CASE REPORT

Acute ischemic stroke in a child due to basilar artery occlusion treated successfully with a stent retriever

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Accepted 8 June 2015

SUMMARY

Ischemic strokes in childhood are rare. Thrombolytic therapy with intravenous (IV) tissue plasminogen activator (tPA) has been the main intervention for the management of pediatric stroke patients, but safety data are lacking and efficacy has been questioned. Recently, successful endovascular treatments for acute ischemic stroke in children have been reported with increasing frequency, suggesting that mechanical thrombectomy can

be a safe and effective treatment. We present the case of a 22-month-old child with acute ischemic stroke due to basilar artery occlusion that was successfully treated with a stent retriever.

BACKGROUND

Ischemic stroke in the pediatric population is rare, with incidence ranging from 2.3 to 13 per 100 000

Figure 1 Diffusion-weighted MRIs demonstrating restricted diffusion (arrows) within (A) the right thalamus and (B) the left pons. Magnetic resonance angiograms demonstrate lack of flow-related enhancement within the mid- and distal basilar arteries (C and D). There are patent bilateral posterior communicating arteries, the left greater than the right, with reconstitution of P2 segments of the bilateral posterior cerebral arteries (D, asterisk).

To cite: Savastano L, Gemmete JJ, Pandey AS, et al. *BMJ Case Rep* Published online: [please include Day Month Year] doi:10.1136/bcr-2015-011821

children.¹ Up to 70% of survivors will be disabled, causing significant loss of productive years of life and resulting in substantial healthcare costs.² Due to the low incidence of pediatric ischemic stroke, limited data are available, making the development of a standard treatment algorithm difficult. Historically, management of pediatric cases was patterned on adult cases, using intravenous (IV) tissue plasminogen activator (tPA).³ However, recent guidelines from the American Heart Association (AHA) do not recommend IV tPA in children outside of clinical trials.⁴ Recently, the Multicenter Randomized Clinical trial of Endovascular treatment for Acute ischemic stroke in the Netherlands (MR CLEAN) demonstrated that transarterial treatment improved outcomes in adult patients with severe stroke and proximal vessel occlusion within a 6 h window after ictus.⁵ Although these findings cannot be directly extrapolated to children, successful endovascular treatment for acute ischemic stroke has been reported with increasing frequency in this age group.⁶

CASE PRESENTATION

A 22-month-old female child presented with altered mental status and new-onset gait unsteadiness. She was in her usual state of health until the evening of presentation, whereupon she began crawling 'army style,' with poor arm strength, generalized

poor muscle tone, and disconjugate gaze. On physical examination, she was unable to stand and had profound ataxia.

Pertinent past medical history included tricuspid atresia, biotinidase deficiency, ventricular and atrial septal defects. Previous surgical history included pulmonary arterial banding at age 1 week and hemi-Fontan procedure at age 10 weeks. Medications included 40.5 mg aspirin (ASA) daily.

INVESTIGATIONS

Non-contrast brain CT showed a hyperdense basilar artery with no evidence of acute ischemia. Brain MRI demonstrated foci of restricted diffusion within the left paramedian pons, right midbrain, and right thalamus, consistent with acute infarcts (figure 1A, B). Magnetic resonance angiography (MRA) of the circle of Willis showed absent flow within the mid- and distal basilar arteries (figure 1C, D). Echocardiogram showed no evidence of intracardiac thrombus.

TREATMENT

Under general anesthesia, a retrograde puncture of the right common femoral artery was performed, with a 6F sheath placed approximately 16 h after ictus. A left vertebral arteriogram showed complete occlusion of the basilar artery at the anterior inferior cerebellar artery (TICI flow, 0) (figure 2A, B). A 6F Cello balloon guide catheter (ev3 Endovascular, Plymouth,

Figure 2 Neurointerventional procedure. Upper row, anterior-posterior projection; bottom row, lateral projection. Left column, baseline angiogram; middle column, angiogram post-mechanical thrombectomy with a stent retriever; right column, angiogram post-intraarterial infusion of 5 mg nicardipine.

Figure 3 Magnetic resonance angiogram obtained on postoperative day 1 demonstrates restoration of flow within the basilar artery with mild residual narrowing (A and B). MRI obtained 6 months post-mechanical thrombectomy demonstrates a widely open basilar artery (C and D).

