

Surgical treatment of an atlantoaxial fracture after a delayed diagnosis in a comatose patient

Takayuki Imura¹ · Gen Inoue¹ · Toshiyuki Nakazawa¹ · Wataru Saito¹ ·
Masashi Takaso¹

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Abstract

Study design Case report.

Objective To report a case of fractures of the right lateral atlantoaxial joint and C2 body diagnosed more than 5 months after injury.

Summary of background data Misdiagnosis of an injury to the cervical spine has been reported frequently. For patients in whom cervical injury is suspected, the primary screening modality is axial CT from the occiput to T1 with sagittal and coronal reconstructions. The inadequacy of this radiological evaluation could delay diagnosis of fractures and lead to unnecessary surgical treatment of the cervical spine.

Methods We report the case of a 74-year-old woman with an old, displaced combined fracture of the C1 and C2 right facet joint. In this case, CT of the brain was evaluated at the time of injury, but not CT of the cervical spine. As a consequence, diagnosis was delayed and surgical treatment was necessary.

Results We performed posterior fusion surgery for C1 and C2. A pedicle screw was not inserted on both sides of C2, because of destruction of the insertional point on the right side and a high-riding VA on the left. Alternatively, a lamina screw and hook were used for C2, fixed with lateral mass screws on C1, with a bone graft harvested from the iliac crest.

Conclusions To avoid unnecessary surgery, surgeons should recognize the possibility of cervical fractures that cannot be detected without CT, especially in patients who are comatose at injury. Atlantoaxial fixation with a hook and lamina screw in C2 is an option for old upper cervical fractures in cases where a pedicle screw cannot be inserted into C2.

Keywords Upper cervical injury · Delayed diagnosis · Comatose patient

Introduction

The rate of misdiagnosis of cervical spine injuries has been reported to range from 5 to 20 % [1–4]. The early detection of cervical spine injuries is essential because false or delayed diagnosis might lead to tragic consequences for the patients, ranging from neurologic deficits to complete tetraplegia [5, 6].

Although most isolated atlas and axis fractures have been managed with cervical immobilization, the occurrence of the fractures in combination often implies a more significant structural and mechanical injury. The reported incidence of combination atlas and Hangman fractures ranges from 6 to 26 % [7]. Conservative treatment has successfully managed these acute combination fractures by semirigid or rigid external immobilization [7]. By contrast, the treatment of old, displaced combination fractures has not yet been established. Here, we report the case of a 74-year-old woman with an old, displaced combined fracture of C1 and C2 in the right facet joint that was treated by posterior–anterior reduction and fixation without pedicle screws in C2.

✉ Gen Inoue
ginoue@kitasato-u.ac.jp

¹ Department of Orthopaedic Surgery, Kitasato University School of Medicine, 1-15-1, Kitasato, Minami-ku, Sagamihara, Kanagawa 252-0374, Japan

Case presentation

A 74-year-old Japanese woman was hit by a car while walking. She was knocked down and transferred to an emergency hospital with brain contusion, pneumocephalus, and fractures of pelvis and left ankle joint. On arrival at the emergency hospital, the patient had impaired consciousness and hypovolemic shock. CT of the chest, abdomen, face, and brain was taken, but not of the cervical spine. After a transarterial embolization for the pelvis fracture, the patient was hospitalized with mechanical ventilation in an intensive care unit for 10 days until recovering consciousness gradually and extubated 10 days after her injury. There was no symptom concerning her neck or back during her hospitalization. Five months after injury, she recognized right-sided neck pain and headache, and visited to our hospital. No motor weakness or sensory impairment was observed. We conducted plain X-ray imaging and CT (Figs. 1, 2). Plain lateral X-ray images showed a slight kyphotic alignment, and in the anterolateral view of the upper cervical spine, irregularity of the right lateral atlantoaxial joint and osteophyte formation of left C2–C3 facet joint were noted (Fig. 1a, b). Coronal and three-dimensional (3D) CT revealed articular surfaces of both fractured atlas and axis were pinched (Fig. 2a, b), and in 3D CT angiography (3D-CTA), C1 was inclined to the damaged right side, and a left high-riding vertebral artery (VA) was noted.

