



Experience with A Direct Aspiration First Pass Technique (ADAPT) for Thrombectomy in Distal Cerebral Artery Occlusions Causing Acute Ischemic Stroke

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■ **BACKGROUND:** Thromboembolic occlusion of distal branches in anterior and posterior circulation may produce severe clinical deficits. A Direct Aspiration at first Pass Technique (ADAPT) is a simple, fast method for achieving good angiographic and clinical outcomes using large-bore catheters in large vessel occlusions. We present our results using ADAPT with distal cerebral artery occlusions.

■ **METHODS:** ADAPT was used to treat 35 patients (14 women, 21 men; average age 65.5 years \pm 12.6) with acute ischemic stroke with thrombus in the distal middle cerebral artery, anterior cerebral artery, or posterior cerebral artery. Patients presented with a mean National Institutes of Health Stroke Scale score of 14.1 ± 6.9 ; 15 patients received intravenous tissue plasminogen activator. Mean time from onset to puncture was 7.1 hours \pm 5.1. Of patients, 28 (80%) presented with isolated M2 segment occlusions, 1 (2.9%) presented with isolated A3 segment occlusion, and 6 (17.1%) presented with tandem occlusions.

■ **RESULTS:** Mean time to recanalization was 35.7 minutes \pm 26.4. A thrombolysis in cerebral infarction grade 2B or better was achieved in 34 patients (97.1%), with 15 achieving a thrombolysis in cerebral infarction 3. Aspiration alone was successful in 26 cases (77.1%), whereas 7 (20%) required additional techniques. A 90-day modified Rankin Scale score was available in 32 patients; 59.4% had a 90-day score of 0–2. No patients had a modified Rankin Scale score of 6.

■ **CONCLUSIONS:** Acute distal anterior circulation thromboembolic occlusions may be treated safely with intraarterial thrombectomy. Prior studies have demonstrated the success of ADAPT in proximal large vessel occlusions. This series suggests that ADAPT is an effective, safe method for performing thrombectomy in distal branches of anterior and posterior circulation.

INTRODUCTION

The treatment options for acute ischemic stroke have rapidly evolved, culminating with several recent clinical trials demonstrating improved outcomes in patients with ischemic stroke from a large vessel occlusion (LVO) who undergo thrombectomy.^{1–5} The development of new revascularization devices has led to faster and better recanalization rates and subsequent outcomes compared with older technologies.^{6–8} Thromboembolic occlusion of distal branches in anterior and posterior circulation may produce severe clinical deficits, despite a smaller core infarct volume. There is little evidence to guide therapies when patients present with these more distal occlusions, although the new American Heart Association guidelines state that treatment of symptomatic distal occlusions of the middle cerebral artery (MCA) or anterior cerebral artery (ACA) within 6 hours may be reasonable.⁹ A Direct Aspiration at first Pass Technique (ADAPT) has been shown to be a simple, fast method for achieving good angiographic and clinical outcomes

Key words

- Acute ischemic stroke
- Distal cerebral artery
- Occlusion
- Stroke
- Thrombectomy

Abbreviations and Acronyms

- ACA:** Anterior cerebral artery
- ADAPT:** A Direct Aspiration at first Pass Technique
- IV:** Intravenous
- LVO:** Large vessel occlusion
- MCA:** Middle cerebral artery
- MERCI:** Mechanical Embolus Removal in Cerebral Ischemia
- mRS:** Modified Rankin Scale
- NIHSS:** National Institutes of Health Stroke Scale

TICI: Thrombolysis in cerebral infarction

tPA: Tissue plasminogen activator

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using large bore aspiration catheters in LVOs.^{10,11} We present our results using ADAPT for distal cerebral artery occlusions.

MATERIALS AND METHODS

Database

A retrospective analysis of a prospectively maintained database was performed to identify patients undergoing thrombectomy for acute ischemic stroke with ADAPT. Institutional review board approval was obtained. Only patients with lesions in distal MCA, ACA, or posterior cerebral artery were included. Distal MCA, ACA, and posterior cerebral artery vessels were defined as M2, M3, A2, A3, and P2 segments. Patients were also included if they had tandem occlusions in both a proximal and a distal branch (e.g., an M1 and M3 occlusion).

Specific parameters captured included age, sex, National Institutes of Health Stroke Scale (NIHSS) score at presentation, time to presentation from last normal examination, and modified Rankin Scale (mRS) score at 90-day follow-up. The average hospital discharge NIHSS score was calculated excluding any patients who died during hospitalization. Radiologic and angiographic imaging was reviewed to document the location of the vascular occlusion. Independent review included determination of revascularization before and after the procedure using both the thrombolysis in cerebral infarction (TICI) flow postprocedure and the 2C TICI grading scale (including scores of 0, 1, 2a, 2b, and 3). Recanalization time was defined as time from groin access to achieving at least TICI 2B flow within the affected territory. Angiograms were reviewed by a blinded neurointerventionalist who independently graded the TICI score via the modified¹² and 2C scoring systems.¹³ Postprocedural head computed tomography and magnetic resonance imaging scans were reviewed for any concern for intracranial hemorrhage, even in the event of likely contrast extravasation. Concerning scans were scored for intracranial hemorrhage using the European Cooperative Acute Stroke Study 1 and 2 grading scales by an independent reviewer.¹⁴ mRS score data were obtained from the neurology clinic record.

