



# Mechanical Thrombectomy in a 12-Month-Old Infant with Acute Ischemic Stroke Possibly due to Internal Carotid Artery Dissection: A Case Report

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Stroke in children is a rare but devastating disease. Although endovascular treatment has been reported to be safe and effective in the treatment of stroke with large vessel occlusion in this population, there are still limitations and controversies. In this case report, we describe a 12-month-old girl who was admitted to the hospital with acute onset of left-sided hemiplegia and confusion, which turned out to be due to a large infarct in the right middle cerebral artery territory, possibly caused by dissection of the right cervical internal carotid artery. Aspiration thrombectomy was successfully performed, and the patient was able to walk a few steps and raise her left upper extremity at the 12-month follow-up. The aspiration-only technique in thrombectomy may be safe and technically feasible to treat acute ischemic stroke with large vessel occlusion in children as young as 12 months, although large-volume prospective studies are needed.

**Key Words:** Stroke; Infant; Aspiration thrombectomy; Arterial dissection

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## INTRODUCTION

Childhood stroke, with an estimated incidence of 2 to 8 per 100,000 children per year, is a rare but devastating clinical event.<sup>1</sup> In terms of presentation, etiology, and response to therapeutic intervention, stroke in childhood differs from adulthood.<sup>2</sup> Nearly half of the childhood strokes are ischemic in nature and the common underlying mechanisms are arteriopathy, connective tissue disorders, infection, trauma, underlying

structural cardiac disease, and rarely atherosclerosis.<sup>3</sup> Approximately 10% of cases are idiopathic and the tendency for recurrence is relatively high in pediatric cases, reaching up to 35%.<sup>3-6</sup> Since 2015, endovascular therapy has become the standard of care for eligible large vessel occlusion strokes in adults and has revolutionized the outcome of acute ischemic stroke (AIS). However, there are limited data on mechanical endovascular therapy in pediatric stroke.<sup>7</sup> Despite these limitations, mechanical

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thrombectomy alone or in combination with intravenous tissue plasminogen activator is increasingly performed in the pediatric population.<sup>8</sup> The safety and feasibility of aspiration thrombectomy is challenged by the compatibility of the aspiration devices with smaller pediatric intracranial vessels, but the stent retrieval technique may still be used, especially in older children, given the higher rates of recanalization.<sup>9</sup>

In this case report, we describe an AIS in a 1-year-old child that was successfully treated by aspiration thrombectomy and report the patient's outcome after this procedure.