We diagnosed her symptoms as induced by instability or deformity of C1 and C2, and possibly pedicular impingement of the C2 spinal nerve root. We performed posterior fusion surgery for C1 and C2. A pedicle screw was not inserted in both sides of C2, because of destruction of the insertional point on the right side and a high-riding VA on the left. Therefore, alternatively, a lamina screw and hook were used for C2, fixed with lateral mass screws in C1. The right atlantoaxial space was distracted to release the C2 spinal nerve root, and a rectangular-shaped unicortical bone graft and bone tips harvested from the iliac crest were transplanted onto the lamina of C1 and C2, and fixed with 3-mm-wide ultra-high molecular weight polyethylene cables (Fig. 3a, b).

Our patient became symptom-free several weeks after surgery, and presented no complication related to the surgery. Six months after the surgery, in CT, complete fusion of transplanted autograft with C1 and C2 was seen (Fig. 4a). The right atlantoaxial joint space was completely fused without bone grafting, maintaining a distracted alignment in the coronal plane (Fig. 4b). No influence on C2–C3 was noted. At 1-year follow-up, she still has no symptoms related to her neck or head.

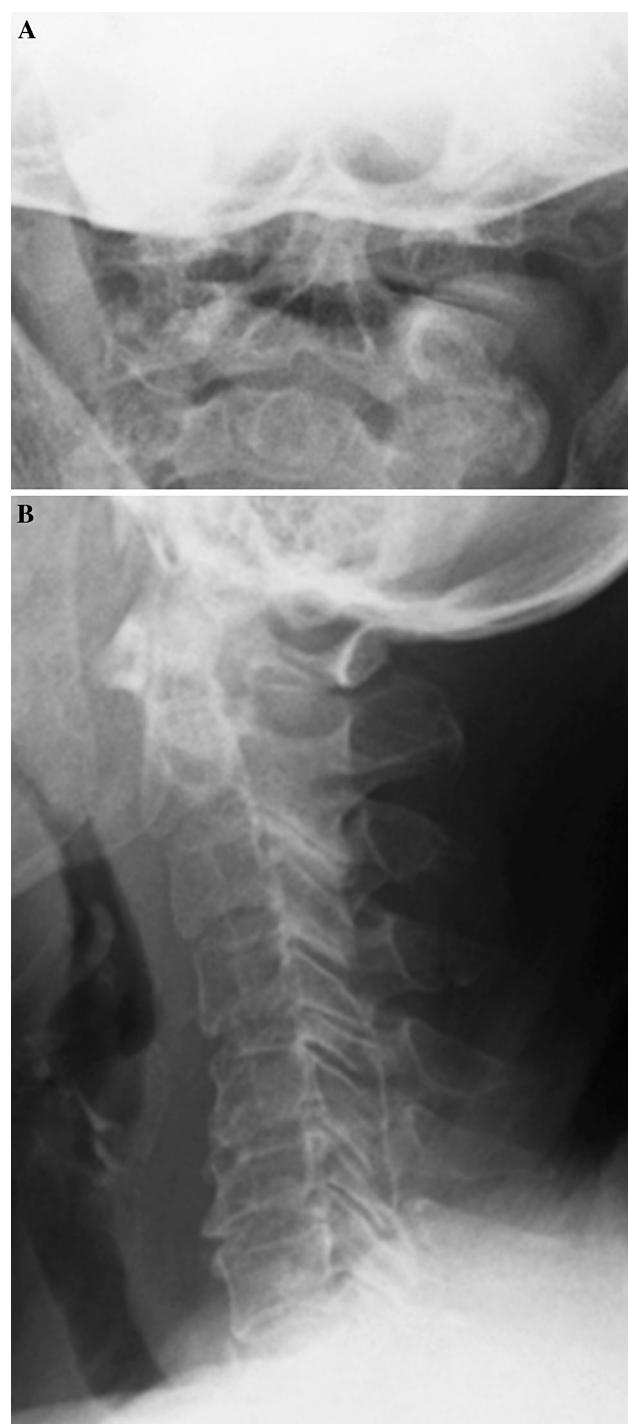


Fig. 1 Plain lateral X-ray images at 5 months after injury showed slight kyphotic alignment and irregularity of the right lateral atlantoaxial joint and osteophyte formation of left C2–C3 facet joint. **a** Anterolateral view of the upper cervical spine. **b** Lateral view

