Basilar Artery Occlusion in a Teenaged Boy Treated with Intra-Arterial Thrombolysis

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Abstract-

Purpose: Intra-venous thrombolysis (IVT) with recombinant tissue plasminogen activator (r-tPA) is the standard treatment of acute ischemic stroke in Taiwan. However, there are many limitations to this treatment, such as the three-hour therapeutic time window and an age limit of 18 to 80 years.

Case report: We reported a 15-year-old boy with vertebrobasilar artery total occlusion that presented with a sudden onset of consciousness disturbance. The accompanying findings were clonic-jerky movements of the 4 limbs and startled gazing for 10 minutes. Consciousness soon returned, but left hemiplegia and bilateral total ophthalmoplegia were noted. Brain computed tomography (CT) angiography revealed basilar artery total occlusion. Emergency intra-arterial thrombolysis (IAT) with urokinase was performed 5.3 hours after the onset. The course was smooth and the patient recovered well. He was free of symptoms at clinical follow up 30 months after the IAT.

Conclusion: To the best of our knowledge, this is the youngest reported patient with complete basilar artery occlusion to have received IAT and achieve a complete recovery in Taiwan. Our experience might suggest that IAT is an alternative treatment for patients having acute ischemic strokes but exceeding the three-hour time window for IVT with r-tPA, even in adolescence.

Key Words: basilar artery occlusion, intra-arterial thrombolysis, teenaged stroke

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INTRODUCTION

Acute ischemic stroke is an acute brain insult due to occlusion or hypo-perfusion of brain vessels. Basilar artery occlusion is an infrequent form of acute stroke, especially in adolescence, which might lead to death or long-term disability if not recanalized in time. The outcome of vertebrobasilar artery occlusion in adults is very poor, with mortality rates up to 90% in non-recanalization patients[(1)]. This seems to be the case in children, as well, but sufficient data is still lacking.

IVT with recombinant tissue plasminogen activator (r-tPA) is the standard treatment for acute ischemic stroke within 3 hours of onset. However, in clinical practice, only a small number of patients qualified for r-tPA treatment because of inadequate public awareness of stroke, delayed transportation to hospital, and difficulties in early diagnosis of stroke, especially those

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occurring in the posterior circulation. IAT has the theoretical advantages of higher concentrations delivered to the clot,gentle mechanical disruption of the clot, precise imaging of anatomy, pathology and collateral pattern and exact degree and timing of recanalization. Therefore, IAT with urokinase provides an alternative interventional therapy for patients who have had ischemic stroke for 3-6 hours or even longer, especially in the cases with posterior circulation occlusion.

CASE REPORT

A 15-year-old high school student suffered from a sudden onset of altered consciousness while chatting with his classmate at 16:40 on December 28, 2007. He was sent to the emergency room (ER) of our hospital at 17:20. At the ER, neurologic examinations revealed drowsiness with slurred speech and clonic-jerky movements of the 4 limbs. There was startled gazing for 10 minutes. No nausea or vomiting was noted. He had fever, cough and diarrhea one week previously and took Chinese herbal medicine for 5 days. His personal history revealed he had smoked 0.5 packs per day since the age of 12, but had no alcohol or drug abuse; the family history was unremarkable. There were no systemic diseases, such as hypertension, diabetic mellitus or other coagulopathy, and there was no emotional or physical stress as a possible precipitating factor. The laboratory data for complete blood count (CBC), blood sugar, liver/renal functions, antithrombin activity, Anti-HIV 1&2, antinuclear antibody (ANA), homocysteine and protein C/S were all normal. The electrocardiogram (EKG) showed no arrhythmia or ischemic change. The cardioechogram revealed no obvious vegetation over all valve and no thrombus over LV or LA appendage.

Emergency brain CT revealed no hemorrhage, infarction or tumor (Figure 1A). Consciousness was regained 1 hour and 40 minutes later, and the tentative diagnosis at the ER was seizure-like attack. Unfortunately, bilateral total ophthalmoplegia, no verbal output, left hemiplegia and persistent hiccup were noted. Emergency brain CT perfusion angiography was performed under the impression of acute stroke at the posterior circulatory territory at 20:12. The image revealed occlusion of the basilar artery at its middle third (Figure 1B). His neurologic condition soon deteriorated to a "locked-in" state.