## CASE REPORT

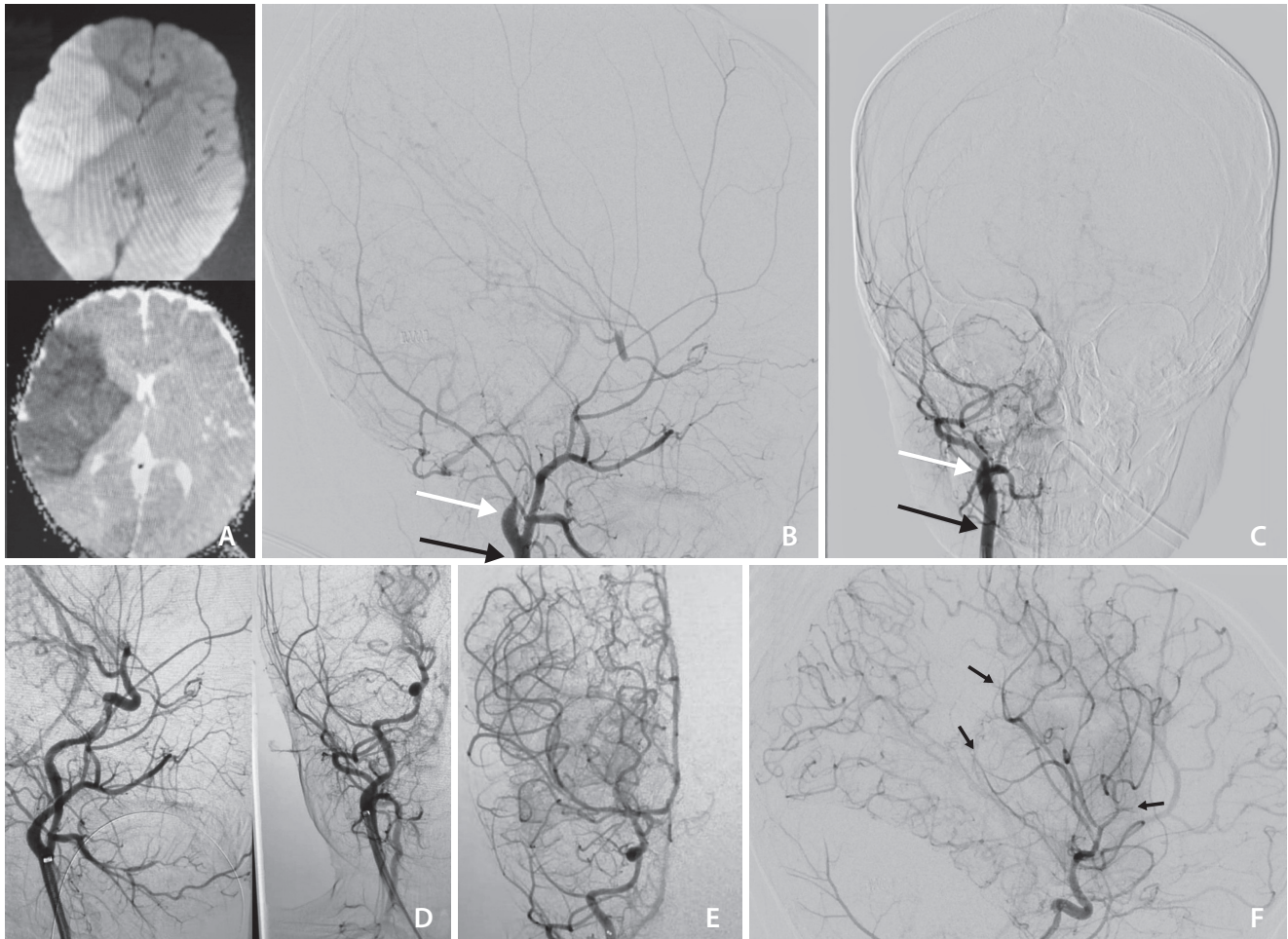
A 12-month-old girl presented to the emergency department with acute right-sided hemiplegia and confusion for 6 hours, 2 days after a fall from stairs. Magnetic resonance imaging (MRI) of the brain was performed and showed an acute large ischemic infarction in the right middle cerebral artery (MCA) territory (Fig. 1A). Magnetic resonance angiography (MRA) of the head and neck showed occlusion of the right internal carotid artery (ICA) just above the carotid bulb. She was transferred to our institution approximately 12 hours after the onset of symptoms. After discussion among the multidisciplinary team and with the parents regarding the intended benefits and potential risks of the procedure, the decision was made to proceed with the procedure. In the neuroendovascular suite, she was intubated and under general anesthesia, right femoral artery access was accessed with a 5F radial sheath 13.5 hours after the onset of symptoms. Cerebral angiography of the right common carotid artery (CCA) showed occlusion of the right ICA just above the carotid bulb, possibly due to dissection (Fig. 1B). Next, the 5F short sheath was exchanged for a 6F Cook Shuttle 80 cm (Cook Inc.), which was parked in the right CCA. Using an Echelon 14 microcatheter (Medtronic) over a 0.014 Traxcess microwire (MicroVention), the dissected portion of the right ICA was easily crossed and the 5F Sofia catheter (MicroVention) was advanced over the Echelon 14 into the petrous segment of ICA through the true lumen and clot aspiration was done. Control angiography showed terminal ICA occlusion (Fig. 1C). The second round of aspiration thrombectomy was performed in the same fashion, resulting in proximal M1 segment occlusion on control angiography. The third pass of thrombectomy with Sofia 5F catheter resulted in distal posterior M2 segment occlusion. At this

time, 0.6 mg of Integrilin (Millennium Pharmaceuticals, Inc.) was infused into the posterior branch of the right MCA over 2 minutes. Final angiography showed Thrombolysis in Cerebral Infarction (TICI) 2b with occlusion of distal M3 branches of the MCA vascular tree (Fig. 1D–F). She was transferred to the intensive care unit and remained intubated under sedation for the next 24 hours. The next day, a follow-up brain MRI/MRA showed patent right ICA and MCA branches without infarct progression or hemorrhage. She was extubated on the 2nd postoperative day and discharged to a rehabilitation facility on 40 mg of aspirin daily. At discharge, there was some improvement in left lower extremity strength (2/5) but the right arm remained paralyzed. At the 12-month follow-up, there was a great improvement in the left lower extremity muscle strength, and she could walk 3–4 steps without assistance and the left upper extremity had muscle strength of 3/5.

