Successful Endovascular Therapy for Acute Basilar Thrombosis in an Adolescent

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ABSTRACT. Pediatric stroke is an underrecognized, potentially treatable cause of childhood neurologic disease. Acute basilar artery thrombosis is a devastating disease rarely encountered in children. Acute interventions with both chemical and mechanical thrombolysis techniques can improve outcomes in adults with arterial thrombosis of the posterior cerebral circulation. We report a case of intervention with both intra-arterial alteplase (tissue plasminogen activator) and cerebral balloon angioplasty to treat a prolonged basilar artery occlusion secondary to idiopathic thrombosis in an adolescent. Despite the patient being clinically locked-in and intervention being delayed at least 20 hours from symptom onset, he obtained complete neurologic recovery. Issues of pediatric stroke, late therapeutic intervention, chemical thrombolysis, and cerebral angioplasty are discussed. This case highlights the underrecognition and subsequent delay in diagnosis of pediatric stroke and how acute intervention may cure otherwise catastrophic strokes in children. *Pediatrics* 2003;112:e248–e251. URL: http://www.pediatrics.org/cgi/content/full/112/3/e248; *stroke, child, basilar artery, thrombosis, balloon angioplasty, alteplase.*

ABBREVIATIONS. CT, computed tomography (scan); MRI, magnetic resonance imaging.

Pediatric stroke is an underrecognized, potentially treatable cause of childhood neurologic disease. Acute ischemic stroke attributable to occlusion of the basilar artery carries an extremely poor prognosis[1–3] and is rarely encountered in children.[4,5] Although recanalization with thrombolytic agents has substantially improved outcomes in adults with brainstem stroke,[6–8] mortality and morbidity rates remain high. Experience with thrombolytic agents in pediatric stroke is limited but has potential utility similar to that observed in adults.[9–11] Mechanical recanalization therapies, such as balloon angioplasty, are relatively new but show significant promise in the treatment of acute stroke.[12,13] Chemical thrombolysis and mechanical recanalization have been used in combination, although their order of use has not been consistent.[5,13] The use of cerebral angioplasty is not widespread, particularly in children, and precise techniques remain to be defined.[5]

We report a case of childhood stroke attributable to acute basilar artery thrombosis treated with intra-arterial alteplase combined with balloon angioplasty.

CASE REPORT

A 15-year-old, right-handed male presented to a rural emergency department with a 24- to 36-hour history of diffuse headache and a 2-hour history of left arm weakness. Family history was negative. He was previously well with no history of trauma or neck manipulation. Physical examination revealed only mild weakness of the left arm. A computed tomography (CT) scan of the head was performed at the peripheral center and interpreted as normal. The tertiary care pediatric neurologist was consulted and transport to the pediatric tertiary care center (a distance of 300 km) was arranged.

Because of combined delays in initial diagnosis, referral, and transport, the patient was first seen at the tertiary center nearly 17 hours later. Examination demonstrated a decreased level of consciousness to a stuporous state, bilateral supranuclear bulbar palsy, dense left hemiplegia, and right hemiparesis. A clinical diagnosis of acute brainstem ischemia was suspected.

Magnetic resonance imaging (MRI) of the brain demonstrated bilateral pontomedullary ischemia. Magnetic resonance angiography and subsequent cerebral angiography demonstrated a large basilar artery thrombosis extending from the midbasilar artery to the level of the superior cerebellar arteries with complete occlusion (Fig 1). Reexamination revealed progression to a locked-in state (bilateral hemiparesis, minimal bulbar function except eye movements, retained consciousness). After obtaining informed consent from the parents, intra-arterial alteplase was given via pulse-spray technique (0.1 mg/kg per dose) and flow slightly improved. Mechanical thrombus disruption using microguidewire manipulation, an Attracter-18 coil retriever (Target Therapeutics, Fremont, CA), and a Retriever-18 endovascular snare (Target Therapeutics) produced only a modest additional improvement in blood flow. Two sequential sessions of balloon angioplasty of the midbasilar thrombus were then performed with a Sentry 3.5-mm × 15-mm balloon (Boston Scientific Target, Fremont, CA) resulting in marked improvement in basilar artery patency (Fig 2A and B). Migration of tiny nonocclusive emboli into the superior cerebellar artery distribution was noted after angioplasty. A total of 7000 units of intravenous unfractionated heparin was given at interspersed segments during the case. Time from initial presentation to the rural emergency department to restored flow was nearly 20 hours, and as long as 60 hours had elapsed from the initial symptom of headache.