Minnesota, USA) was then placed in the distal V2 segment. A Rebar microcatheter (ev3) was advanced into the left posterior cerebral artery. Then, a 4×20 mm Solitaire stent retriever (ev3) was deployed from the proximal left P1 segment to the distal left V4 segment. After 5 min, the stent retriever was removed under flow arrest and negative aspiration. Repeat left vertebral arteriogram demonstrated severe vasospasm in the basilar artery; however, there was antegrade flow within the basilar artery (TICI flow, 2a) (figure 2C, D). Chemical angioplasty was then performed with 5 mg total intraarterial nicardipine over 30 min. Repeat left vertebral angiogram showed significant improvement in vasospasm, with TICI 3 flow in basilar artery (figure 2E, F).

OUTCOME AND FOLLOW-UP

The evening after the procedure the patient moved all extremities to stimulation with anti-gravity strength. Pupils were equal and reactive with full extraocular movements and no nystagmus. Repeat MRI/MRA on postoperative day (POD) #1 demonstrated normal flow in the basilar artery with no new areas of restricted diffusion (figure 3A, B). ASA was restarted 24 h after the procedure. Warfarin was started on POD #5. Once INR was therapeutic, ASA was discontinued. The patient was discharged to home neurologically intact. At 6-month follow-up, she remained neurologically intact and met appropriate developmental milestones. MRA demonstrated a widely patent vertebro-basilar system (figure 3C, D).

DISCUSSION

Only 10–30% of pediatric acute ischemic strokes occur in the posterior circulation, and basilar artery stroke is exceedingly

uncommon with a reported incidence 0.037 per 100 000 children per year, or approximately 3.5% of pediatric ischemic strokes.⁷ In children, the most frequent presentation is impaired consciousness and hemi- or quadriplegia. However, symptoms can be subtle and the differential diagnosis challenging, causing significant delay in diagnosis.⁸ In the largest prospective population-based study published, the time to diagnosis of basilar artery stroke in children averaged 19 h versus <6 h in adults.⁹ Basilar stroke in the pediatric population has a mortality rate of approximately 8%, with severe lifetime neurological deficits in 50% of survivors.

Strategies for pediatric ischemic stroke management during the last few decades have been extrapolated from adult cases and focused on thrombolytic therapy with IV tPA. However, the majority of evidence supporting this practice comes from individual case reports and small patient series, and prospective registries and clinical trials have not confirmed the presumed benefit.³ Recently, the first prospective open-labeled treatment trial in acute pediatric stroke—the Thrombolysis in Pediatric Stroke (TIPS) trial—was designed to define pharmacokinetics and effectiveness to improve outcome with IV tPA in children, but was prematurely terminated due to low patient enrolment.¹⁰ To date, the AHA recommendation for IV tPA use in children only includes clinical trials; dosing and safety are still unclear and potential benefits remain unproven.

In our patient we were able to open an occluded basilar artery approximately 17 h from time of onset of symptoms. Neurologic recovery was remarkable given the late timeframe from symptom onset to revascularization. We chose a 4 mm diameter stent retriever, even though the basilar artery only measured 2.5 mm. This large diameter stent probably caused the significant

vasospasm noted after first capture. We used a 4 mm diameter stent retriever because this was the smallest size available when the case was performed almost 1½ years ago. We would use a 3 mm stent retriever if the case was performed today.¹¹ Vasospasm maybe more common in the pediatric population due to lack of customized thrombectomy devices; physicians performing stroke interventions in children need to be aware of this. Furthermore, we used a 6F guide catheter in the vertebral artery because we thought the catheter could be easily navigated into the left vertebral artery. The vertebral artery measured 3.2 mm, with the outer diameter of the guide catheter measuring 2.55 mm. The guide catheter was not occlusive to flow when we selected the left vertebral artery. We thought this catheter would provide excellent negative aspiration during flow arrest. Sub-analysis of the recent SWIFT trial showed improved outcome with employment of a balloon guide when using a stent retriever. In this case, a majority of the thrombus was identified within the balloon guide and not in the interstices of the stent.¹²

Learning points

- ▶ Mechanical thrombectomy can be a safe and effective adjunct intervention for acute ischemic stroke in children.
- ▶ Vasospasm after removal of a stent retriever may be more common in the pediatric population since the device is sized for adult patients.
- ▶ A 3 mm stent retriever may be required when performing acute stroke interventions in the pediatric population.

Contributors LS, JJG, ASP, CR, NC: acquired and analyzed the data, drafted and critically edited the article, and reviewed and approved the final version for submission; JJG, ASP, NC: supervised the study.

Competing interests None declared.

Patient consent Obtained.

Provenance and peer review Not commissioned; externally peer reviewed.

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