Emergency IAT was performed at 5.3 hours after the onset of stroke, using the trans-femoral approach, and a micro-catheter was placed into the thrombosed segment of the basilar artery; 3,000 units of heparin was injected intravenously and 540,000 units of urokinase were administered using the micro-catheter clot maceration technique (Figure 2A). The whole procedure was smooth

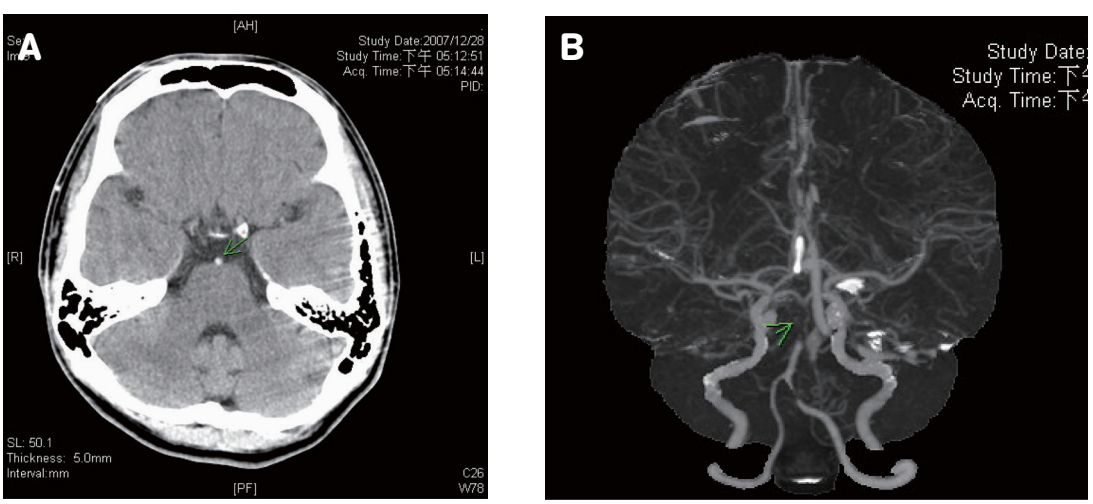

Figure 1. Axial CT (A) reveals hyperdense acute thrombus (arrow) in the basilar artery. CT angiography (B) shows occlusion of the basilar artery at its middle third (arrow) and the bilateral posterior cerebral arteries are unoccluded.

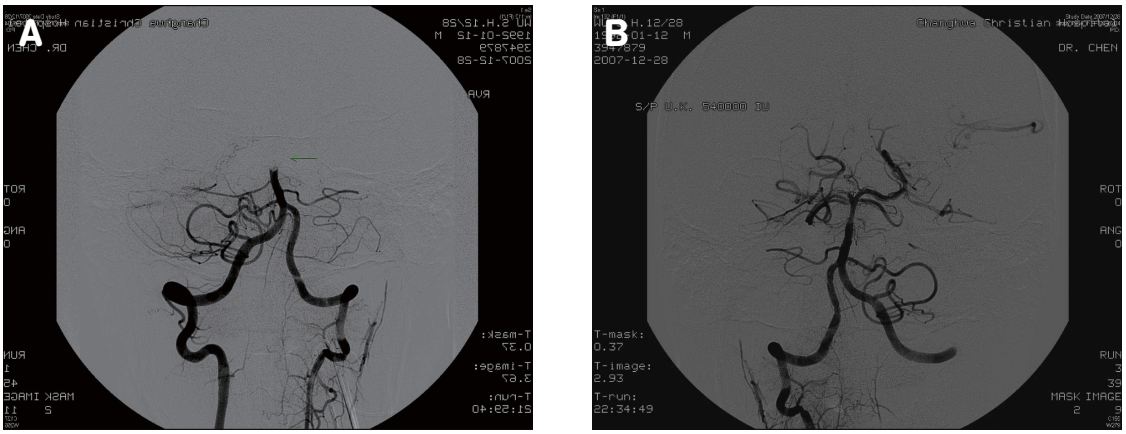

Figure 2. The right vertebral angiogram (A) before thrombolysis demonstrates total occlusion in the middle third to distal basilar artery (arrow); the bilateral superior cerebellar arteries and bilateral posterior cerebral arteries are not visualized. The follow-up angiogram (B) after thrombolysis shows recanalization of the basilar artery but residual mild to moderate stenosis at distal basilar artery is seen.

