A Retrospective Study of Clinical Outcomes After Endovascular Treatment in Acute Ischemic Stroke Patients with Complete Anterior Circulation Infarction in the Absence of Multimodal Computed Tomography

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OBJECTIVE: **To analyze the positive predictive value of large artery occlusion and clinical prognosis in acute ischemic stroke patients with total anterior circulation infarct (TACI) who underwent endovascular treatment in the absence of multimodal CT angiography or CT perfusion.**

METHODS: **The inclusion criteria for the acute ischemic stroke patients to receive endovascular treatment were as the follows: the Oxfordshire Community Stroke Project classification was TACI, Alberta Stroke Program Early Computed Tomography Score (ASPECTS) ≥ 6, National Institutes of Health stroke scale (NIHSS) score ≥8, and less than 4.5 hours since stroke onset. The endovascular treatment was performed on patients who met the inclusion criteria. The endovascular treatment included intra-arterial thrombolysis, mechanical treatments, or both. A retrospective analysis was performed on all eligible acute ischemic stroke patients who underwent endovascular treatment from January 1, 2015 to December 31, 2015.**

RESULTS: **A total of 17 patients met the inclusion criteria and underwent endovascular treatment. The median age was 76 years (range, 59—88 years). 12 patients (70.6%) were diagnosed with atrial fibrillation. 16 patients were diagnosed with large artery occlusion by digital subtraction angiography, and the positive predictive value was 94.1%. 16 patients (94.1%) had recanalization (TICI Grade 3); 12 patients (70.6%) had a modified Rankin Scale score of 0—2, and 1 patient (5.9%) died 90 days after treatment.**

CONCLUSIONS: **In the absence of multimodal CT, endovascular treatment might be beneficial to patients with TACI acute ischemic stroke within 4.5 hours of stroke onset, who had NIHSS score of 8 or greater and ASPECTS of 6 or greater. These inclusion criteria have a high positive predictive value for anterior circulation large artery occlusion.**

INTRODUCTION

Endovascular treatments, such as intra-arterial fibrinolysis, were used in patients with acute cerebral infarction since 1999.[1] In 2015, the results from multiple clinical trials worldwide, including the Multicenter Randomized Clinical Trial of Endovascular Treatment for Acute Ischemic Stroke in the Netherlands (MR CLEAN),[2] the Endovascular Treatment for Small Core and Anterior Circulation Proximal Occlusion with Emphasis on Minimizing CT to Recanalization Times (ESCAPE) trial,[3] and the Extending the Time for Thrombolysis in Emergency Neurological Deficits—Intra-arterial (EXTEND-IA)

Key words
- Acute ischemic stroke
- Endovascular treatment
- Multimodal CT
- TACI

Abbreviations and Acronyms
ASPECTS: Alberta Stroke Program Early Computed Tomography Score
CT: Computed tomography
DSA: Digital subtraction angiography
ESCAPE: Endovascular Treatment for Small Core and Anterior Circulation Proximal Occlusion with Emphasis on Minimizing CT to Recanalization Times
EXTEND-IA: Extending the Time for Thrombolysis in Emergency Neurological Deficits—Intra-arterial
MR CLEAN: Multicenter Randomized Clinical Trial of Endovascular Treatment for Acute Ischemic Stroke in the Netherlands
mRS: modified Rankin scale
NIHSS: National Institutes of Health Stroke Scale
OCSP: Oxfordshire Community Stroke Project
rt-PA: Recombinant tissue-type plasminogen activator
TACI: Total anterior circulation infarct
TICI: Thrombolysis in cerebral ischemia
TOR: Time from stroke onset to reperfusion

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trial,[4] indicate that endovascular treatment is safe and effective in patients with acute anterior circulation occlusion stroke. Anterior circulation stroke refers to the distal carotid artery occlusion, middle cerebral artery M1, M2 occlusion or anterior cerebral artery A1, and A2 occlusion.[2]

The ESCAPE trial, EXTEND-IA trial, and MR CLEAN were conducted under the guidance of multimode computed tomography (CT). However, emergency multimode CT (e.g., CT angiography, CT perfusion) might not be available in hospitals in most of the developing countries. It is critical to select appropriate patients for endovascular treatment in hospitals that lack multimode CT. To date, there is no study of the outcomes of endovascular treatment in acute ischemic stroke in the absence of multimodal CT. According to the Oxfordshire Community Stroke Project (OCSP), total anterior circulation infarct (TACI) represents complete middle cerebral artery occlusion syndromes, including 1) neurologic disorders (e.g., disturbance of consciousness, aphasia, dyscalculia, dysfunction of spatial orientation); 2) ipsilateral hemianopia; and 3) contralateral face, upper, and lower limb motor or sensory disturbances. These syndromes indicate the existence of the middle cerebral artery or internal carotid artery occlusion in the absence of imaging information.[5] In this study, we performed a retrospective analysis on the outcomes of endovascular treatment in patients with acute ischemic stroke in the absence of multimode CT.

