

CASE REPORT

Delayed bilateral vertebral artery occlusion after cervical spine injury: a case report

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INTRODUCTION: There are considerable risks for the secondary spinal cord injury and the initial and/or delayed vertebral artery occlusion in cases of cervical fracture dislocation.

CASE PRESENTATION: An 86-year-old man was injured in a car accident and was diagnosed with no fracture or dislocation of the cervical spine by the emergency physician. However, he was transferred to our hospital 3 days later because he had motor weakness that was evaluated to be 32 points (out of 50 points) on the upper limb American Spinal Injury Association (ASIA) motor score and was diagnosed with spontaneously reduced fracture dislocation at C5/6. Magnetic resonance images revealed that the bilateral vertebral arteries were occluded, and there were some microinfarction lesions in the brain. On the first visit to his previous doctor, he was found to have a flow void in the right vertebral artery. This indicated that it was occluded during the waiting period at his previous doctor. On the day of his arrival at our hospital, the patient underwent a C5/6 posterior spinal fusion. Three months after surgery, he recovered to 46 points on the upper extremity ASIA motor score, and blood flow in the left vertebral artery was resumed.

DISCUSSION: Early reduction and stabilization are necessary for cervical spine fracture dislocation; however, it is important not only for the prevention of the secondary injury but also for the reduction of the risk of vertebral artery occlusion.

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CASE DESCRIPTION

An 86-year-old man was injured in a car accident and was admitted to the emergency department of a hospital. His general condition was poor, and the evaluation of paralysis was difficult; however, he was diagnosed with no fracture or dislocation of the cervical spine by an emergency physician and was followed up. He was transferred to our hospital 3 days later because he was suspected of having a fracture dislocation of the C5/6 by an orthopedist at the hospital.

Upon arrival at our hospital, the patient had a motor weakness that was evaluated as 32 points (out of 50 points) on the upper limb American Spinal Injury Association (ASIA) motor score and hypoesthesia in four limbs, which is presented with central cord syndrome. His consciousness was lucid and had neither obvious central nervous system manifestation nor ataxia at that time.

A computed tomography (CT) scan showed abnormal expansion in the disk space and facet joints between C5 and C6, but no fracture of the vertebral body, lateral mass or lamina (Figure 1a). T2-weighted magnetic resonance (MR) images revealed hyperintense signal changes between C5 and C6 of the vertebral body, the facet joint space, the retropharyngeal space and the paravertebral muscles, but could not follow the normal relief of the posterior ligamentous complex (Figure 1b). Collectively, we diagnosed spontaneously reduced fracture dislocation that was classified into distractive flexion injury of Allen Fergusson classification with severe instability.

Moreover, an evaluation of the vertebrobasilar artery system using CT and MR angiography revealed that the bilateral vertebral arteries were occluded (Figure 2). Diffusion-weighted MR

imaging of the brain revealed some microinfarction lesions in the cerebrum and cerebellum, which were considered to be hemodynamic cerebral ischemia or fragmentation-induced infarction (Figure 3). On the first visit to his previous doctor, he was found to have a flow void in the right vertebral artery by MR imaging (Figure 4). This clearly indicates that there was blood flow at the initial visit and that it was occluded during the follow-up with his previous doctor.

On the day of his arrival at our hospital, the patient underwent a C5/6 posterior spinal fusion. Pedicle screws were used for one side and lateral mass screws were concomitantly used for the other side because the patient was suffering from highly unstable damage and had lost circumferential stability (Figure 5). Moreover, lateral mass screws for the boss side could not anchor his cervical spine because of remarkable osteoporosis.

After surgery, neither central nervous system manifestation nor ataxia presented. In addition, new cerebral infarction lesions did not appear. Blood flow in the left vertebral artery was resumed, albeit a small amount (Figure 6). Three months after surgery, he recovered to 46 points on the upper extremity ASIA motor score and was discharged from the hospital to walk home independently.

DISCUSSION

Traumatic vertebral artery occlusion occurs in association with 17.2% of cervical spine injury.¹ In addition, although it is not associated with occlusion during injury, the blood flow in the