Discussion

We present a case of fractures of the right lateral atlantoaxial joint and C2 body diagnosed more than 5 months after injury, treated by C1–C2 posterior fusion

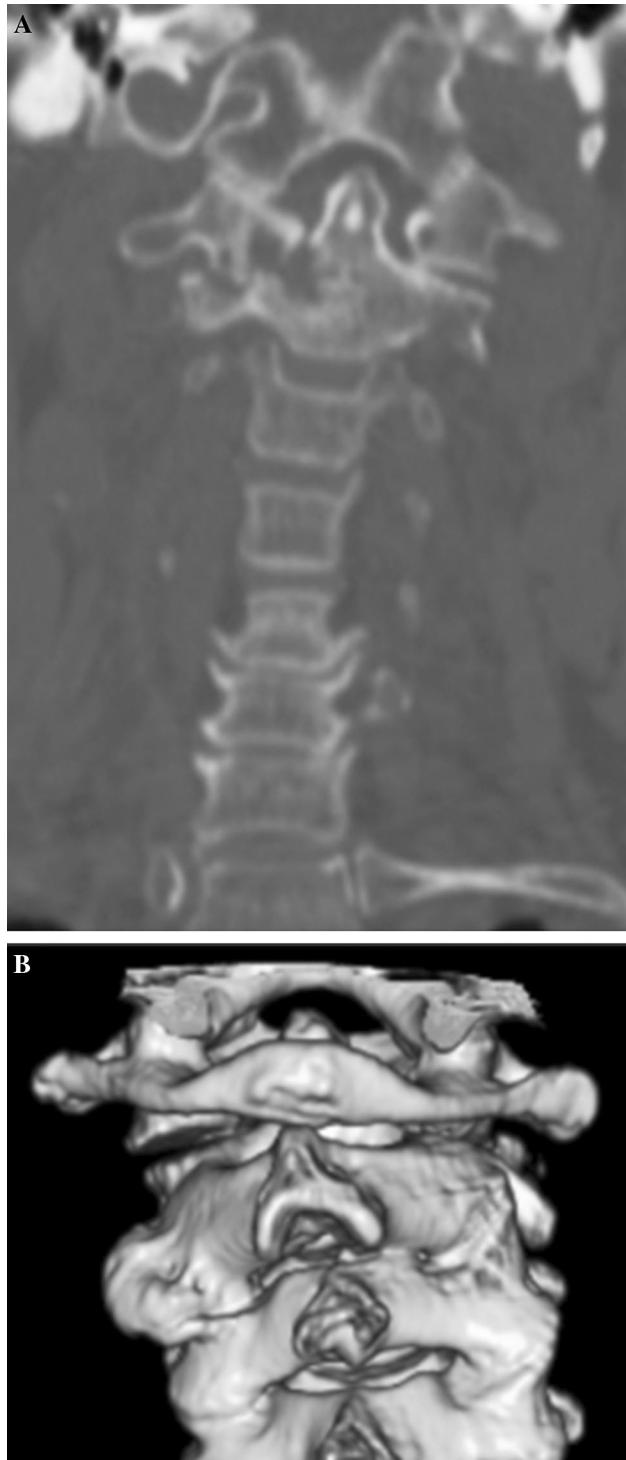


Fig. 2 CT revealed pinching of the articular surfaces of the fractured atlas and axis. **a** Coronal section. **b** Three-dimensional

surgery. After surgery, bony fusion was achieved, and our patient's neck pain and headache disappeared.

