

Cerebral infarction due to malposition of cervical pedicle screw

A case report

Jun Zhang, MD, Rongming Xu, PhD, MD*, Zheng Li, MD, Weibin Zha, BS

Abstract

Rationale: Malposition of cervical pedicle screw (CPS) has a risk of vertebral artery (VA) injury which sometimes may cause unexpected and catastrophic outcome. A rare case of delayed onset of cerebral infarction caused by malposition of CPS was reported.

Patient concerns: A 23-year-old man who underwent a posterior cervical reduction and fusion of C4–5 using CPS fixation and allograft for cervical spine injury is presented. The patient suffered progressively weakness and numbness for both of upper and lower extremities 1 day after the operation. Computed tomography scans revealed bilateral occupation of the pedicle screws in the foramen of C4 and C5 and the magnetic resonance imaging (MRI) displayed several areas of infarction in the brainstem and cerebellum.

Diagnoses: Plain radiographs of the cervical spine revealed the C4 vertebral body and MRI displayed a disruption of the anterior longitudinal ligament on the level of C4–5 and severe injury to the soft tissues of the cervical spine at admission. Brainstem and cerebellum infarction was diagnosed at postoperative.

Intervention: A revision surgery was decided to remove all of the pedicle screws and place lateral mass screws instead.

Outcomes: The patient felt better on his all of 4 extremities following revision surgery. Fortunately, he was neurologically close to normal at a 3-month follow-up.

Lessons: Delayed onset of cerebral infarction is rarely reported complication caused by malposition of CPS. When a CPS perforates the transverse foramen and causes symptom of cerebral infarction, a revision surgery in time is strongly recommended to prevent further sequelae.

Abbreviations: C4–5 = cervical vertebrae 4–cervical vertebrae 5, CT = computed tomography, CPSs = cervical pedicle screws, MRI = magnetic resonance imaging, VA = vertebral artery.

Keywords: cerebral infarction, cervical pedicle screw, cervical spinal trauma, revision surgery, vertebral artery injury

1. Introduction

Cervical pedicle screws (CPSs) which first introduced by Abumi and Jeanneret in 1994 have been widely used in the treatment of various degenerative, traumatic, and developmental spinal disorders.^[1,2] Comparative biomechanical study demonstrated that CPSs can provide greater stable fixation and higher pullout strengths than lateral mass screws.^[3] However, the use of CPS can lead to some potential risks such as vertebral artery (VA), spinal cord injury, which may sometimes cause a catastrophic

outcome.^[4,5] Besides, for the patients who have cervical trauma or instability, insertion of pedicle screws would become more complicated due to anatomical and morphological variations.^[5] Here, we present a case of a delayed cerebral infarction following CPS malposition because of pedicle screws' obstruction.

2. Case report

A 25-year-old man presented with severe neck pain without neurologic deficit after a traffic accident. The mental status of the patient was intact after admission. Physical examination showed tenderness and pain on the posterior aspect of the cervical spine. Neurologic examination revealed no deficit of motor power and sensation on all 4 of his extremities. Plain radiographs of the cervical spine revealed the C4 vertebral body slightly displaced anteriorly and increased interspinous space at the level of C4–5, magnetic resonance imaging (MRI) displayed a disruption of the anterior longitudinal ligament on the level of C4–5 and severe injury to the soft tissues of the cervical spine (Fig. 1). The patient underwent a posterior cervical reduction and fusion of C4–5 using pedicle screw fixation and allograft after admission. All pedicle screws were inserted by free-hand technique, that is, the pedicle was inserted according to the anatomical landmarks of cervical spine and self-medical experience without navigation. After creating a pilot hole and confirming no arterial bleeding or cerebrospinal fluid leakage, an appropriate pedicle screw was inserted (Fig. 2), C-arm machine was used to confirm the pedicle screw had no obvious deviation. The patient was neurologically

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The authors disclose no conflicts of interest.

