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ORIGINAL ARTICLE

Outcome after mechanical thrombectomy using a stent retriever under conscious sedation: Comparison between tandem and single occlusion of the anterior circulation



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KEYWORDS

Stroke;
Tandem;
Thrombectomy;
Endovascular
procedures;
Mechanical
thrombolysis;
Conscious sedation

Summary

Background and purpose: In acute ischemic stroke patients, internal carotid artery/middle cerebral artery (ICA/MCA) occlusion in tandem predicts a poor outcome after systemic thrombolysis. This study aimed to compare outcomes after mechanical thrombectomy for tandem and single occlusions of the anterior circulation.

Materials and methods: This prospective study included consecutive patients with acute ischemic stroke of the anterior circulation who had undergone mechanical thrombectomy performed with a stent retriever under conscious sedation within 6 h of symptom onset. Data on clinical, imaging and endovascular findings were collected. In cases of tandem occlusion, distal thrombectomy (retrograde approach) was performed first whenever possible. Tandem and single occlusions were compared in terms of functional outcome and mortality at 3 months.

Results: From May 2010 to April 2012, 42 patients with acute ischemic stroke attributable to MCA and/or ICA occlusion were treated. Eleven patients (26.2%) presented with tandem occlusions and 31 patients (73.8%) had a single anterior circulation occlusion. Baseline characteristics were similar between the two groups. Recanalization status also did not differ significantly ($P=0.76$), but patients with tandem occlusions had poorer functional outcomes (18.2% vs. 67.7% for single occlusions; $P=0.01$), a higher mortality rate at 3 months (45.5% vs. 12.9%, respectively; $P=0.03$) and more symptomatic intracranial hemorrhages at 24 h (9.7% vs. 0%, respectively; $P=0.01$). A high rate of early proximal re-occlusion or severe residual stenosis (66%) was also observed in the tandem group.

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Conclusion: Tandem occlusions had poor clinical outcomes after mechanical thrombectomy compared with single occlusions. The retrograde approach (treatment of distal occlusion first) used in patients under conscious sedation may have contributed to these poor outcomes.

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Introduction

The therapeutic reference for acute ischemic stroke is intravenous thrombolysis with recombinant tissue plasminogen activator (rt-PA) within 4.5 h of stroke onset [1,2]. Patients with cervical internal carotid artery (ICA)/middle cerebral artery (MCA) occlusions in tandem are a unique population with a poor natural history and low response to intravenous (IV) fibrinolysis compared with isolated MCA occlusions [3,4]. As early recanalization is highly correlated with patient prognosis, new techniques such as intra-arterial thrombolysis and mechanical thrombectomy have been developed to improve the recanalization rate as well as the clinical outcome of these patients [5,6]. Mechanical thrombectomy with retrievable stents has demonstrated increased recanalization rates (ranging from 77.8% to 90%) and improved clinical outcomes at 3 months (all occlusion locations taken together) [7,8]. Recent reports have described treating tandem occlusions with thrombectomy techniques called either "antegrade" (treating the proximal occlusion first) or "retrograde" (treating the distal occlusion first), performed under general anesthesia, with similar improvements in terms of outcome [9–12]. The present study reports the results of tandem occlusions treated by a retrograde approach performed under conscious sedation, a modality not previously described in the literature. Endpoint measures were compared with those of single anterior circulation occlusions treated under the same conditions.

Materials and methods

After receiving Institutional Review Board (IRB) approval, this prospective study was conducted from May 2010 to April 2012 at our academic center. Prospectively included were consecutive patients who underwent mechanical thrombectomy using the Solitaire™ FR device (eV3/Covidien, Plymouth, MN, USA) for acute ischemic stroke of the anterior circulation. The requirement for consent from the individual patients or their relatives was waived. According to our institutional stroke protocol [8], those eligible for mechanical thrombectomy (in association with IV administration of rt-PA if within 4.5 h of stroke onset) were patients with acute stroke and relevant neurological symptoms (as defined by a National Institutes of Health Stroke Scale [NIHSS] score ≥ 8), presenting within 6 h of symptom onset with occlusion of a large intracranial vessel of the anterior circulation (ICA and/or MCA), as depicted on magnetic resonance imaging (MRI) and confirmed by angiography, without spontaneous intracranial hemorrhage. Tandem occlusion was defined as blockages in both the ICA and MCA separated by a normal segment in between. Data from 32 of our included patients

have already been published as part of our initial study on the safety and efficacy of mechanical thrombectomy under conscious sedation [8].

Neurological evaluation and care

Upon admission, every patient suspected of having acute ischemic stroke was examined by an experienced stroke unit neurologist. After an acute MRI was performed (see below), blood pressure and pulse and respiration rates were monitored continuously and watched over by the stroke unit neurologists. The NIHSS score was calculated to determine clinical severity. The stroke unit neurologist administered IV rt-PA (Actilyse [alteplase], Boehringer Ingelheim France, Paris, France) at an effective dose of 0.9 mg/kg if within 4.5 h of stroke onset and if no contraindications were present. Patients were transferred immediately to the angiography suite if they did not receive IV thrombolysis or if, after 30–60 min of receiving it, there were no signs of clinical improvement (NIHSS score ≤ 8 or a decrease > 10).

As our institution has no dedicated anesthetic team for the procedure, conscious sedation was provided by the stroke neurologist. All patients received 1 mg of midazolam (IV) before arterial puncture. In cases of agitation or pain, an IV bolus of 1 mg midazolam was administered and repeated if necessary. Blood pressure was lowered with nicardipine if systolic blood pressure was greater or equal to 180 mmHg or diastolic blood pressure was greater or equal to 110 mmHg. After the endovascular treatment, the patient was transferred to the stroke intensive care unit.

Imaging protocol

All patients underwent acute 3-Tesla MRI (Achieva, Philips Healthcare, Best, The Netherlands) to confirm the diagnosis of stroke, locate the occluded vessel and search for exclusion criteria. To evaluate the extent of the ischemic lesion as seen on diffusion-weighted imaging (DWI), the Alberta Stroke Program Early CT Score (ASPECTS) was used [13]. However, ASPECTS was not used to select candidates for mechanical thrombectomy. A time-of-flight (TOF) sequence focused on the circle of Willis was used to locate the site of intracranial vessel occlusion. A T2 gradient echo sequence was performed to screen for intracranial hemorrhage, and fluid-attenuated inversion recovery (FLAIR) imaging completed the protocol. No perfusion-weighted imaging was performed.

Patients with tandem occlusions underwent cervical contrast-enhanced (CE) magnetic resonance angiography (MRA) to confirm the presence and severity of carotid artery disease before angiography. A computed tomography (CT) scan was taken after 24 h, or earlier if rapid neurological

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