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CASE REPORT

# Internal carotid artery dissection at the supraclinoid portion after severe traumatic head injury in a child

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## ABSTRACT

*A 14-year-old boy with severe traumatic brain injury (TBI) and cranial fractures was admitted to our emergency department after a motor vehicle accident. An emergency craniotomy was performed, and traumatic carotid artery (CA) dissection (tCAD) was revealed by cerebral angiography. The patient then underwent close observation in the intensive care unit. Traumatic CADs are difficult to diagnose in the early period after injury, and are associated with serious problems and a high mortality rate. There is still a lack of knowledge surrounding its natural history and treatment options, especially in children. Moreover, it commonly occurs at the cervical internal CA, and tCAD at the supraclinoid portion is quite rare. To the best of our knowledge, this is the first report accompanied by radiological images of the clinical course of tCAD at the supraclinoid portion following severe TBI in a child.*

**Key words: traumatic brain injury, craniotomy, neurosurgery, computed tomography, angiography.**

## Introduction

Although cerebral artery dissections are potentially fatal, there is still a lack of knowledge related to their natural history and adequate treatment options. Spontaneous dissections occur most commonly in older populations, but traumatic dissections are more prevalent in younger age groups. (1) Traumatic carotid artery (CA) dissection (tCAD) is a serious problem that results in neurological deficits and a mortality rate of up to 40%. (2) Traumatic CAD at the supraclinoid portion is extremely rare, especially in children. This report details the clinical observation, accompanied by radiological images, of tCAD at the supraclinoid portion after severe traumatic brain injury (TBI) in a child.

## Case presentation

A 14-year-old boy was admitted to our emergency department after a motor vehicle accident (MVA). He had no notable past medical history. On examination, he was restless, had a 7 Glasgow Coma Scale score (E1V2M4), blood pressure of 109/83 mmHg, heart rate of 150 beats/minute, respiratory rate of 24/minutes, and his pupils were 4 mm in diameter. After receiving initial trauma resuscitation, head computed tomography (CT) showed severe traumatic brain injury (TBI) and cranial fractures (figure 1). Because anisocoria was newly determined at the completion of CT, he was emergently transferred to the operating suite. After craniotomy for a right brain contusion and acute subdural hematoma, decompressive craniotomy was performed and the operation was finished.

After finishing the craniotomy, the patient was immediately transferred to the angiography suite and cerebral angiography was performed in order to evaluate the condition of intracranial internal carotid artery (ICA). Angiography of the right ICA showed the pearl and string sign at the supraclinoid portion of the ICA, and traumatic carotid artery (CA) dissection (tCAD) was suspected. A direct carotid cavernous fistula (CCF) was also observed (figure 2A). The patient was then admitted to the intensive care unit (ICU). Angiography on day 2 of hospitalization showed exacerbation of stenosis at the supraclinoid portion, but this improved to normal after 1 week, and the CCF was no longer noted (figures 2B,C). Two weeks after admission, the patient made a good recovery and was discharged from the ICU. 3-D CT angiography (CTA) after 3 weeks revealed no re-stenosis or pseudoaneurysm formation at the supraclinoid portion.

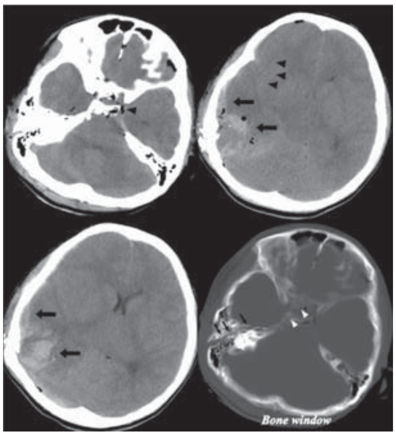


**Figure 1. Head computed tomography (CT) shows a right subdural hematoma with a brain contusion at the temporal lobe (large arrow). Pneunoencephalus and subarachnoid hemorrhage are also detected (black arrow head). The bone window in head CT shows a transverse type petrosal fracture (small arrow). The fracture line penetrates an aperture interna canalis carotici and extends to the base of the skull (white arrow head).**

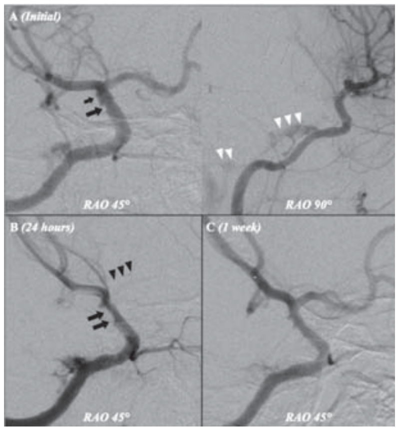


**Figure 2. Initial right internal carotid artery (ICA) angiography shows stenosis (large arrow) and dilatation (small arrow) compatible with the žpearl and string sign' at the supraclinoid portion of the ICA. Direct carotid cavernous fistula is also detected (white arrow head). Angiography on day 2 shows stenosis at the supraclinoid portion of the ICA (arrow). Anterior cerebral artery can not be detected (black arrow head). Angiography on day 7 shows complete healing of the dissection without any restenosis of the right ICA. Anterior cerebral artery, anterior choroidal artery and posterior communication artery are detected.**

## Discussion

This patient was admitted to the hospital after an MVA, and had a potentially fatal situation due to severe TBI and cranial fractures. The most common mechanism of tCAD in pediatrics is either a direct blow to the neck, or head, or hyperextension, and MVAs are the most common causes of such injury. (1) Traumatic CADs commonly occur at the level of the 1st and 2nd vertebrae, which is the anatomically mobile segment of the ICA. (3) In this case, it was necessary to perform angiography postoperatively in order to evaluate the condition of ICA. This was because the petrosal fracture was transversely fractured, and the fracture line, which penetrated an aperture interna canalis carotici, extended to the base of the skull. Impact to the skull causes an opposing movement of the brain parenchyma, which leads to stretching and shearing effects on the vessels. This can in turn lead to a traumatic endothelial intimal lesion due to a high moment of inertia. CAD, which can lead to thrombosis and occlusion of the anterior, middle cerebral artery or CA, is one of the major causes of ischemic stroke in children. Conversely, causes related to hemorrhagic events are less understood in children.

Angiography is the gold standard for diagnosis, and magnetic resonance angiography (MRA) is also a popular imaging method. CT angiography is increasingly used with less invasive methods. (4) Although the focus should be on the natural history of untreated dissections, most reports lack sequential angiographic follow-up, especially in children. The treatment of CAD in relation to the administration of anticoagulation agents, antiplatelet agents and thrombolytics for ischemic symptoms remains controversial due to the presumed increased risk of intracranial hemorrhage.

When fractures involving the base of the skull are identified in pediatric patients with severe TBI, early evaluation using angiography, MRA, or CTA is essential to confirm details about intracranial ICA injury, especially tCAD, and indicate appropriate treatment, even if no symptoms are present. Observational treatment with intensive care is thus recommended as a conservation option in pediatric patients with severe TBI who undergo tCAD.

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