Department of Orthopaedics, Mingzhou Hospital of Zhejiang University, Ningbo, Zhejiang Province, China.

* Correspondence: Rongming Xu, Department of Orthopaedics, Mingzhou Hospital of Zhejiang University, 168 Taian West Road, Ningbo, Zhejiang Province, China (e-mail: xmmzyy@163.com).

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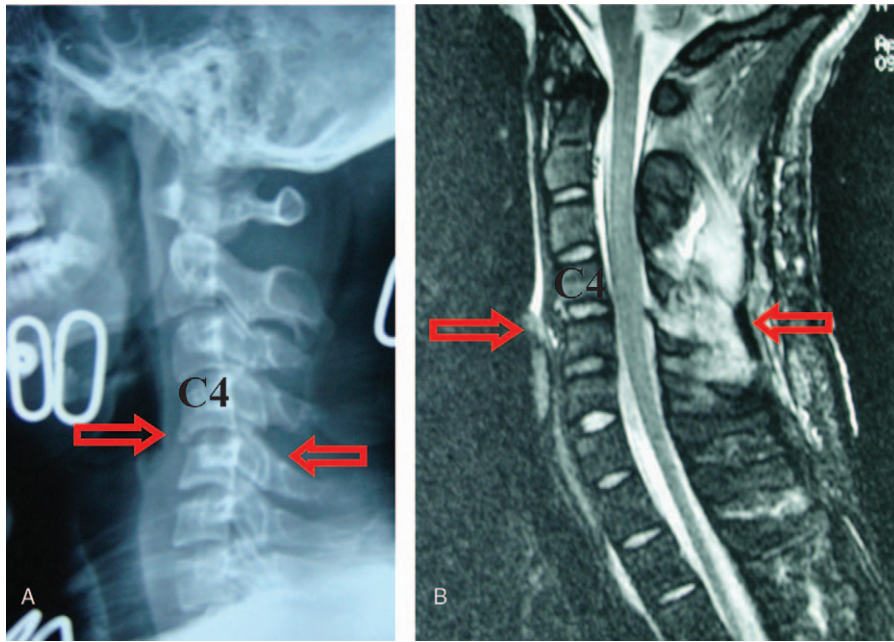


Figure 1. Plain radiographs of the cervical spine revealed the C4 vertebral body slightly displaced anteriorly and increased interspinous space at the level of C4–5 (A, the red arrow), MRI displayed a disruption of the anterior longitudinal ligament on the level of C4–5 and severe injury to the soft tissues of the cervical spine (B, the red arrow). MRI=magnetic resonance imaging.

intact after wake-up. However, the patient felt weakness and numbness for both of upper and lower extremities (motor power Grade II–III) in the next morning. Computed tomography (CT) scans of C4–5 and MRI of the brain were performed orderly and immediately. The CT scans revealed bilateral occupation of the pedicle screws of the foramen of C4 and C5 (Fig. 3) and the MRI displayed several areas of infarction of the brainstem and cerebellum (Fig. 4). Given that the symptoms of cerebral infarction may directly be caused by the occupation of bilateral VA, a second surgery was immediately decided to remove all of the pedicle screws and place lateral mass screws instead (Fig. 5).

The patient felt better on his all of 4 extremities following revision surgery. Fortunately, he was neurologically close to normal at a 3-month follow-up.

The ethical committee was waived for this retrospective study. Informed consent was obtained by patient himself.