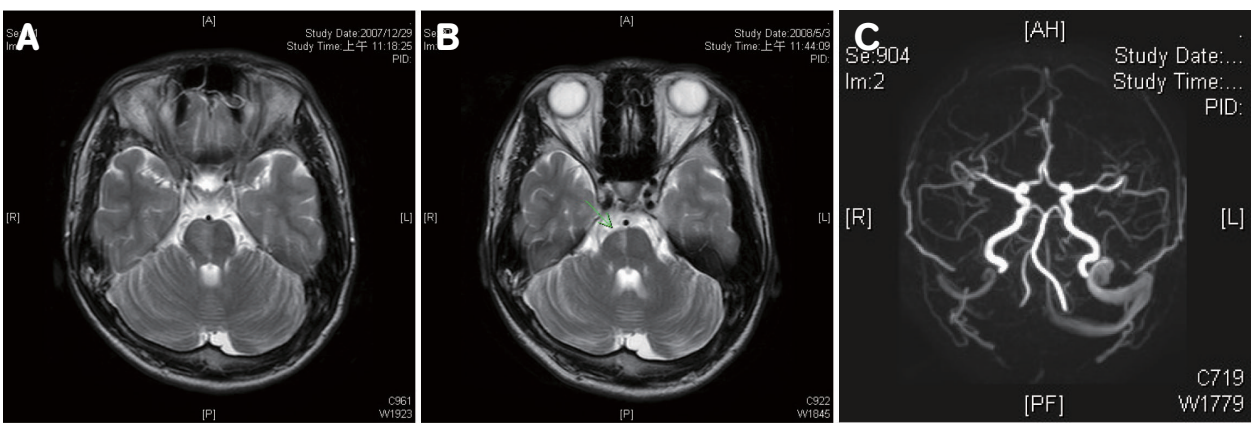

Figure 3. The follow-up axial T2-weighted image during administration reveals edema in the right pons. (A) The 5-month follow-up axial T2-weighted image reveals tissue loss and focal encephalomalacia (arrow) in the right pons. (B) A 5-month follow-up TOF (Time-of-Flight) MR angiogram demonstrates the normal appearance of the basilar artery and its distal branches.(C)

and terminated within 60 minutes with good re-visualization of the basilar artery (Figure 2B). The follow-up brain MRI showed focal hyper-intensity in the diffusion weighted image (DWI) and hypo-intensity in the apparent diffusion coefficient (ADC) in the right side pons and right cerebellum (Figure 3A); MRA showed mild narrowing at the distal basilar artery on December 29. His clinical condition dramatically improved, with residual mild left hemiparesis, mild dysarthria and unsteady gait after thrombolysis. The National Institutes of Health Stroke Scale (NIHSS) score was 25 points before IAT and decreased to 16 points after the intervention. The NIHSS score was further improved to 4 points after extubation on the second hospital day and achieved 2 points on discharge. The patient completely recovered functionally 5 months later (Figures 3B, 3C).

DISCUSSION

The incidence of stroke at a young age is rather rare

as compared with adults and is estimated to be 2.5 to 7.8 per 100,000 children[2,3]; basilar artery occlusion is even rarer[4]. Other neurological disorders such as seizure or basilar migraine might mimic stroke attack; therefore, early diagnosis of basilar artery occlusion is difficult.

Basilar artery occlusion in adults is a devastating event, with a mortality rate of 83-92%[5]. Etiologies such as prothrombotic diseases[6], anabolic steroid[7], inflammatory vasculitis[8], spontaneous dissection[9], neonatal thrombo-embolism[10], and vertebral artery dissection[11] have been reported. In our case, the etiology was unclear. The factors related to the functional outcome include age, initial clinical status, location and length of occlusion, etiology, timing of intervention, recanalization and the degree of collateral circulation[12]. Recanalization is the principle factor related to functional outcome[12] and is associated with a significant increase in the survival rate.