The patient was locked-in for 24 hours, but made dramatic clinical improvements over the first week. By 4 weeks, he was running in the gym. At 6 months, the only deficit was mild incoordination of fine motor movements in the left hand. MRI at 6 months demonstrated sequelae of his pontine ischemia (Fig 2C). At 12 months, his neurologic examination was normal. The mechanism of stroke remains cryptogenic.

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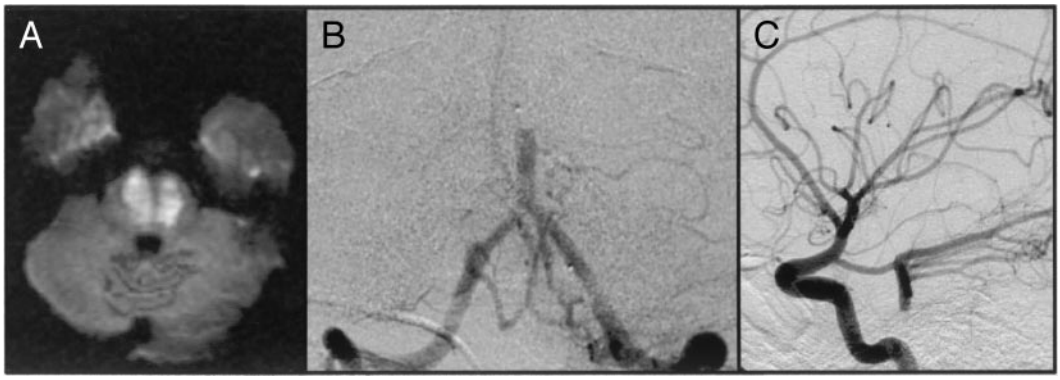

Fig 1. Initial imaging. A, Diffusion-weighted MRI demonstrates bilateral pontine ischemia. B and C, angiography demonstrates midbasilar occlusion with filling of the top-of-the-basilar from the anterior circulation.

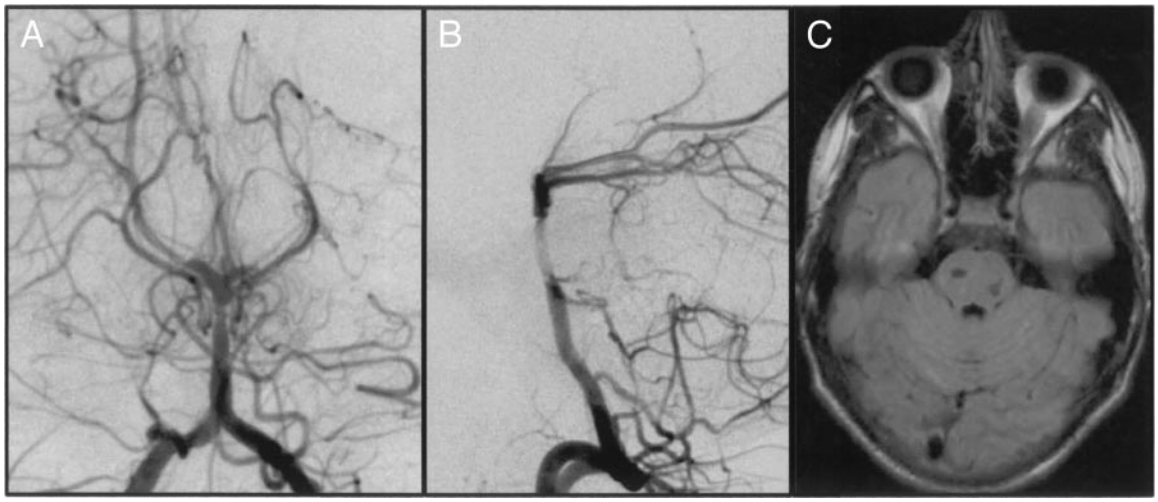

Fig 2. Follow-up imaging. A and B, Angiography at the end of the endovascular procedure demonstrates persistent stenosis of the basilar artery but excellent anterograde filling. C, Follow-up T1-weighted axial MR scan shows infarcted regions as cystic encephalomalacia.