## DISCUSSION

To the best of our knowledge, this case is the youngest report in the literature of a child who successfully underwent aspiration thrombectomy for ischemic stroke possibly due to ICA dissection. ICA dissection is a common cause of AIS in the pediatric age group, considering that it is the etiology of 7.5–20% of ischemic stroke cases in children.<sup>10</sup> Except for history of head trauma, pain, and paralysis of cranial nerves, other signs, and symptoms would not be helpful to differentiate stroke due to ICA dissection from other causes.<sup>11,12</sup> Angiography is still the gold standard modality for the diagnosis of craniocervical arterial dissection, although it has its challenges in children.<sup>12</sup>

Considering its low incidence, there is a lack of high-quality evidence to choose the appropriate treatment strategy for AIS in children. Endovascular treatment is the standard of care for the eligible adults with large vessel occlusion AIS but its role in the pediatric population is uncertain due to a lack of randomized clinical trials.<sup>7,13</sup> A review of the literature by Christi et al.<sup>14</sup> examined cases from 2016 to 2021, including 21 cases with a mean age of 12.8 years. The most common underlying mechanism of stroke was cardiac pathologies in 9 cases, followed by arterial dissection in 2 cases. This study found that the mean of the pediatric National Institute of Health Stroke Scale (NIHSS) was reduced by  $8.07 \pm 5.47$  after mechanical thrombectomy. In terms of recanalization, the



**Fig. 1.** (A) Magnetic resonance imaging of the brain without contrast, diffusion-weighted imaging, and apparent diffusion coefficient (ADC) map, showing diffusion restriction with ADC map correlation in the right middle cerebral artery (MCA) territory suggestive of acute infarction. (B) Lateral view: Right internal carotid artery (ICA) flame-shaped tapering above the carotid bulb is suggestive of occlusive right ICA dissection. Right intracranial ICA partially supplied by retrograde flow of the ophthalmic artery. Arrows indicate right ICA (white long arrow) and right common carotid artery (CCA) (black long arrow). (C) Anterior view: right CCA angiogram showed right ICA dissection above the carotid bulb. Right intracranial ICA partially supplied by retrograde flow of the ophthalmic artery. Arrows indicate right ICA (white long arrow) and right CCA (black long arrow). (D) Lateral and anterior-posterior (AP) view of the right CCA angiogram after 1st pass of thrombectomy, showing right terminal ICA occlusion. (E) Final AP view angiogram of the right ICA showing complete recanalization of the right MCA vascular tree except for distal M3 branches occlusion (Thrombolysis in Cerebral Infarction [TICI] 2b). (F) Final lateral view of the right ICA angiogram showed occlusion of distal M3 branches of the right MCA (TICI 2b) (short arrows). Short arrows indicate occlusion in right MCA distal branches.

final modified TICI score was reported as 3 in 6 cases, 2c in one case, and 2b in 9 cases. A retrospective analysis of all children presenting with AIS at 3 German tertiary care stroke centers was performed in 12 children.<sup>15</sup> The results showed good angiographic outcomes in all patients with mechanical thrombectomy (stent retrieval) with an improvement in neurological outcome with a median pediatric NIHSS of 3.5 at day 7 and a modified Rankin scale of 1 at 3 months.

Mechanical thrombectomy can be performed using retriever pulls, aspiration alone, or a combination of both techniques. However, due to the small intracranial vessels in

children younger than 5 years of the age, the feasibility and efficacy of the aspiration-alone technique has been debated and controversial.<sup>16,17</sup> The majority of reported thrombectomy procedures in the pediatric population have been performed with stent retrievers due to the smaller crossing profile of the device. Fewer cases have been reported using the aspiration-only technique.<sup>18,19</sup> Mechanical thrombectomy was performed in our case despite the presence of a large infarct core in the right MCA territory on the initial brain MRI. Recent high-quality data support the use of endovascular mechanical thrombectomy in large vessel occlusion strokes

with large infarct core.<sup>20,21</sup> Although such data are not available in the pediatric population due to the low incidence of stroke, we occasionally apply adult data to children in our practice. For effective aspiration thrombectomy, we need a large-bore catheter to reach the distal cranial vasculature and there is a risk of severe vasospasm or perforation. In this case, we were able to pass the 5F Sofia catheter to the distal MCA segment uneventfully with the assistance of a long sheath. We chose a 6F Cook Shuttle long sheath for support, as its outer diameter was smaller than the other available long sheath in our catheterization lab.

In conclusion, the aspiration-only method may be safe and technically feasible to treat AIS with large vessel occlusion in children as young as 12 months, although further prospective studies are needed.

### Fund

None.

### Ethics Statement

This study was a case report that anonymously reported and there was no identifiable information about the patient so it does not need it. Informed consent was obtained from the family of the patient for the publication of this case report.

### Conflicts of Interest

Ashkan Mowla is speaker bureau and consultant to Cerenovus, Stryker, Wallaby Medical, RapidAI, BALT USA, LLC.

### Author Contributions

Concept and design: LAH, SA, MHM, AM, and HB. Analysis and interpretation: SA and AM. Writing the article: LAH, SA, MHM, SH, AM, and HB. Critical revision of the article: LAH, SA, MHM, SH, AM, and HB. Final approval of the article: LAH, SA, MHM, SH, AM, and HB. Statistical analysis: SH. Overall responsibility: LAH, SA, MHM, SH, AM, and HB.

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