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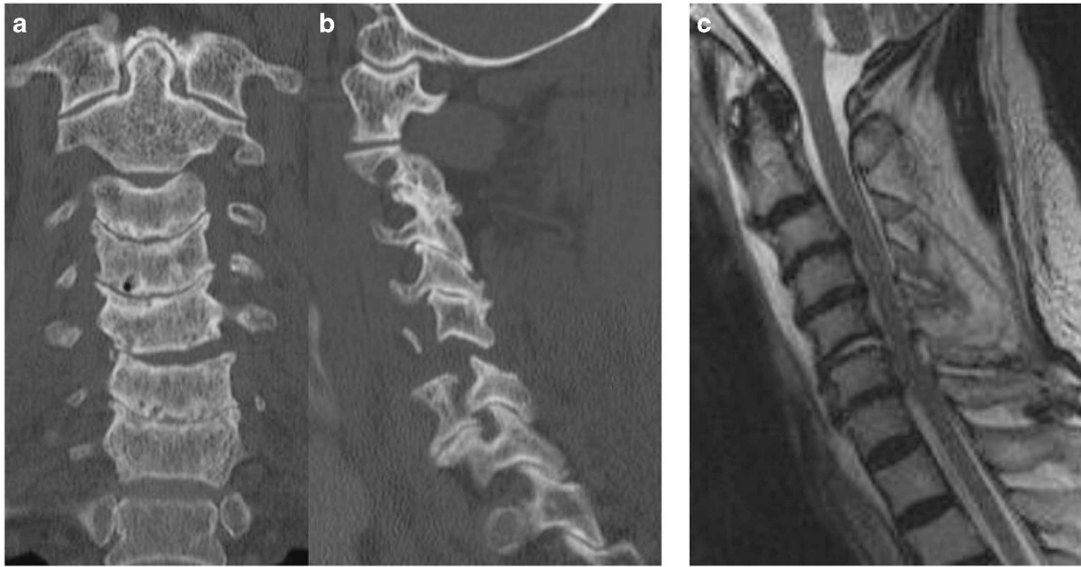


Figure 1. Preoperative CT scans of the cervical spine (**a**, **b**). The C5/6 joint was dislocated without any fractures. Preoperative MR image of the cervical spine (**c**). The intervertebral disk of C5/6 and the posterior ligamentous complex were ruptured and hemorrhage was spreading into the paravertebral muscles, retropharyngeal space and epidural space.

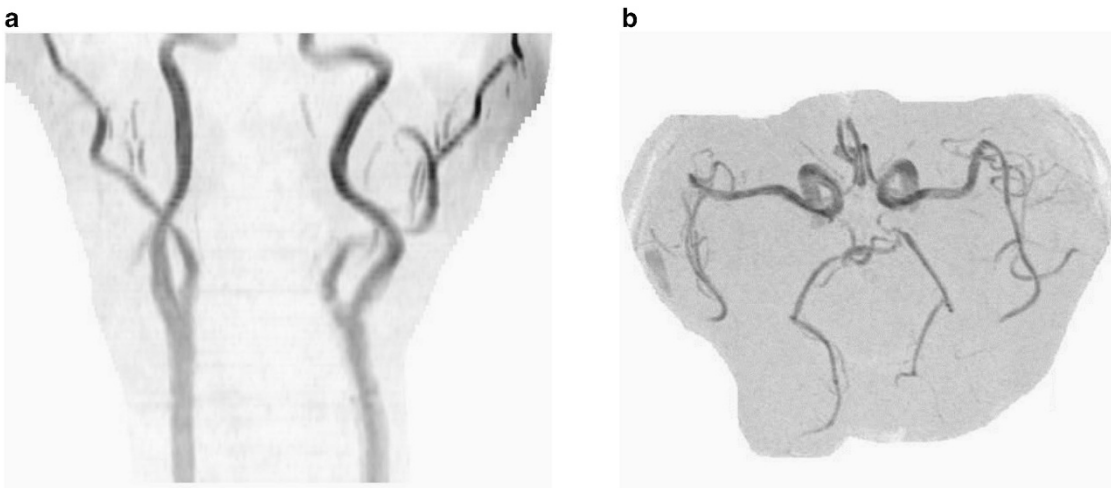


Figure 2. Preoperative MR angiography image of the neck (**a**) and the circle of Willis (**b**). Bilateral vertebral artery flow was lacking (**a**), and the posterior cerebral artery was perfused via the posterior communicating artery from the internal carotid artery (**b**).

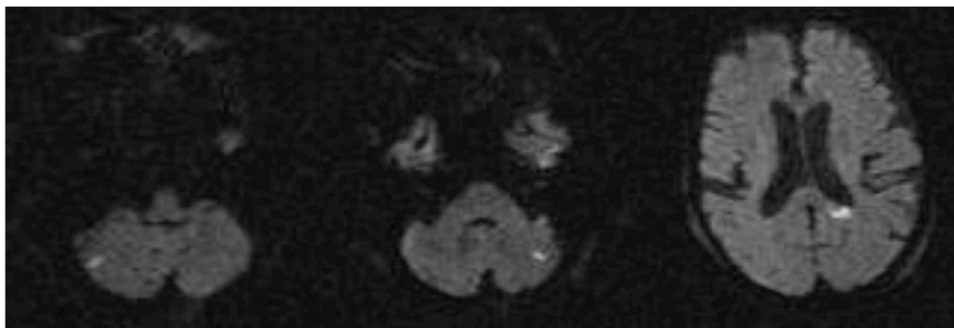


Figure 3. Preoperative diffusion-weighted MR images of the brain. Some small infarctions were located in the territory of the posterior cerebral artery or posterior inferior cerebellar artery.

