

Case Report

Sudden cerebral infarction after interventional vertebral artery embolism for vertebral artery injury during removal of C1-C2 pedicle screw fixation: a case report

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Abstract: Vertebral artery injury (VAI) is a rare but serious complication of cervical spine surgery. Instrumented posterior surgery of the upper cervical spine places the vertebral artery at the highest risk of injury. However, VAI during removal of cervical internal fixation is really rare and unexpected. We present a case of 52-year-old male patient who suffered VAI during removal of C1-C2 pedicle screw fixation. An interventional vertebral artery embolism was performed and the patient suffered a sudden cerebral infarction one day after interventional vertebral artery embolism. From this case, removal of upper cervical pedicle screws of malposition is not recommended if it is not really necessary for some other reasons. Interventional vertebral artery embolism is an effective and less invasive procedure than open ligation surgery in the treatment of haemorrhage resulted from VAI but potential risk of cerebral infarction should not be ignored.

Keywords: Vertebral artery injury, cerebral infarction, cervical spine, pedicle screw, endovascular

Introduction

Vertebral artery injury (VAI) is a rare but serious complication of cervical spine surgery, with the potential to cause arteriovenous fistula (AVF), pseudoaneurysm, hemorrhage, thrombosis, embolism, cerebral ischemia, and even death [1]. Results from previous studies have demonstrated that rates of VAI are associated with anterior cervical surgery at 0.2% to 0.5% and with posterior C1-C2 trans-articular fixation for atlantoaxial instability at 0% to 8.2% [2-4]. A well-performed survey with good response rate found that the most common three causes of VAI were posterior instrumentation of the upper cervical (C1-C2) spine (34.2%), anterior corpectomy (23.4%) and posterior exposure (11.7%) [5].

C1-C2 pedicle screw fixation has been widely applied in recent years due to its advantage of biomechanical characteristics. Ma et al. reported that the biomechanical stability of unicortical C1 pedicle screws provided the same pull-out resistance and three-dimensional stability

as bicortical C1 lateral mass screws and Zarro et al. found that unicortical C1 pedicle screw fixation has higher pull-out strengths than with the unicortical C1 lateral mass screw [6, 7]. However, because of the concern for neurovascular injury, the routine use of cervical pedicle screw fixation remains controversial [8]. VAI was reported to often occur in three procedure stages: approach, decompression and implantation of instruments. However, VAI during removal of cervical internal fixation is really rare. To the best of our knowledge, this is the first case report of vertebral artery injury during removal of C1-C2 pedicle screw fixation.

Case report

A 52-year-old male patient was performed atlantoaxial arthrodesis using C1-C2 pedicle screw fixation due to atlantoaxial dislocation 4 years ago. He presented at the department of orthopaedics and asked for removal of C1-C2 pedicle screw fixation 20 days ago. The operative X-ray showed evidence of bony fusion at the level of C1-C2 (**Figure 1**). A standard posterior

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Figure 1. Antero-posterior and lateral X-ray before operation of removal of C1-C2 pedicle screw fixation.



Figure 2. Antero-posterior and lateral X-ray after operation of removal of C1-C2 pedicle screw fixation.

approach to the upper cervical spine was used to remove the C1-C2 pedicle screw fixation.

After removal of pedicle screws, fresh pulsatile blood pumped out from the right C1 screw hole.

