DOI: 10.5137/1019-5149.JTN.5664-11.1
Received: 29.12.2011 / Accepted: 04.06.2012

Case Report

The Penumbra System for the Treatment of Acute Ischemic Stroke: Report of Two Cases

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ABSTRACT

Mortality associated with the occlusion of large vessels in acute ischemic stroke is particularly high despite best available medical therapy. Early and safe revascularization of the primary occlusion is correlated with good clinical result. We report two patients with acute ischemic stroke in whom the mechanical device Penumbra System was used for thrombolysis and embolectomy. The Penumbra System provided the revascularization of the primary occlusion site in the two patients and complete revascularization was obtained. Improvement was observed in both cases on the National Institutes of Health Stroke Scale and on modified Rankin scale scores at 1 and 30 days post-procedure. Neither of the patients had intracranial hemorrhage. The Penumbra System is a valuable device as a treatment for acute ischemic stroke secondary to large vessel occlusion.

KEYWORDS: Acute ischemic stroke, Occlusions of large vessels, Penumbra system, Revascularization

INTRODUCTION

Mortality associated with occlusions of large vessels in acute ischemic stroke is high despite the improvements in medical treatment (2,3,6). Substantial evidence has shown that early and safe revascularization of the primary occlusion is correlated with a satisfactory clinical outcome (1,5). The Penumbra System (PS; Penumbra, Alameda, California, USA) is a new embolectomy device which is designed to remove the thrombus in acute ischemic stroke secondary to large vessel obstruction (Figure 1) (1). We report two patients with acute ischemic stroke in whom the mechanical device Penumbra System was used for thrombolysis.

CASE REPORTS

Two patients were admitted to the Thomas Jefferson University Hospital for Neuroscience.

Case 1: A seventy-year-old female patient had a history of atrial fibrillation, and presented with sudden onset of right hemiplegia and aphasia. Baseline National Institutes of Health Stroke Scale (NIHSS) score was 14. Head computed tomography (CT) scan was normal. Digital subtraction angiography (DSA) showed left middle cerebral artery (MCA) superior M2 segment occlusion with intact lenticulostriate arteries. Times from onset to arterial puncture were 4 hours 10 minutes. After using the Penumbra system, normal flow was restored. NIHSS was 0 one day after procedure. The thirty-day modified Rankin scale (mRS) score was 0 (Figure 2A, B).

Case 2: A 65-year-old male presented with right hemiplegia. The baseline NIHSS score was 20. No abnormality was found on CT scan. DSA demonstrated left MCA M1 segment occlusion. Arterial puncture was accessed in 5 hours when symptoms occurred. After using a mechanical device, complete revascularization was obtained. The NIHSS score was 5 one day post-procedure. The thirty day mRS score was 1 (Figure 3A, B).

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Figure 1: The Penumbra System (PS; Penumbra, Alameda, Calif).

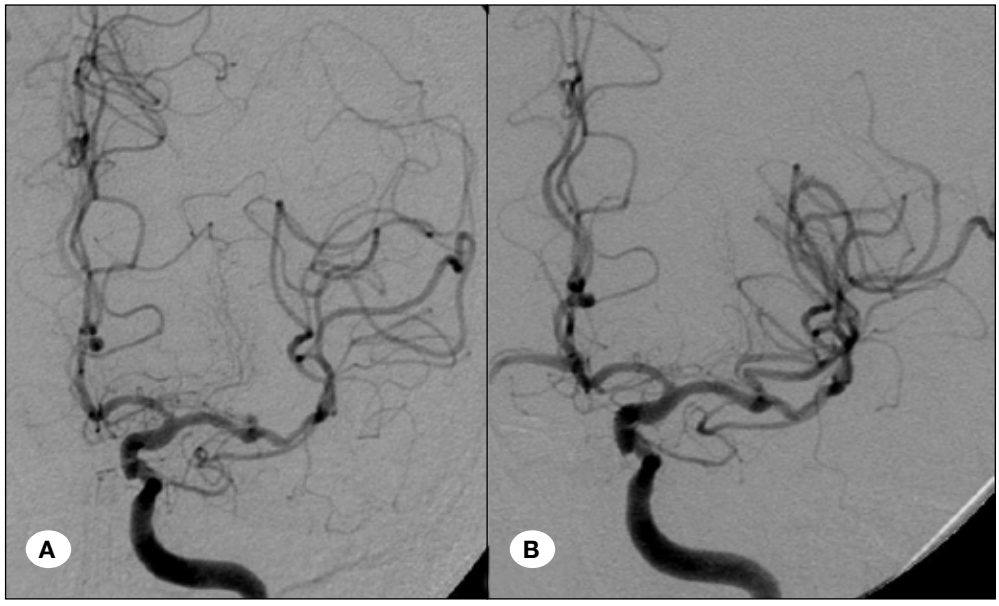

Figure 2: A) Before Penumbra left MCA superior M2 segment occlusion, **B**) post Penumbra normal flow was restored.