Of 682 patients with blunt trauma, 14 % had no neck complaints and there was no cervical spine injury in any

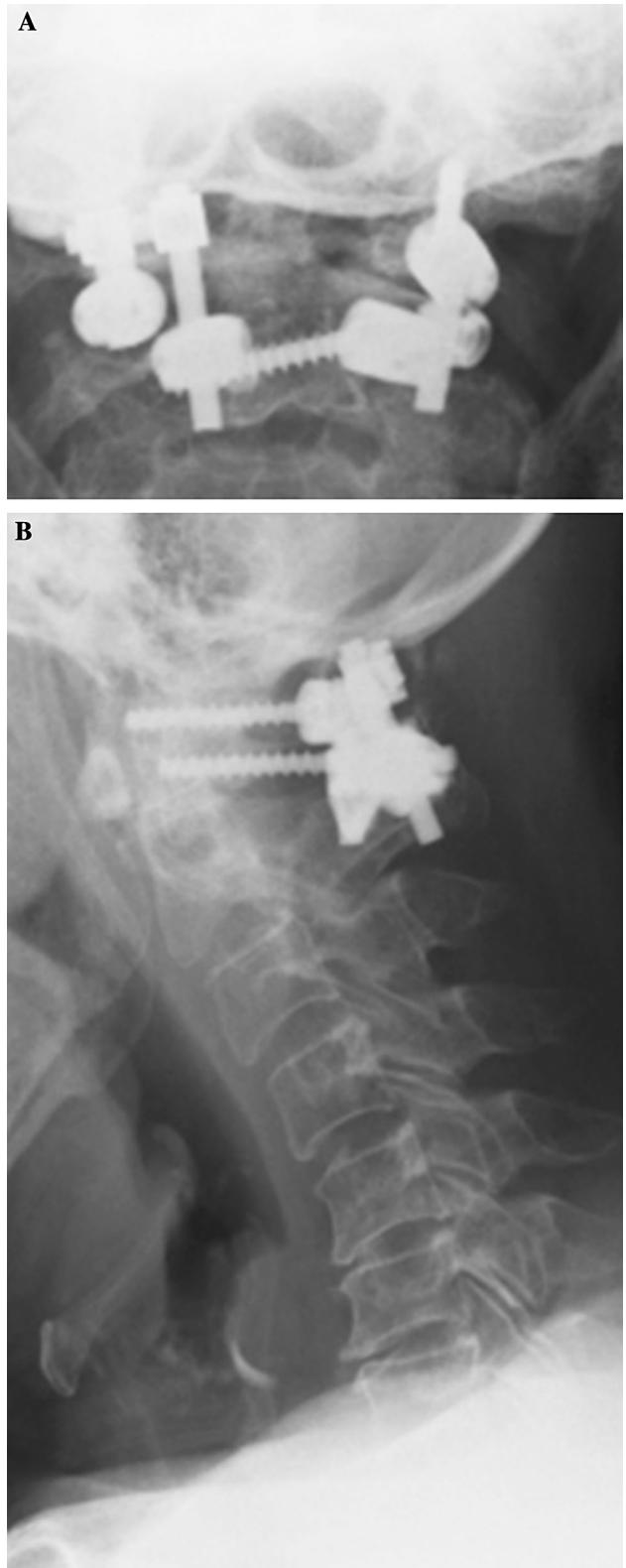


Fig. 3 Plain X-ray image after posterior fusion surgery for C1 and C2. A lamina screw and hook were used for C2, fixed with lateral mass screws in C1. **a** Anterolateral view. **b** Lateral view