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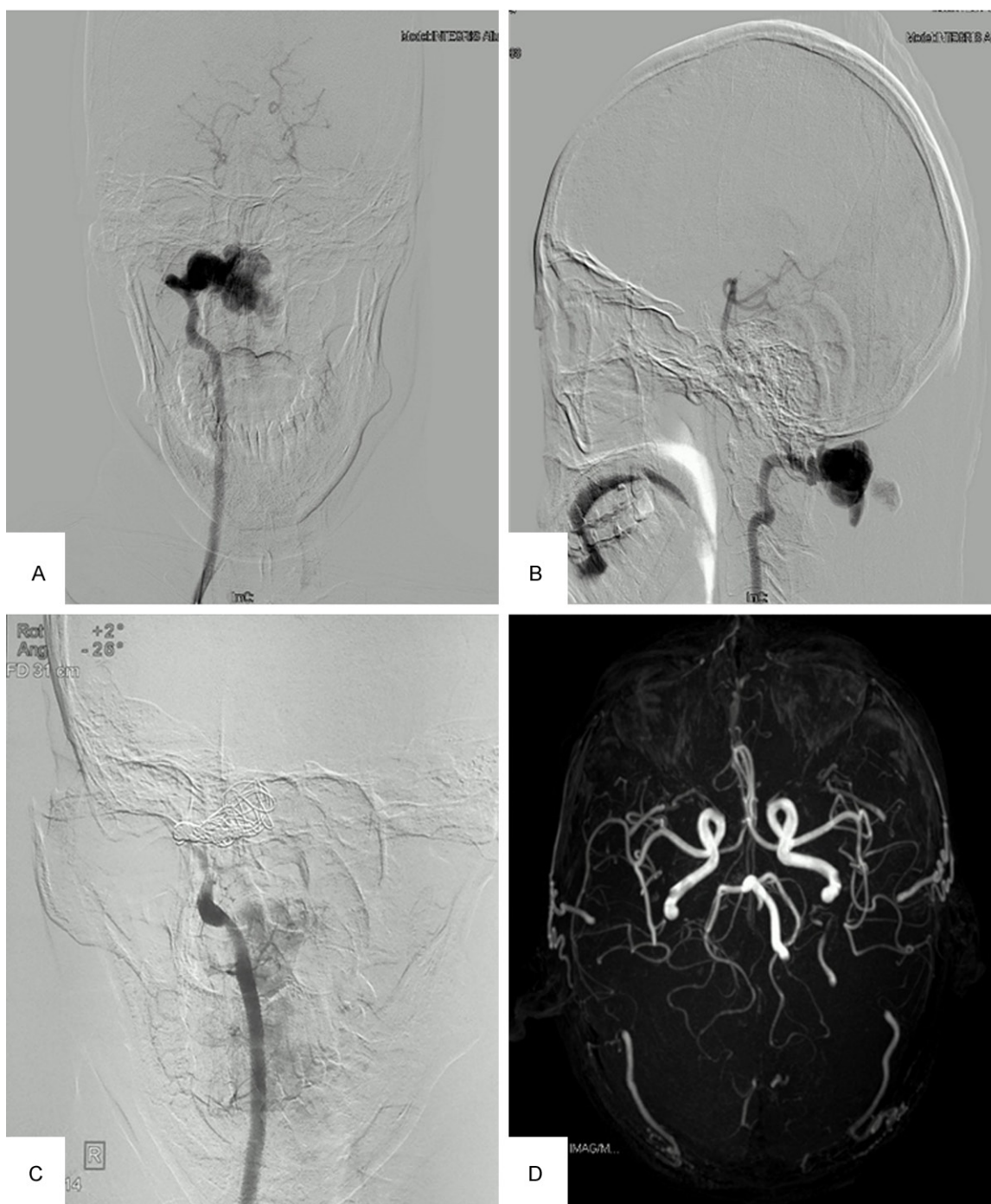


Figure 3. Vertebral artery angiography before interventional vertebral artery embolism (A, B), vertebral artery angiography after interventional vertebral artery embolism (C), magnetic resonance angiography after interventional vertebral artery embolism (D).

