

Pontine Infarction Induced by Injury of the Perforating Branch of the Basilar Artery After Blunt Head Impact

—Case Report—

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Abstract

A 77-year-old male pedestrian was hit by a car. On admission, he had disturbance of consciousness and left hemiplegia. Computed tomography (CT) indicated only left frontal subcutaneous hematoma and minor hemorrhage in the left frontal lobe, suggesting axonal injury. CT on hospital day 2 revealed a low density area in the right paramedian pons, but CT angiography showed no dissection or occlusion of the vertebrobasilar artery. The diagnosis was pontine infarction resulting from shearing force injury to the paramedian branch of the basilar artery. He was transferred to another hospital for rehabilitation without improvement of symptoms on hospital day 51. Paramedian pontine infarction tends to occur in patients with risk factors for arteriosclerosis, including hypertension, diabetes mellitus, hyperlipidemia, or smoking. The present elderly patient had hypertension and hyperlipidemia, so arteriosclerosis in the paramedian branch may have contributed to his susceptibility to such injury.

Key words: axonal injury, hemiplegia, basilar artery, pons, infarction

Introduction

Cerebrovascular injury induced by blunt injury is uncommon, affecting the carotid artery in 0.08% to 0.86% and the vertebrobasilar artery in 0.4% to 0.53% of cases.^{2,3,5,15)} Aggressive searching for cerebrovascular injury may lead to earlier diagnosis before the development of neurological symptoms.¹⁵⁾ The patterns of injury that indicate carotid artery injury include Horner syndrome, basilar skull fracture through the foramen lacerum, significant neck injury, and facial fracture, whereas the patterns of injury that indicate vertebrobasilar artery injury include cervical spine fracture, significant neck injury, and facial fracture.¹⁵⁾ The most typical neurological symptom of carotid artery injury is hemiplegia and that of vertebrobasilar artery injury is Wallenberg's syndrome or unconsciousness with various neurological deficits. The cerebrovascular injury tends to involve dissection and occlusion of the main vascular trunk.¹⁵⁾

Here we describe an extremely rare case of brain-stem infarction caused by injury to the paramedian branch of the basilar artery after blunt head impact.

Case Report

A 77-year-old male pedestrian was hit by a car, with his head striking the front windshield. He suffered disturbance of consciousness and was transferred to our department. His previous history included hypertension and hyperlipidemia for 30 years, but no known neurological deficit. He did not smoke, but did drink 50 g/day of alcohol. Family history was unremarkable.

On admission, the patient showed eye opening in response to speech, moaning without words, and purposeful movements responding painful stimuli to the right extremities, corresponding to a total score of 10 on the Glasgow Coma Scale. Examination also found left hemiplegia and swelling of the left side of the face. His blood pressure was 128/80 mmHg, heart rate 68 beats/min, and axillary temperature 34.6°C. Chest radiography demonstrated fracture of the left scapula. Electrocardiography showed no abnormalities. Computed tomography (CT) of the head indicated only left frontal subcutaneous hematoma and minor hemorrhage in the left frontal lobe, suggesting axonal injury (Fig. 1), but no significant lesions were identified as responsible for the left hemiplegia. Cervical sonography demonstrated no

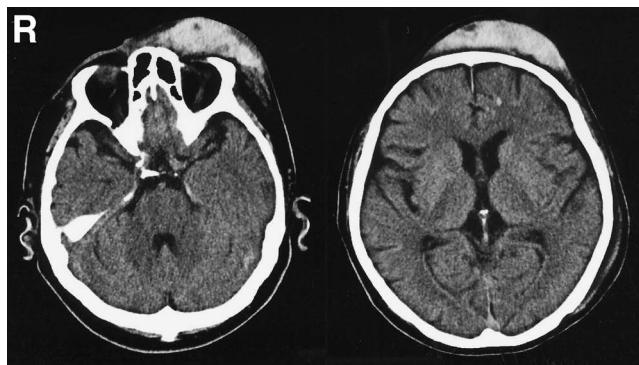


Fig. 1 Computed tomography scans of the head on arrival showing a left frontal subcutaneous hematoma and minor hemorrhage in the left frontal lobe, suggesting axonal injury.

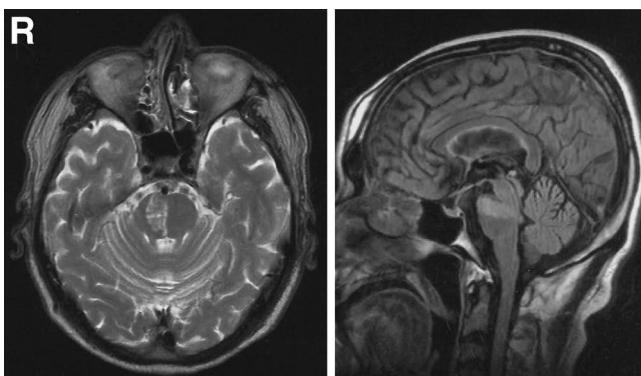


Fig. 4 Axial T₂-weighted (left) and sagittal fluid-attenuated inversion recovery (right) magnetic resonance images on hospital day 9 demonstrating hyperintensity in the right paramedian pons.