3. Discussion

CPS is widely used in cervical surgery, compared with the lateral mass screw, CPS can provide greater stability and extraction force, however, CPS can also cause some intractable complica-

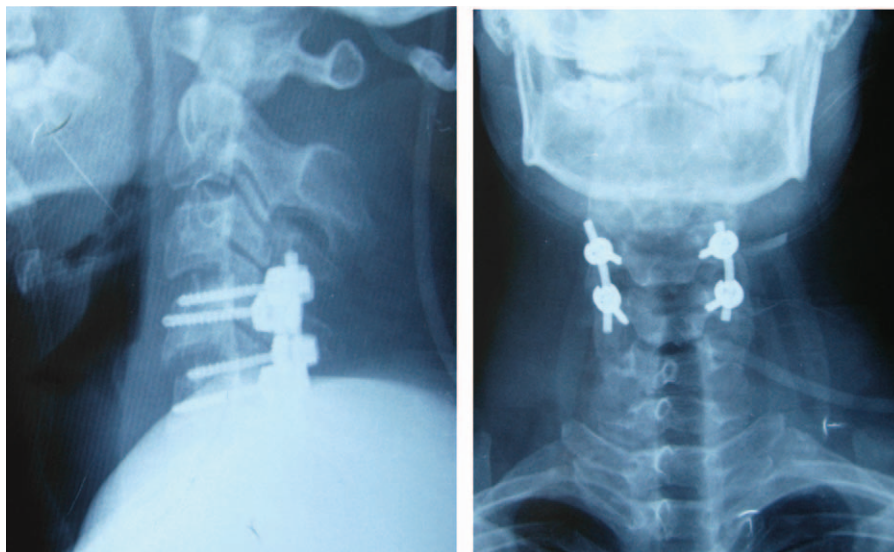


Figure 2. The patient underwent a posterior cervical reduction and fusion of C4–5 using pedicle screw fixation and allograft after admission. All pedicle screws were inserted by free-hand technique.

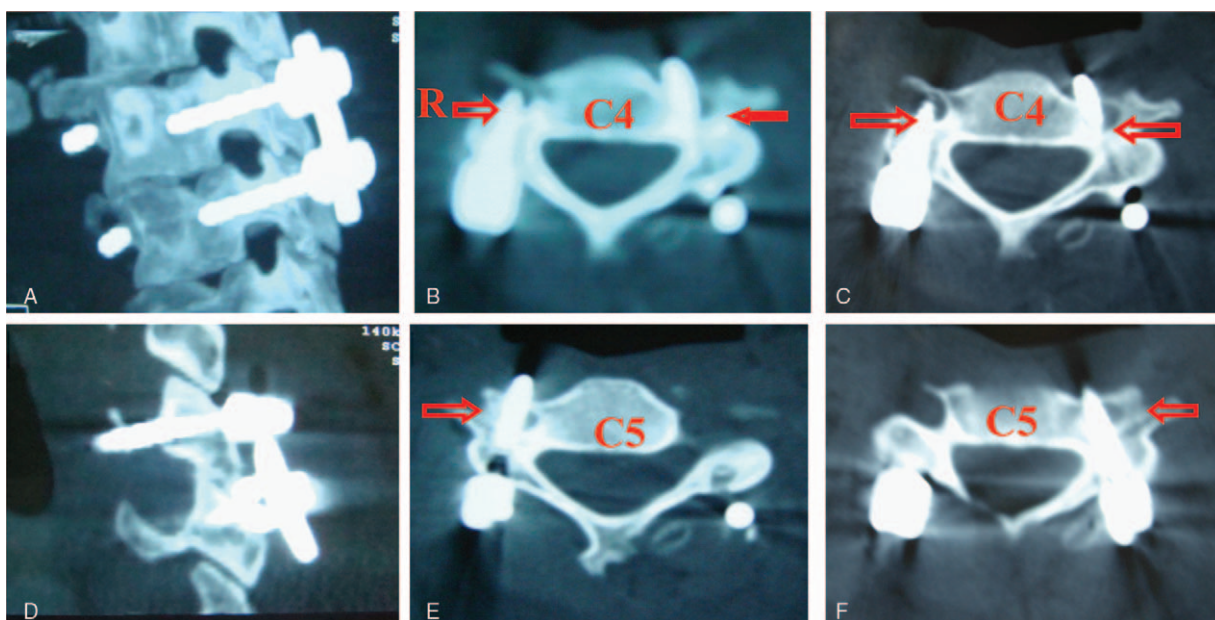


Figure 3. CT scans revealed bilateral occupation of the pedicle screws of the foramen of C4 and C5 (the red arrow). CT=computed tomography.