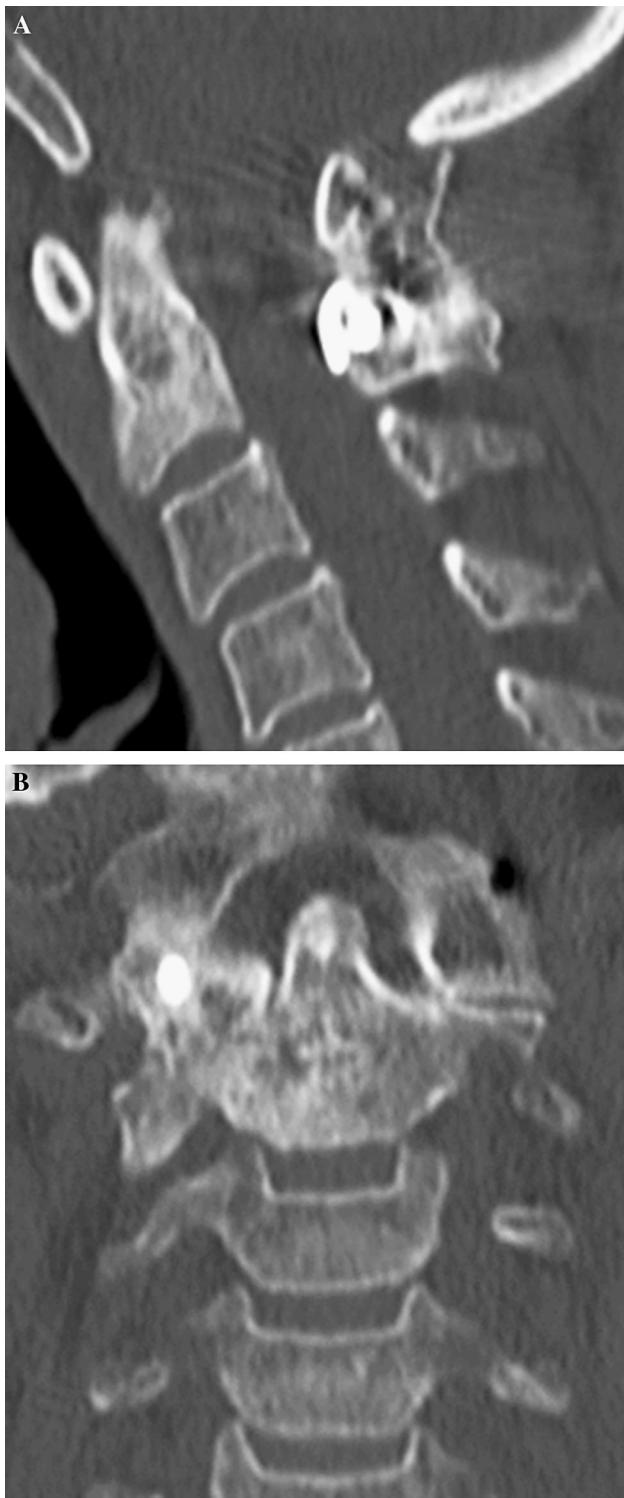


Fig. 4 CT 6 months after the surgery. Transplanted autograft was completely fused. Additionally, the right atlantoaxial joint space was completely fused without bone grafting, maintaining distracted alignment in the coronal plane. **a** Sagittal view. **b** Coronal view

patients, as evaluated by plain X-ray images, with antero-posterior, lateral, and open-mouth odontoid views [8]. A meta-analysis identified the sensitivity of plain X-ray

imaging to detect cervical spinal injury as just 52 %, whereas for CT it was 98 % [10]. Time efficiency and cost-benefit in CT were also reported, compared with plain X-ray imaging [11, 12]. MRI is reported to identify soft tissue damage such as cervical disc herniation, ligamentous injuries, meningeal tears, and spinal cord damage, even in cases with negative CT findings [13, 14]. For patients in whom cervical injury is suspected, the primary screening modality is axial CT from the occiput to T1 with sagittal and coronal reconstructions, whereas the effectiveness of cervical MRI in addition to CT remains unclear [15]. In the current case, brain, but not cervical spine CT was evaluated.

For acute fractures of the lateral atlantoaxial joint and C2 body, conservative treatment is usually indicated and priority is given to decompression of neurological structures and reperfusion of the tissue, followed by restoration of mechanical integrity [7, 16]. By contrast, few authors have reported surgical treatment for old, wedged fractures of this kind. In the current case, preoperative CT suggested encroachment of the C2 spinal nerve root. Therefore, distraction of the right C1 and C2 was considered necessary. Preoperative 3D-CTA is useful for identifying anomalous VA to reduce the risk of intraoperative injury [17]. In this case, 3D-CTA showed that it would be difficult to insert C2 pedicle screws, therefore, to ensure the safety, we alternatively used a lamina screw and hook for C2, fixed with a lateral mass screw in C1 [18, 19]. As a result, initial fixation was achieved successfully, and fusion using autologous iliac bone completed after 6 months, maintaining adjusted atlantoaxial alignment and pain relief.

To avoid unnecessary surgery we recommend surgeons recognize the possibility of cervical fractures that cannot be detected without CT, especially in patients comatose at injury.

Conflict of interest The authors declare that they have no competing interests.

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