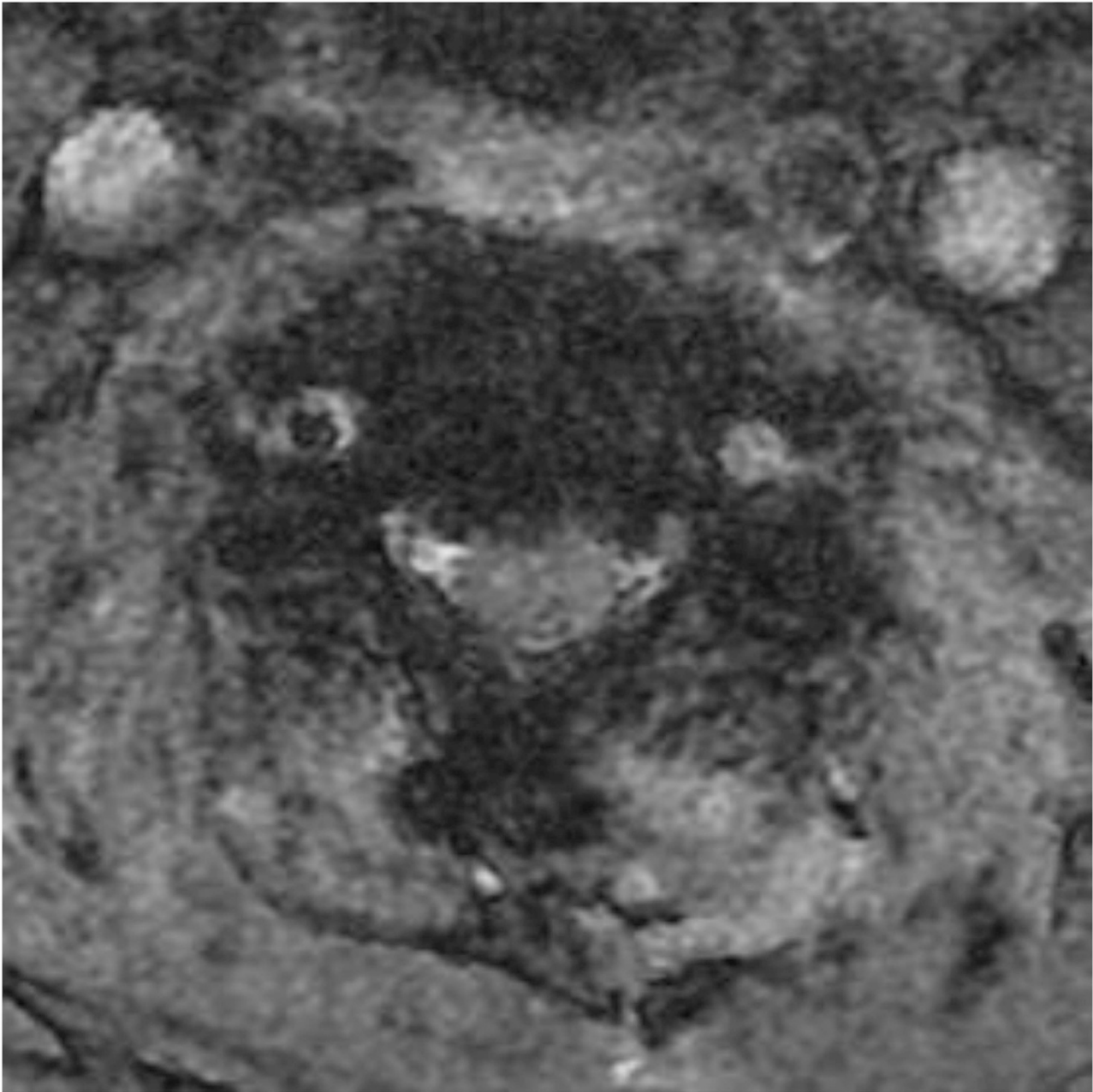


Figure 4. MR images of the cervical spine at the initial visit to the previous hospital. Right side vertebral artery maintained the blood flow.