tions, such as spinal cord injury, nerve root injury, and vertebral artery injury, for the latter one, the results are often disastrous and complicated.^[6] Fortunately, the transverse foramen has enough space for most inbreaking screws and thus vertebral artery injury is infrequent. Abumi et al^[7] conducted a

retrospective study in 180 patients who were treated with CPS fixation, vertebral artery injury occurred in 1 patient. Another study by Neo et al^[8] reported 18 consecutive patients who submitted to CPS treatment, a total of 86 screws were inserted in degenerative vertebrae, and 21 (24%) deviated laterally and violated the transverse foramen, including 13 screws (15%) that deviated >2mm, however, no intraoperative vertebral artery or spinal cord injuries were encountered in their study. CPS implantation can also lead to cerebral infarction, although such occurrences may be very infrequent, the diagnosis and prognosis is always complicated and unexpected. Onishi et al^[9] reported a case with delayed onset (3 days after the operation) of cerebral infarction caused by an embolism after CPS fixation, the screws were removed after 2 weeks' anticoagulation therapy, however, the patient left hemiparesis, facial nerve palsy, and hearing loss in his left ear in the final follow-up.

In our case, the patient presented with sudden weakness and numbness for both of upper and lower extremities (motor power Grade II–III) in the next morning after the surgery, especially appeared the symptoms which cannot explain with preoperative condition, at this time, a routine CT examination should be conducted in early time, as soon as CPS broke through the transverse foramen was confirmed, especially bilateral CPS occupation, it should be noted that the occurrence of cerebral infarction, cerebral MRI should be conducted immediately, the reason was that MRI can detect tiny lesions after the cerebral infarction in early time. A revision surgery was conducted as we confirmed the cerebral infarction after 6 hours, lateral mass screws were used in revision surgery instead of CPS, although CPS can provide better stability, in this case, CPS may lead to increased probability of vertebral artery injury, lateral mass screws may be a better choice for revision surgery. The patient's symptoms were improved after the surgery and no obvious sequelae were found at a 3-months follow-up, which also suggest that early decompression of vertebral artery is recommended when cerebral infarction is confirmed, once the thrombus formation, later recovery may be unsatisfactory, at

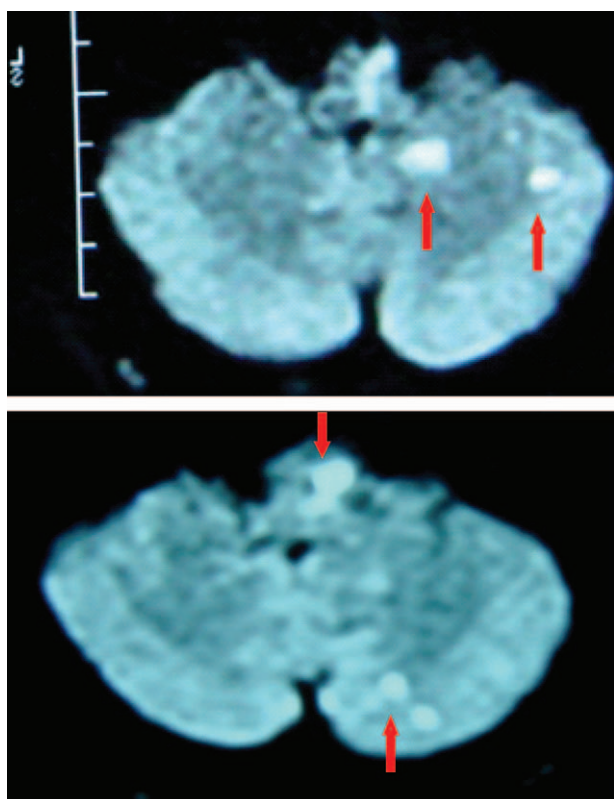


Figure 4. MRI displayed several areas of infarction of the brainstem and cerebellum (the red arrow). MRI=magnetic resonance imaging.

