Atlantoaxial Fixation in a Patient with Bilateral Persistent First Intersegmental Vertebral Artery Anomaly Using an O-arm Navigation System: A Case Report

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Several variants of the vertebral artery (VA) have been reported, including those in the extraosseous and intraosseous regions of the craniovertebral junction (CVJ)[1]. The extraosseous variants include persistent first intersegmental vertebral artery (PFIA) and fenestration. Atlantoaxial fixation for PFIA or fenestration is challenging because C1/2 transarticular screws (TAS) and screw rod constructs with C1 lateral mass screws (LMS) and C2 pedicle screws are required to expose the bony landmarks, including the C1/2 joint, C2 pedicle, and C2 isthmus, where the anomalous VA is located[2-4]. Yamazaki et al. performed fusion in patients with an anomalous VA in the extraosseous region of the CVJ[1]. Although occipitocervical fusion provides rigid and secure fixation for various kinds of lesions around the craniocervical junction, it decreases the range of motion of the cervical spine and may cause dyspnea and/or dysphagia postoperatively.[5,6]

Here, we describe a patient with bilateral PFIA and atlantoaxial subluxation who was successfully treated with TAS using an O-arm navigation system (O-arm).

A 53-year-old woman presented with severe pain in the left occipital region. She had been treated for rheumatoid arthritis for 10 years. Results of neurological examination were normal. Preoperative radiographs revealed an increased atlas-dens interval (Fig. 1a). MRI showed no spinal stenosis or high-intensity signal on T2-weighted images at C1/2 (Fig. 1b). Preoperative three-dimensional computed tomography (CT) angiography revealed bilateral PFIA but no congenital skeletal anomaly (Fig. 2).

Surgery was planned because of the severe left occipital pain. Fixation could not be performed using screw rod constructs because the PFIA ran across the entry points of the LMS at C1. Furthermore, conventional TAS with exposure of the C2 isthmus and C1/2 joints[7] was not possible because of the presence of PFIA. Therefore, we performed TAS fixation and Brooks'procedure using an O-arm without exposing the C2 isthmus and C1/2 joints.

After induction of general anesthesia, the patient was placed in the prone position. A midline incision was made to expose the C1 posterior arch, C2 lamina, and cranial side of the C3 lamina. Next, 3-mm Nesplon tapes (Alfresa Pharma, Osaka, Japan) were passed under the C1 posterior arch and C2 lamina. A Doppler echo probe was used to confirm the position of the VA during these steps. A Nesplon tape was tightened for the temporary fixation of C 1/2 joints. The starting point of the TAS was confirmed using an O-arm, and screw holes were made with a navigated drill guide, through which 4-mm screws were inserted (Fig. 3a, b). The bone graft was harvested from the iliac crest and placed using Brooks'procedure with Nesplon tape.

Severe pain in the left occipital region disappeared just after surgery. The patient wore a cervical collar until bone union was confirmed with CT three months after surgery.

Here, we describe a patient with PFIA in whom we performed atlantoaxial fixation using an O-arm. Atlantoaxial fixation using an O-arm has previously been reported[8,9]. Wada et al. reported insertion of LMS at C1 caudally from the C2 nerve root using an O-arm, with no screw malpositioning observed on postoperative CT[8]. Hitti et al. reported less blood loss when fixation of the upper cervical spine was performed with navigation rather than without[9]. They also reported that the use of an O-arm avoided the need to

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Figure 1. Preoperative X-ray showing atlantoaxial subluxation in lateral view in flexion position (a). Preoperative sagittal view of MRI T2 weighted image showing no spinal stenosis or high-intensity signal in atlantoaxial level (b).

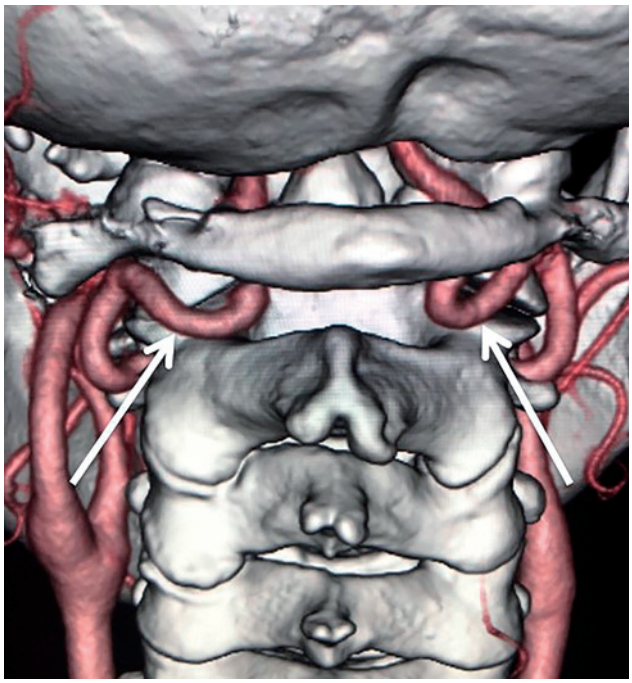

Figure 2. Posterior view on three-dimensional computed tomography angiography showing bilateral persistent first intersegmental artery (white arrow).

expose any bony landmarks when placing TAS for atlantoaxial fixation. We, therefore, applied an O-arm for this case, as it could minimize the exposure of the bony landmarks where the PFIA was located. However, screw malposition in cervical spine with an O-arm has been reported[10]. Thus, we need to recognize the potential risks of using an O-arm.

Conflicts of Interest: The authors declare that there are no relevant conflicts of interest.

Author Contributions: Hideaki Kashiro wrote and prepared the manuscript. All authors participated in the study design. All authors have read, reviewed, and approved the article.

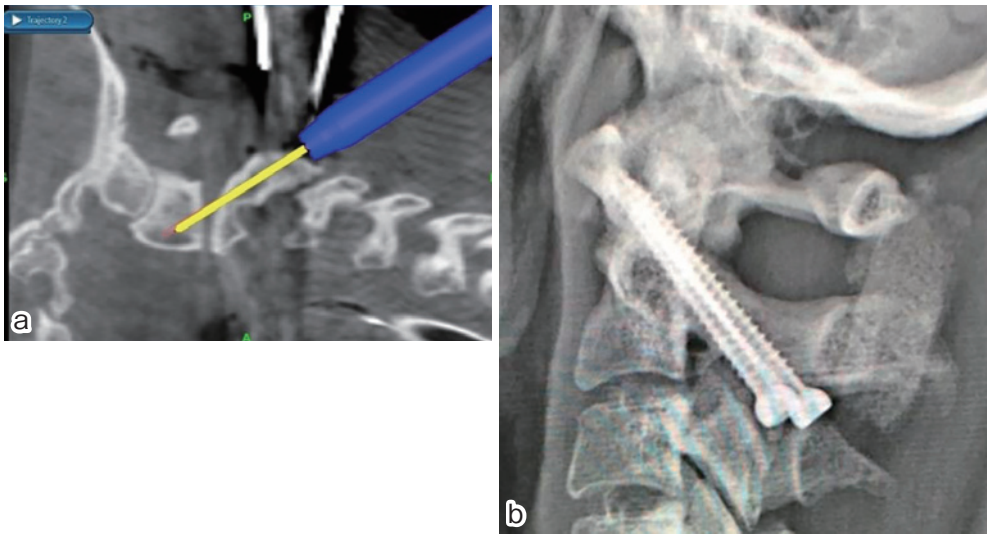

Figure 3. Intraoperative navigation images showing screw holes made with navigated drill guide from the starting point (a). Postoperative X-ray showing proper transarticular screw position (b).

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