DISCUSSION

Arterial Ischemic Stroke in Children

Stroke is an underrecognized, potentially treatable cause of neurologic disease in children. Cerebrovascular disorders are among the top 10 causes of death in children.[14] Current estimates of incidence are 2 to 13 per 100 000 children,[14–17] a rate comparable to that of pediatric central nervous system malignancy. A large Canadian center diagnosed >150 new cases of pediatric stroke in the year 2000 (personal communication, G. deVeber, January 2003). Morbidity from pediatric stroke is substantial. At least 50% of children are left with significant neurologic deficits or epilepsy[18,19] and mortality ranges from 7% to 28%.[5,20,21] These poor outcomes are compounded by a high recurrence rate, estimated at 20% to 33%.[14,22,23] Both outcome and recurrence risk depend on the underlying cause, of which there are many in children.[18,24,25]

Basilar artery stroke is uncommon in children but likely carries a similarly dismal prognosis to that of adults. In adults, mortality rates of 75% to 90% (with major morbidity in most survivors) improve to ~50% with intervention.[3,7,26] Case reports of basilar artery stroke in children are few[14,27–30] and a cause for most is never found. However, association with prothrombotic diseases,[31] anabolic steroid use,[32] inflammatory vasculitis,[33] spontaneous dissection,[34] and neonatal thromboembolism[35] have been reported. A recent report emphasized that factors common to pediatric posterior circulation stroke were male gender and vertebral artery dissection.[23]

Acute Intervention in Pediatric Stroke

Acute interventions to restore cerebral blood flow improve outcome and are now a reality in the management of adult stroke.[36] Current evidence suggests that alteplase is the best agent for intravenous use when given within the first 3 hours of stroke onset. Use of intravenous alteplase in the 3- to 6-hour time window after stroke is more controversial. Alteplase may be the thrombolytic agent of choice in children. Its potential benefits compared with other agents include evidence of increased thrombolysis in vitro, decreased immunogenicity, higher fibrin selectivity, and better side effect profile.[37,38] Based on this indirect evidence, alteplase was chosen for this case and the dose of 0.1 mg/kg was based on the few documented cases of alteplase use in children.[9–11] Intra-arterial, rather than systemic intravenous, administration was performed because of the perceived

increase in safety of this method when ischemia has been prolonged.

The risk of intracerebral hemorrhage as a complication of alteplase use in pediatric stroke is unknown. A recent review of the literature discloses 70 cases of intra-arterial alteplase administration in children where complete or partial thrombolysis was achieved in 70% of cases with major bleeding in 11%.[38] In children receiving thrombolytic treatments for noncerebral thrombosis, the incidence of intracranial hemorrhage has been estimated at 1% to 2%, and is likely well below 1% outside the neonatal period.[39] These figures are consistent with those observed in adults undergoing systemic thrombolysis for acute myocardial infarction.[40]

Late/Delayed Intervention

A remarkable feature of our case is the dramatic improvement obtained after intervention after such prolonged brainstem ischemia. Although time is paramount in stroke thrombolysis,[41] including vertebrobasilar stroke,[42] multiple cases of successful "late" interventions in arterial stroke have been documented, including good outcomes with intervention up to 80 hours after symptom onset[7,26,43] Such late interventions may be undertaken more often in brainstem, rather than hemispheric, strokes because of the poorer prognosis associated with brainstem stroke. One other pediatric case report has documented complete neurologic recovery following recanalization after brainstem ischemia of at least 24 to 36 hours' duration.[5] The precise location of the thrombus, extent of collateral flow, and the greater plasticity of the nervous system at a younger age are likely important factors in prognosis.

Percutaneous Transluminal Cerebral Angioplasty for Stroke

Angioplasty of the vertebrobasilar circulation has been described infrequently for over 20 years.[44–49] Complication rates are estimated to be substantial and may stem from vessel rupture, thromboembolic events, or damage to small perforators and subsequent infarction.[45,47,48] It is only because the prognosis of basilar occlusion is so grave that these risks can be both tolerated and ethically justified. Our study documents the sequential use of chemical, followed by mechanical means of recanalization of the basilar artery. Only a few cases have been reported using this particular combination of therapies in vertebrobasilar stroke,[50,51] and, to our knowledge, this report is the first to do so in children. Only one other similar pediatric case report was found where the order of interventions was reversed with chemical thrombolysis after angioplasty.[5]

Our report highlights the dramatic and successful treatment of an adolescent with acute posterior circulation stroke using a novel combined chemical and mechanical approach to revascularization. Further discussion on the early recognition and potential treatment of acute ischemic stroke in children is warranted.

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