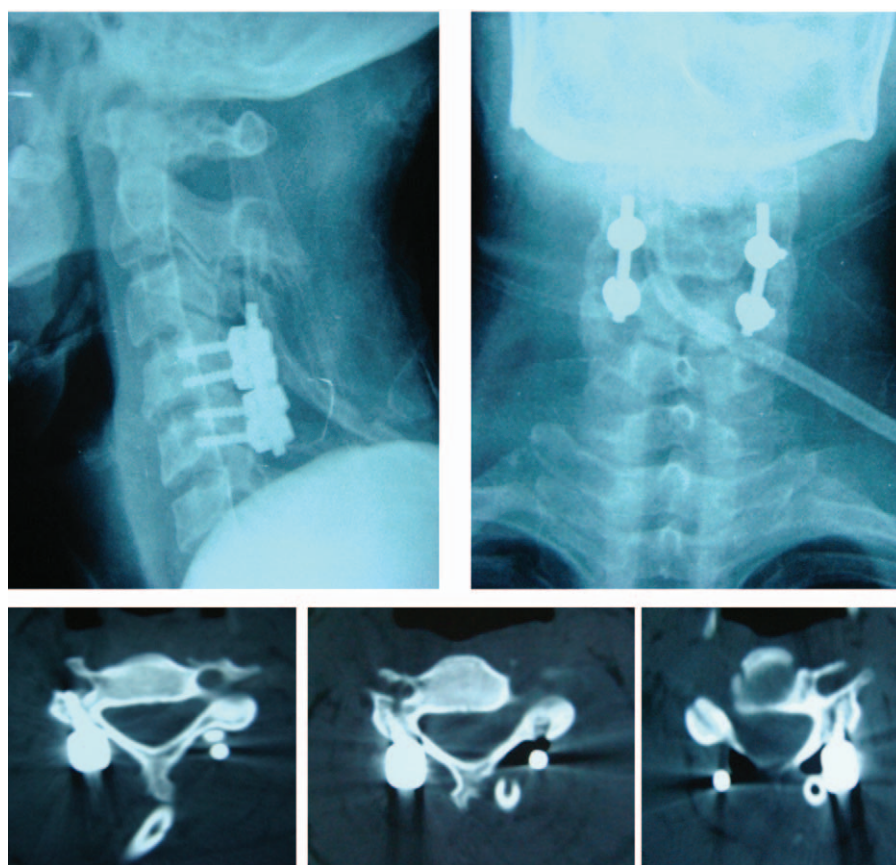


Figure 5. Revision surgery was immediately decided to remove all of the pedicle screws and place lateral mass screws instead. CT demonstrated VA decompression. CT=computed tomography, VA=vertebral artery.

the same time, vertebral artery injury should be aware during the removal of CPS. Yang et al^[10] reported 1 patient, who suffered vertebral artery injury during removal of C1 to C2 pedicle screw fixation, and the patient developed a sudden cerebral infarction 1 day after the surgery, the author reminded us that removal of upper CPS of malposition was not recommended if it was not really necessary for some other reasons.

CPS is a milestone in cervical spine surgery, however, free-hand CPS is a very demanding technique, learning cycle is relevant long, in recent years, with the development of navigation and 3D technology, CPS applications have become more and more secure,^[11,12] in spite of this, every patient has different and unique cervical condition, we still need to be alert to the unpredictable risks which may be caused by insertion of CPS and strive to minimize the complications.

4. Conclusions

Delayed onset of cerebral infarction is rarely reported complication caused by malposition of CPS. When a CPS perforates the transverse foramen and causes symptom of cerebral infarction, a revision surgery in time is strongly recommended to prevent further sequelae, of course, application with navigation in surgery is also imperative.

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