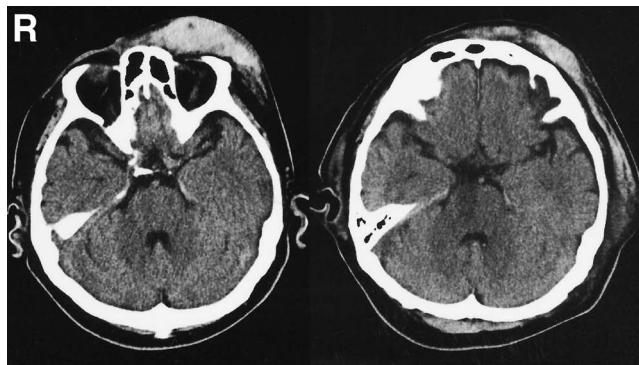


Fig. 2 Computed tomography scans of the head on hospital day 2 revealing a new low density area in the pons.

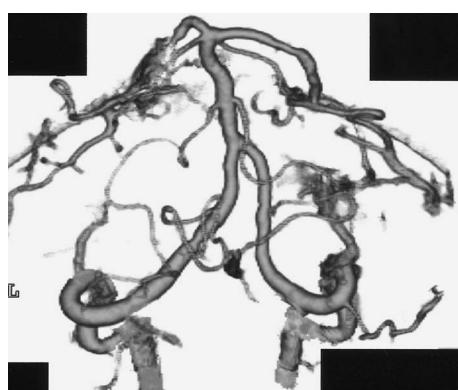


Fig. 3 Computed tomography angiogram on hospital day 2 showing no dissection or occlusion of the vertebral artery.

stenosis or occlusion of the internal carotid artery. Head CT on hospital day 2 revealed a low density

area in the pons (Fig. 2). CT angiography on the same day found no dissection or occlusion of the vertebral artery (Fig. 3).

His consciousness became clear, and neurological examination demonstrated pure motor hemiplegia sparing the face on hospital day 4. Head magnetic resonance imaging demonstrated a hyperintense lesion on T₂-weighted imaging, suggesting right paramedian pontine infarction on hospital day 9 (Fig. 4). The diagnosis was pontine infarction resulting from injury to the paramedian branch of the basilar artery. The patient was transferred to another hospital for rehabilitation without improvement of symptoms on hospital day 51.

Discussion

Vertebral artery injury does not always manifest as symptoms of posterior circulation ischemia. In fact, only 12% of patients with vertebral artery injury demonstrate ischemic symptoms.¹⁵⁾ Vertebral artery injury occurs in over 30% of patients with cervical fractures,²⁾ and trivial trauma and various other mechanisms not involving cervical fracture can also induce either dissection or occlusion of the vertebral artery.^{2,20,22)} Penetrating injury may rarely induce vertebral artery injury resulting in brainstem or cerebellar infarction.^{7,13,18)} In addition, basilar artery herniation can even more rarely progress into the sphenoid sinus due to clivus fracture, resulting in pontine infarction.^{10,19)}

The present patient had no cervical fracture, clivus fracture, penetrating wound, or occlusion or dissection of the basilar artery. He presented with signs of a blow to his forehead with minor hemorrhage in

the deep frontal brain without cortical injury, suggesting axonal injury.^{9,16)} Axonal injury is occasionally associated with perforating branch injury, resulting in hemorrhage or infarction due to shearing force.^{1,12)} Therefore, shearing force to the paramedian branch of the basilar artery may have caused the cerebral infarction in this case.

One previous case of pontine infarction induced by injury to the paramedian branch of the basilar artery due to blunt head injury was reported in a 9-year-old boy who presented with hemiparesis 10 days after falling off his bicycle.²¹⁾ The injury was probably caused by shearing or stretching resulting in intimal injury with delayed intimal dissection and infarction. Generally, children have unique anatomical and developmental features in the brain, skull, and neck. The brain attains 75% of full weight by age 2 years and almost the entire adult weight by age 5 to 6 years, so the head proportionately much larger and heavier than later in life. The neck musculature in a young child is also immature, and unable to fully support the weight of the head. Accordingly, the larger heavy head supported on the weak neck allows greater movement of the head and brain in response to acceleration and deceleration forces. In addition, the absence of myelination and the small axonal size predisposes the young brain to shearing injury. Therefore, young people tend to be vulnerable to shearing injuries, which cause diffuse axonal injury, in comparison to adults.⁴⁾ Moreover, children have small but elastic blood vessels. Brain infarction following perforator injury, which also tends to occur following shearing force due to blunt head trauma, is thus more frequently reported in children^{1,6,8,14)} than in adults.²³⁾ Furthermore, the cerebral hemisphere may be more vulnerable than the brainstem following shearing force,¹⁷⁾ as infarction of the basal ganglia due to perforator injury induced by shear stress^{1,6,8,14)} is more frequent than that of the brainstem²¹⁾ in children. Again, infarction due to perforator injury induced by shear stress of both basal ganglia and brainstem is extremely rare in adults in comparison to children.

The present case occurred in an elderly man, so is extremely rare. Paramedian pontine infarction tends to occur in patients with risk factors for arteriosclerosis, including hypertension, diabetes mellitus, hyperlipidemia, or smoking.¹¹⁾ The present patient also had hypertension and hyperlipidemia. Therefore, the presence of arteriosclerosis in the paramedian branch may have contributed to his susceptibility to such injury. This unique case adds one more cause to the list of documented etiologies of paramedian pontine infarction.

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