was approved by the Ethical Committee of The Army General Hospital, and all patients signed an informed consent sheet. APCIS patients in the study were confirmed by magnetic resonance angiography (MRA) and/or digital subtraction angiography (DSA) between May 2012 and May 2016.

The pretreatment evaluation and preparation of the patients were similar to our previous study on anterior circulation stroke [10]. APCIS were considered as large vessel occlusion, including 1 or more segments of V4 segment vertebral artery, basilar artery or posterior cerebral artery within 24 h of stroke onset. The lowest National Institutes of Health Stroke Scale (NIHSS) was 4 and there is no limitation for patients' age.

The following information were collected: the medical histories, the time from symptom onset to emergency department (ED), admission NIHSS score, location of the thrombus, recombinant tissue plasminogen activator (rt-PA) administration, therapy methods.

Pharmacologic agents and/or devices using was based on institutional protocols. Patients came to the ED within 4.5 h after symptom onset and were scheduled to begin treatment with intravenous (IV) alteplase thrombolysis. For patients who did not show improvement (NIHSS score decrease < 4 points) within 1 h after IV rt-PA and had no evidence of hemorrhage, or those patients who came to the ED between 4.5 and 6 h after the onset of symptoms intra-arterial thrombolysis (IAT) was conducted after angiography by a skilled neurosurgeon. If none or partial recanalization (TICI grade 0/2a) is achieved, or the patients arrive at the ED beyond 6 h after the onset of the symptoms, MMT would be administered first. During this procedure, intra-arterial medicaments, balloon angioplasty (Aviator, Gateway balloon), implantation of stents (Wingspan, Enterprise) or mechanical clot disruption using a clot retrieval device (Solitaire FR, Penumbra system) would be performed alone or in combination by the neurosurgeon. If a

stent was deployed, patients were placed on dual antiplatelet agents with clopidogrel and aspirin within 24 h of placement. The MMT method involves treating patients with a combination of thrombolysis agents and mechanical devices.

2.2. Outcomes and follow-up

Recanalization in post-treatment angiograms was recorded by the interventional neuroradiologists as a Thrombolysis in Cerebral Infarction (TICI) score of 2b/3 [11]. Symptomatic ICH (sICH) was defined according to ECASS II criteria [12]. The clinical outcome was measured with the modified Rankin scale (mRS) score 3 months after the stroke, which was obtained through a phone call interview by a clinician that was blinded to the patient conditions. A good outcome was defined as mRS 0–2 while an unfavorable outcome was defined as mRS 3–6.

2.3. Statistical analysis

Statistical analysis for the variable analyzed in the study was performed by using the IBM SPSS Statistics 20 software. The 2-tailed t-test was employed for comparison of continuous variables. Categorical variables were compared with chi-square or Fisher exact test, as required. Logistic regression models were constructed from variables with bold values, as shown in Table 2, to determine the independent predictors of successful recanalization and favorable outcome.

3. Results

3.1. Patients and procedure characteristics

This study enrolled 124 patients treated in our institution. Eight patients were excluded during the hospital stay and in the follow-up stage due to data missing.

The mean age of the cohort was 59.6 ± 9.5 years, with a mean admission NIHSS score of 15.1 ± 6.6. The sites of arterial occlusion were in vertebral artery in 45 (36.3%) patients, basilar artery in 78 (62.9%) patients, and posterior cerebral artery in 37 (29.8%) patients. Therapeutic methods including pharmaceuticals only and multi-modal therapy (MMT) were employed in 61 (49.2%) and 63 (50.8%) patients respectively. Recanalization (TICI 2b/3) was achieved in 87 (70.2%) patients, while the 3-month post-stroke favorable outcome (mRS 0–2) was found in 65 (52.4%) patients. Symptomatic intracerebral hemorrhage (sICH) occurred in 18 (14.5%) patients, while mortality occurred in 31 (25.0%) patients.

The results of a univariate analysis comparing patients treated with pharmaceuticals only and MMT are shown in Table 1. It seems that MMT more often used in younger patients with a longer time to emergency department, and there seems baseline National Institutes of Health Stroke Scale (NIHSS) score between the two groups seems no difference. Occlusion in the basilar artery showed more use of the MMT method. The therapeutic results showed there was no significant difference in sICH and 3-month mortality between these methods. However, patients who were treated with MMT had a relatively higher patent flow rate compared with those received pharmacologic only.

3.2. Predictors for recanalization and outcomes

Patients with excellent target vessel recanalization (TICI 2b/3) were compared with those who failed after treatment, and the univariate analysis results are summarized in Table 2. Younger patients with lower admission NIHSS score who were treated with MMT, especially the use of stent placement and thrombectomy