cervical spine fracture dislocation can be blocked later because of the embolus formation associated with vasospasm or intimal injury because the vertebral artery is forced to be distorted and/or stretched.² Blood flow can be regained by quick and appropriate reduction and fusion; however, cerebral hemorrhage can secondarily occur because of thrombotic embolism and reperfusion disorder associated with blood reflow.³ Although there are some institutions where embolization is performed for the vertebral artery to prevent these events,⁴⁻⁶ the balance between benefits gained by blood reflow and the risk of developing reperfusion disorder is controversial.⁷ At our hospital, we rarely perform embolization in advance for patients with vertebral artery occlusion; therefore, we have not experienced cases of thrombotic

embolism or hemorrhagic infarction caused by reperfusion disorder.

Only approximately half of healthy persons have a complete circle of Willis, and some patients lack both posterior communicating arteries.⁸⁻¹¹ These cases will result in brain-stem infarction that can be fatal if the vertebral artery is occluded. Therefore, it should be considered that reflow of the vertebral artery has great benefit, and it should not be considered that no issues will occur, although the screws perforated only because the vertebral artery is already occluded.

Early reduction and stabilization are necessary for cervical spine fracture dislocation; however, it is important not only for the prevention of the secondary injury but also for the reduction of the risk of vertebral artery occlusion.

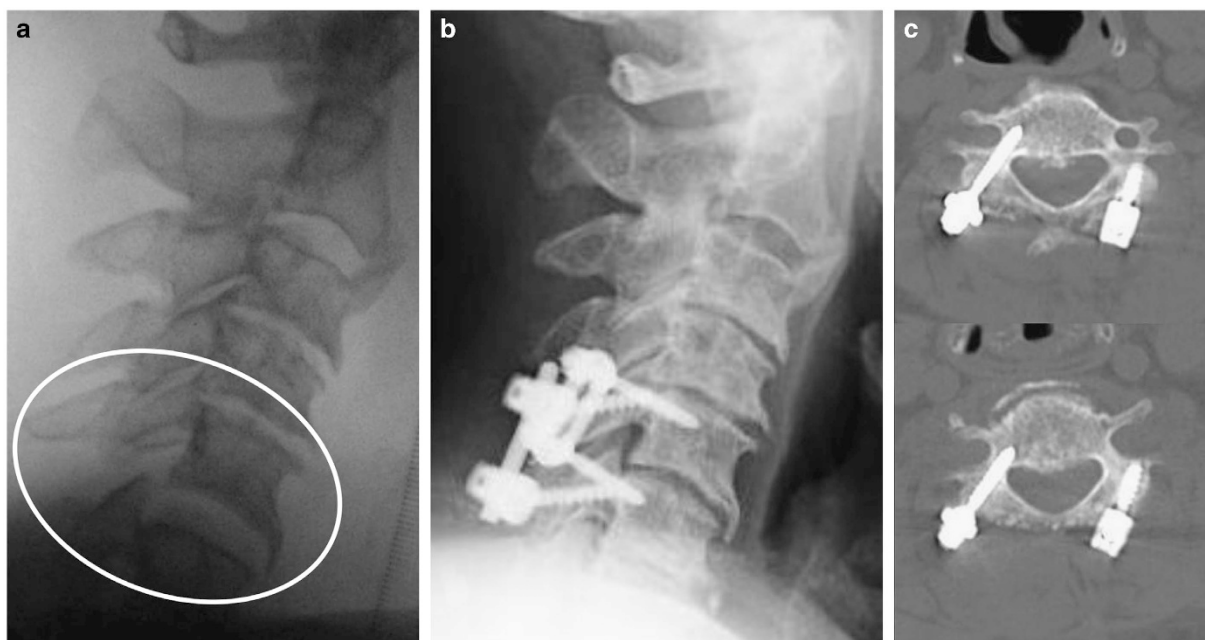


Figure 5. Intraoperative X-ray imaging (a) and postoperative X-ray and CT scans (b,c). Stability of all around vertebral tissues was disrupted, and the interval of C5/6 was easily spread with traction force under anesthesia (a). Posterior fusion with reduced alignment (b).