Patient Selection

At our institution, mechanical thrombectomy is the preferred treatment modality for patients with acute ischemic stroke who do not qualify for intravenous (IV) tissue plasminogen activator (tPA), do not improve with IV tPA, or have severe strokes with LVO. Candidacy for intervention is determined by computed tomography perfusion imaging, regardless of time of onset.

Technique

ADAPT has been previously described.¹¹ Briefly, a large guide catheter (Neuron MAX 088 or Neuron 070; Penumbra, Inc., Alameda, California, USA) is navigated into the distal cervical vessel of interest for proximal support. The largest caliber aspiration catheter that the vessel will accommodate is selected for each case, and the catheter is advanced to the level of the thrombus over a 0.016-inch Fathom wire (Boston Scientific, Marlborough, Massachusetts, USA) (Figure 1). Aspiration is applied by either a 20- or 60-mL syringe or use of the Penumbra aspiration pump that is part of the Penumbra system. Inability to

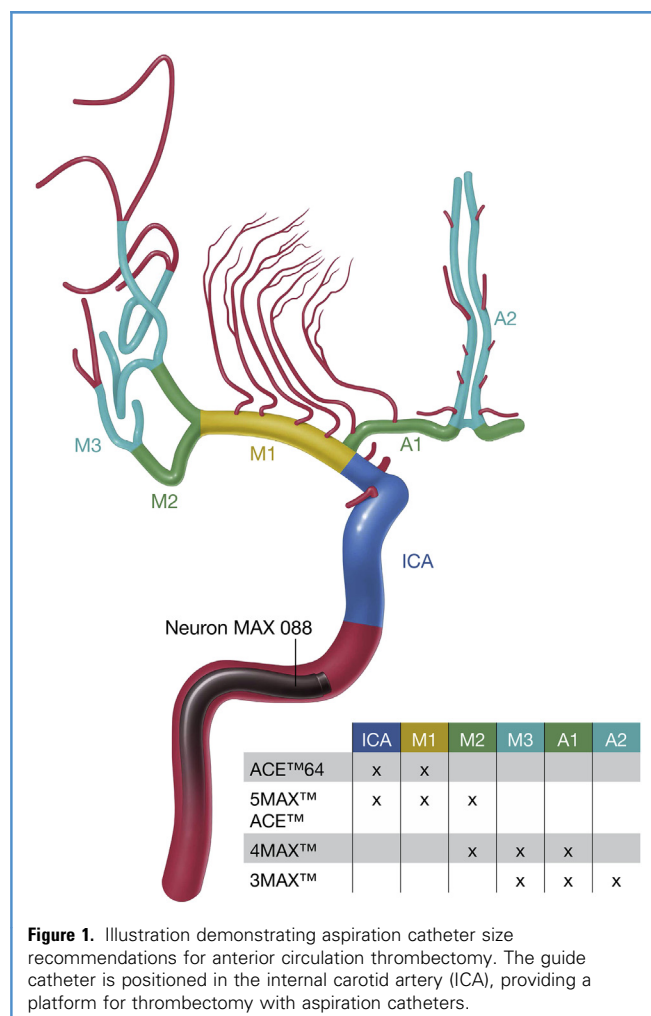


Figure 1. Illustration demonstrating aspiration catheter size recommendations for anterior circulation thrombectomy. The guide catheter is positioned in the internal carotid artery (ICA), providing a platform for thrombectomy with aspiration catheters.

draw back on aspiration confirms the optimal position of the catheter, abutting the thrombus. At this point, the catheter is advanced slightly to ensure firm engagement with the thrombus. The catheter is then slowly withdrawn while maintaining aspiration. Additional devices, such as stent retrievers, were used at the discretion of the operator if aspiration as the frontline strategy failed to achieve recanalization.

RESULTS

Patients

From December 2012 to April 2015, 35 consecutive patients who experienced an acute ischemic stroke with thrombus in the distal MCA, ACA, or posterior cerebral artery were treated with ADAPT. There were 14 women and 21 men with an average age of 65.5 years \pm 12.6 (range, 39–89 years). Patients presented with a mean NIHSS score of 14.1 \pm 6.9 (range, 4–28), and 15 patients received IV tPA. The mean time from onset to puncture was 7.1 hours \pm 5.1 (range, 72 minutes to 18.4 hours).

Of patients, 28 (80%) presented with isolated M2 segment occlusions (Figure 2), 1 (2.9%) presented with an isolated A3

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