Then bone wax and hemostatic sponge were used for hemostasis. The postoperative X-ray showed successful removal of C1-C2 pedicle screw fixation (**Figure 2**). However, after operation the incision was bleeding seriously and the neck was swelling obviously. A second opera-

tion was performed to check hemostasis. The bleeding was becoming more and more seriously despite intensive surgical and non-operative treatments. Vertebral artery angiography confirmed the right vertebral artery injury (**Figure 3A, 3B**) and an interventional vertebral

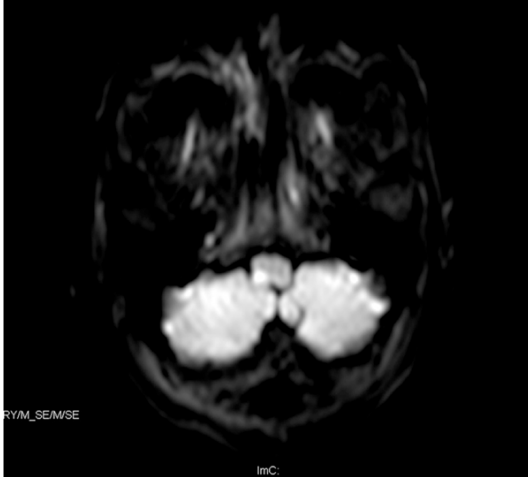


Figure 4. Diffusion weighted magnetic resonance imaging (one day after interventional vertebral artery embolism).

artery embolism was performed successfully (**Figure 3C, 3D**). However, one day after vertebral artery embolism the patient suffered a sudden cerebral infarction and diffusion weighted magnetic resonance imaging (DWMRI) showed multiple cerebral infarction in the right region of the medulla and cerebellum (**Figure 4**). After a 10-day intensive treatment, the patient survived with some neurologic impairment at last.

Discussion

Lateral mass screws have been widely used with a low complication rate in the cervical spine [9]. Cervical pedicle screws have been introduced in recent years, and are thought to provide more optimal stabilization of the cervical spine in certain circumstances. However, because of the concern for neurovascular injury, the routine use of cervical pedicle screws remains controversial. Yoshihara et al. reported in a systematic review that vertebral artery injuries were slightly but statistically significantly higher with the use of cervical pedicle screws relative to lateral mass screws in the cervical spine [10]. Results from a recent meta-analysis identified a higher risk of VAI, neurological injury, and clinically significant malpositions with transarticular screws compared with C2 pedicle screws [11].

Instrumented posterior surgery of the upper cervical spine places the vertebral artery at the highest risk of injury [12]. Preoperative evalua-

tion of the vessel course on advanced imaging, preferably a CT scan, can decrease the incidence of VAI. Surgical ligation of the distal and proximal ends of an injured lesion is the traditional method to treat VAI. Unilateral vertebral artery ligation can cause brainstem infarct and the incidence rate is 3.1% for the left and 1.8% for the right [13]. Endovascular treatment is reported to be safer and more effective than surgical ligation in the case of VAI, especially in a patient with life-threatening haemorrhage [14, 15].

In this case the preoperative X-ray showed the position of screws was not so good. VAI during removal of pedicle screws is really rare and unexpected. An interventional vertebral artery embolism was performed when the bleeding became more and more seriously despite intensive surgical and non-operative treatments. The patient suffered a sudden cerebral infarction one day after interventional vertebral artery embolism. Several mechanisms may explain the causes of the cerebral infarction: ischemic cerebral infarction resulted from right vertebral artery embolism directly, detachment of a previous thrombus and primary intravascular thrombosis in the right vertebral artery. However, to the best of our experience, we think ischemic cerebral infarction resulted from right vertebral artery embolism directly is most likely.

From this case, we think that preoperative evaluation of the vertebral artery course on CT scan is seriously needed, even before a surgery of removing pedicle screw fixation. Removal of upper cervical pedicle screws of malposition is not recommended if it is not really necessary for some other reasons. Interventional vertebral artery embolism is an effective and less invasive procedure than open ligation surgery in the treatment of haemorrhage resulted from VAI but potential risk of cerebral infarction should not be ignored.

Disclosure of conflict of interest

None.

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