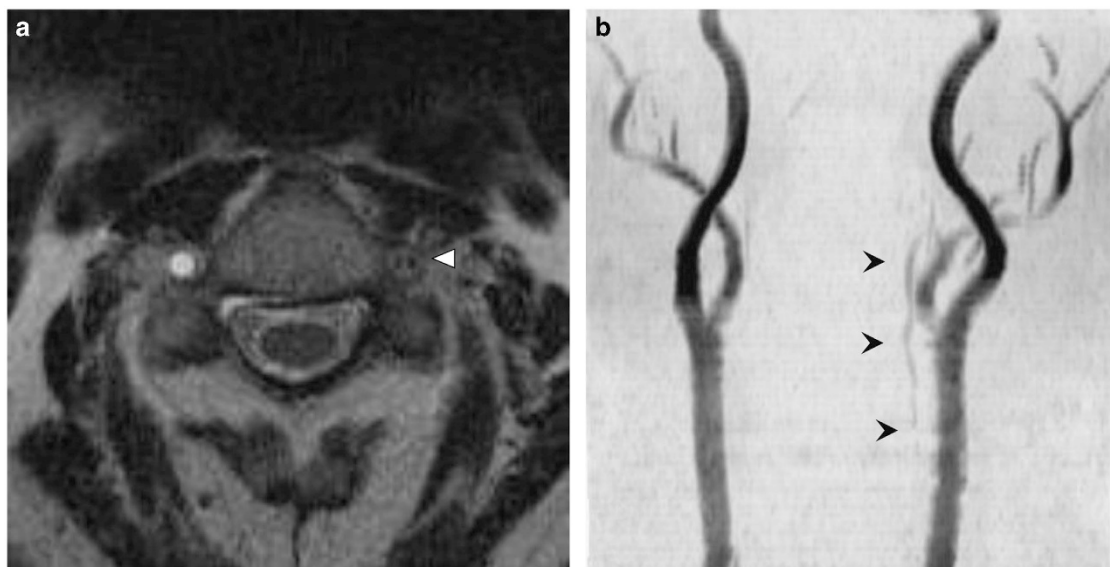


Figure 6. MR image of the cervical spine (a) and MR angiography of the neck (b) performed at the 3-month follow-up. Blood flow of the left side vertebral artery was slightly restored.

COMPETING INTERESTS

The authors declare no conflict of interest.

REFERENCES

- 1 Taneichi H, Suda K, Kajino T, Kaneda K. Traumatically induced vertebral artery occlusion associated with cervical spine injuries: prospective study using magnetic resonance angiography. *Spine* 2005; **30**: 1955–1962.
- 2 Willis BK, Greiner F, Orrison WW, Benzel EC. The incidence of vertebral artery injury after midcervical spine fracture or subluxation. *Neurosurgery* 1994; **34**: 435–441.

- 3 Nakao Y, Terai H. Distal embolic brain infarction due to recanalization of asymptomatic vertebral artery occlusion resulting from cervical spine injury: a case report. *J Chiropr Med* 2014; **13**: 266–272.
- 4 Ashley WW Jr, Rivet D, Cross DT 3rd, Santiago P. Development of a giant cervical vertebral artery pseudoaneurysm after a traumatic C1 fracture: case illustration. *Surg Neurol* 2006; **66**: 80–81.
- 5 Atar E, Griton I, Bachar GN, Bartal G, Kluger Y, Belenky A. Embolization of transected vertebral arteries in unstable trauma patients. *Emerg Radiol* 2005; **11**: 291–294.
- 6 Cohen JE, Rajz G, Itshayek E, Umansky F, Gomori JM. Endovascular management of exsanguinating vertebral artery transection. *Surg Neurol* 2005; **64**: 331–334.

- 7 Fasset DR, Dailey AT, Vaccaro AR. Vertebral artery injuries associated with cervical spine injuries: a review of the literature. *J Spinal Disord Tech* 2008; **21**: 252–258.
- 8 Eftekhari B, Dadmehr M, Ansari S, Ghodsi M, Nazparvar B, Ketabchi E. Are the distributions of variations of circle of Willis different in different populations? Results of an anatomical study and review of literature. *BMC Neurol* 2006; **6**: 22.
- 9 Hoksbergen AW, Fulesdi B, Legemate DA, Csiba L. Collateral configuration of the circle of Willis: transcranial color-coded duplex ultrasonography and comparison with postmortem anatomy. *Stroke* 2000, **31**: 1346–1351.
- 10 Macchi C, Molino Lova R, Miniati B, Zito A, Catini C, Gulisano M *et al*. Collateral circulation in internal carotid artery occlusion. A study by duplex scan and magnetic resonance angiography. *Minerva Cardioangiol* 2002; **50**: 695–700.
- 11 Nagahama K, Sudo H, Abumi K, Ito M, Takahata M, Hiratsuka S *et al*. Anomalous vertebral and posterior communicating arteries as a risk factor in instrumentation of the posterior cervical spine. *Bone Joint J* 2014; **96-B**: 535–540.