MATERIALS AND METHODS

Patients

From January 1, 2015, to December 31, 2015, all patients with ischemic stroke within 4.5 hours of onset were evaluated by neurologists who used OCSP classification, Alberta Stroke Program Early Computed Tomography Score (ASPECTS), and National Institutes of Health Stroke Scale (NIHSS) score. Endovascular therapy was performed on all patients who met the inclusion criteria. Inclusion criteria were defined as the follows: 1) OCSP classification was TACI; 2) ASPECTS $\geq$ 6 points[6]; 3) NIHSS score $\geq$ 8 points[6]; 4) less than 4.5 hours elapsed since stroke onset; 5) signed informed consent. The study was approved by the Taizhou First People's Hospital Ethics Committee.

Stroke Treatment

Each patient was admitted to the hospital and evaluated by an emergency department neurologist. Neurologic examinations, NIHSS scores, and OCSP classification were evaluated for patients with suspected acute ischemic stroke. The signs symptoms of acute ischemic stroke included acute onset, hemiplegia or numbness of one limb (with or without the face); numbness on one side of the face or deviation of mouth, difficulty speaking or understanding language, binocular lateral gaze, loss or blurring of vision in one or both eyes, vertigo or vomiting, severe headache or vomiting, disturbance of consciousness, convulsions, persistent signs and symptoms, and exclusion of nonvascular causes.[7,8] Patients underwent emergency head CT examination, and acute ischemic stroke was diagnosed in the absence of bleeding and on the basis of head CT images.[7,8] The emergency department neurologist then decided whether the patients would receive intravenous recombinant tissue-type plasminogen activator (rt-PA) treatment (0.9 mg/kg; 10% of the total dose was the initial given dose, and the remaining 90% was administered within 60 minutes[8,9]). The head CT imaging of the patients with acute ischemic stroke were reviewed by two associate chief radiologists for evaluation of ASPECTS. The patients who met the inclusion criteria, including OCSP classification of TACI, ASPECTS $\geq$ 6, NIHSS score $\geq$8 and onset within 4.5 hours, underwent interviews by emergency department neurologists and signed informed consent. Patients who agreed to undergo endovascular treatment received endovascular therapy administrated by neurointerventional surgeons. Meanwhile, the emergency neurologists recorded the time of onset, the time of admission, the time to complete head CT, and the start time of intravenous rt-PA.

Endovascular therapy was consisted of mechanical treatments or arterial thrombolysis by administering a thrombolytic agent, rt-PA (Boehringer Ingelheim Pharma, Biberach, Germany; batch no. 602796) via a microcatheter at the site of arterial occlusion, or both. The final endovascular therapy plan was decided by the surgeons. Mechanical treatments included thrombectomy, balloon dilatation, and thrombectomy using SolitaireAB (Micro Therapeutics, Irvine, California, USA; production batch number: A247617.) The specific intraoperative method of operation was decided by the surgeons.[2] The neurointerventional surgeons recorded the time of interventional operation, the time of successful femoral artery puncture, and the time of recanalization. Arterial thrombolysis was performed using microvascular administration of rt-PA drugs. (For patients who did not receive intravenous rt-PA treatment, the total intra-arterial rt-PA volume was no more than 90 mg; for patients who received intravenous rt-PA treatment, the total intra-arterial rt-PA volume was no more than 30 mg). The thrombolysis in cerebral ischemia (TICI) scale grade was 2b/3.[10]

Postoperative Care

All patients who underwent surgery were admitted to a neurologic intensive care unit or a stroke unit for further treatment. Head CT was performed within 24 hours after intravenous rt-PA treatment. For patients who did not receive intravenous rt-PA treatment, head CT examination was performed within 12 or 24 hours after the intervention. The head CT imaging was performed according to the changes in patients' condition. We gave aspirin tablets (200 mg/day) to patients if CT did not show intracranial bleeding, followed by 100 mg/day after 2 weeks. Clopidogrel tablets (Sanofi, Paris, France; production batch number 6A717) were used at an initial dose of 300 mg, followed by 75 mg/day, when patients could not tolerate aspirin.

Endpoints and Safety Measures

The primary endpoint included a modified Rankin Scale (mRS) scoring 90 days after treatment. mRS scores ranged from 0 (no symptoms) to 6 (death). A score of 0–2 indicated unrestricted daily activity and functional independence.[6,8] Secondary end points included NIHSS score at 24 hours after treatment and NIHSS score 5–7 days after treatment.[11] The increase of 4 points or more in NIHSS score was defined as neurologic deterioration. Additional neuroimaging was required if neurologic function worsened. Imaging evidence of intracranial hemorrhage was required for symptomatic intracranial hemorrhage.