The choice of treatment was partly determined by the time since symptom onset (Intra-venous thrombolysis -IVT was more likely to be given if 3 hours or less had elapsed) and the severity of the neurological deficit (intra-arterial thrombolysis -IAT was more likely to be given if the deficit was severe) however lack of any reliable evidence from randomised controlled trials. Patients who have acute symptomatic basilar artery occlusion and a mild-to-moderate deficit benefit better with IVT. In case of subsequent acute worsening, additional IAT can be considered. Patients who present with a severe deficit can be treated with IVT or IAT[13]. The survival rate and functional outcome were equal with systemic IVT and IVA with recombinant tissue plasminogen activator (r-tPA) treatment within 3 hours after the occurrence of basilar artery occlusion in adult patients[14]. Few clinical trials had been conducted to explore the safety and feasibility of systemic and local thrombolytic therapy in childhood stroke[14]. IVT within 3 hours and IAT within 3-6 hours after onset of arterial ischemic stroke in childhood are both effective therapeutic options.

A literature review showed that the time window for local IAT for basilar artery occlusion might be longer than that for anterior circulation occlusion, possibly up to 72 hours[15]. This extension of the therapeutic time window in posterior circulation stroke in children may be explained by the presence of more extensive collateral flow, and the greater plasticity of the nervous system at a younger age. Hence, this might explain why receiving intra-arterial thrombolysis at 5.3 hours after basilar artery occlusion in our patient led to complete recanalization with a good functional outcome.

We have summarized the relevant data in the published reports of basilar artery stroke in children and adolescents treated with IAT (Table 1)[16-22]. The ages of these patients ranged from 3 to 18 years, and the time window for thrombolytic therapy ranged from 5 to 72 hours. The functional outcome according to the modified

Table 1. *Published cases of basilar artery occlusion in children and adolescents treated with intra-arterial thrombolysis (IAT)*

Article	Age (y)	Sex	Clot location	Time to treatment (h)	Treatment	Outcome (Rankin scale)
Mirjam 2009[16]	4	M	Complete BA	60	UK 0.65 x 10^6U	1
Grigoriadis 1998[10]	6	M	Complete BA	44	UK 0.2 x 10^6U	0
Cognard 2000[18]	8	M	Complete BA	36	UK 27, 272U/kg	0
Sungarian and	9	M	Mid BA	6	UK 0.75 x 10^6U	0
Duncan 2003[20]	10	F	Mid BA	5	UK 1.0 x 10^6U	1
Rosman 2003[15]	18	F	Distal BA	72	r-tPA dose unknown	4
Kirton 2003[19]	15	M	Mid BA	20	r-tPA 0.1mg/kg	0
Bhatt A 2008[21]	3	F	BA	18	r-tPA dose unknown	0
Larner 1998[17]	18	F	Distal BA	12	SK 2.4 x 10^6U	3
Our case	15	M	Complete BA	5.3	UK 5.4x10^5U	0

BA, basilar artery; UK, urokinase; r-tPA, recombinant tissue plasminogen activator; SK, streptokinase.

Table 2. *Summary of Pearson's correlation r*

r	Age	Sex	Clot location	Time to treatment	Outcome (Rankin scale)
Age	1	0.254	0.897	0.089	0.613
Sex	0.254	1	0.567	0.039	0.653
Clot location	0.897	0.567	1	0.388	0.504
Time to treatment	0.089	0.039	0.388	1	0.441
Outcome (Rankin scale)	0.613	0.653	0.504	0.441	1

Rankin scale was good (0-1) in 8 of the 10 patients. Because of the small sample size, no firm conclusion can be drawn. We applied Pearson's correlation to analyze the confounding factors of age and gender with functional outcome. The result suggested that male gender and younger age was related to a better outcome (Table 2). More clinical data are needed in order to establish a consensus for the use of thrombolytic therapy in basilar artery occlusion in young people.

We report a young boy with basilar artery total occlusion with a successful IAT. It is an interesting case and rarely reported in the published literatures. We concluded that IAT might be the alternative choice to restore the neurologic deficit with basilar artery occlusion, even after a considerably delayed time window and a worsened clinical presentation.

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