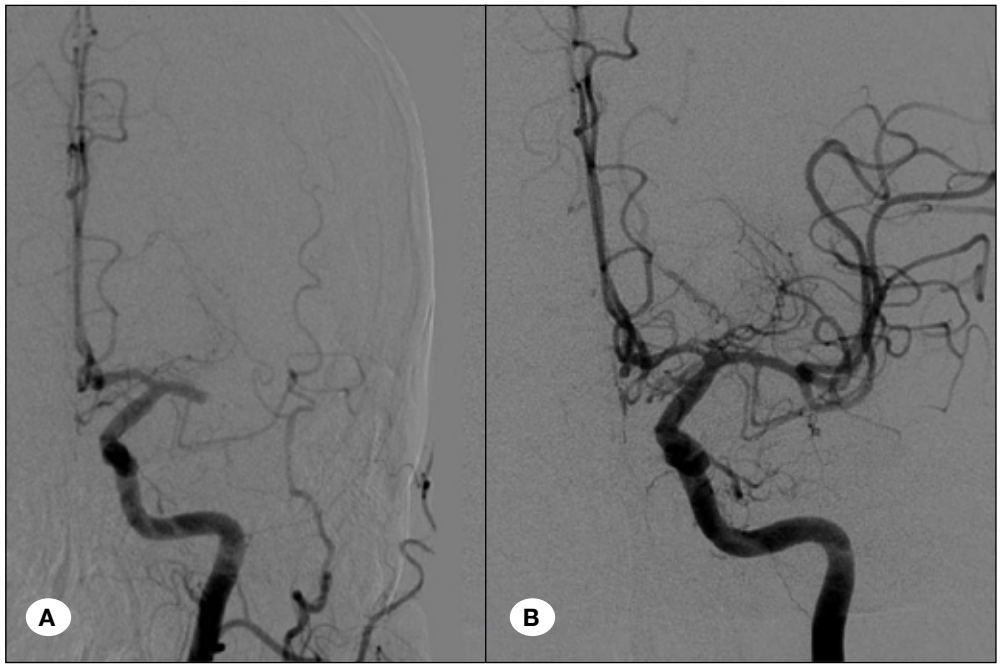

Figure 3: A) Before Penumbra left MCA M1 segment occlusion, **B**) post Penumbra successful revascularization.

Treatment Procedures: Four-vessel DSA was used to determine the occluded vascular segment. Then, a guide catheter was brought into position in the occluded vessel territory to enable access by the reperfusion catheter. All of the components of the PS were deliverable via a 6F guide catheter (1).

Once the appropriate position was achieved proximal to the clot, the guidewire was removed from the reperfusion catheter, and the separator was advanced through the reperfusion catheter. Then, the aspiration pump was turned on to initiate revascularization. Reduction of the clot burden by aspiration was accomplished by connecting the reperfusion catheter to the aspiration pump, which generated a vacuum of -20 inches Hg. Continuous aspiration and debulking process became easy by advancing and withdrawing the separator through the reperfusion catheter into the proximal end of the clot (1).

Administration of anticoagulation and antiplatelet was suspended for 24 hours post-treatment.

DISCUSSION

The National Institute of Neurological Disorders and Stroke study on the use of tissue plasminogen activator for acute ischemic stroke showed that the subjects experienced the greatest benefit from the treatment when the treatment with rtPA was initiated within 3 hours of stroke, (1,7). However, patients in the treatment group did experience a higher rate of symptomatic intracranial hemorrhage (ICH) (7).

Currently, studies have been shifted to mechanical rather than pharmaceutical means of recanalizing the site of primary occlusion in order to reduce adverse effects associated with the thrombolytic agents. Today, one mechanical device is available in the United States and Europe for revascularization of occlusions secondary to acute ischemic stroke (1,4,9,10). Reports showed a revascularization rate of 48% with procedure-related adverse event rate of 7.1% (10). In the MERCI trial, 11 subjects experienced symptomatic ICH, and 27.7% of them had asymptomatic ICH. At 90 days after stroke, 43.5% of the subjects died, and 27.7% of the subjects had a good outcome (1,9,10). In another trial, the rate of revascularization was increased to 69.0%, and mortality was reduced to 30.6% at 3 months (1,9). However, this was associated with an increase in symptomatic ICH to 9.0% and an increase in the asymptomatic ICH rate to 29.7% (1,9). By comparison, in our report, the PS was able to revascularize the site of primary occlusion in two patients, and both patients showed improvement on the NIHSS and an mRS scores at 1 and 30 days post-procedure (1). None of the two patients had intracranial hemorrhage. No procedure-related complications were noted. The Penumbra Pivotal Stroke Trial (8) shows that the Penumbra System provides safe and effective revascularization in patients experiencing ischemic stroke secondary to large vessel occlusive disease who present within 8 hours from symptom onset (8,11).

In conclusion, the Penumbra system is a useful device for the treatment of acute ischemic stroke secondary to large-vessel occlusion, and further mass sample and randomized clinical trial is warranted.

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