Atlantoaxial Fixation using Rod and Screw for Bilateral High-riding Vertebral Artery

Dong Yeob Lee, M.D.,¹ Chun Kee Chung, M.D.,² Tae-Ahn Jahng, M.D.²
Department of Neurosurgery,¹ Woordal Spine Hospital, Seoul, Korea
Department of Neurosurgery,² Seoul National University College of Medicine, Seoul, Korea

We report a case of atlantoaxial subluxation with bilateral high-riding vertebral artery with narrow isthmus. Because of the potential risk of bilateral vertebral artery injury, we performed atlantoaxial fixation using rod and screw instead of transarticular screw fixation. Although postoperative computed tomography reconstruction demonstrated slight breach of bilateral vertebral artery groove, postoperative angiography showed no evidence of vertebral artery injury. Though technically demanding, atlantoaxial fixation using rod and screw can be one of the treatment options for atlantoaxial instability with bilateral high riding vertebral artery.

KEY WORDS : Atlantoaxial · C2 screw · High-riding vertebral artery.

Introduction

Posterior atlantoaxial transarticular screw fixation, which was developed by Magerl⁸, has been widely used as a fixation method for atlantoaxial instability⁹,¹⁰,¹¹. However, vertebral artery injury, one of the major complications of this procedure, sometimes results in fatal condition¹². An anatomical study showed that in 20% the vertebral artery groove on one side was large enough to prevent the safe passage of transarticular screw⁹. Neo et al⁹, who reported atlantoaxial screw fixation for unilateral high-riding vertebral artery, however, suggested that via the safest trajectory - the most medial and posterior part of the isthmus of C2 - transarticular screw fixation was feasible even with a high-riding vertebral artery. But in case of bilateral high-riding vertebral artery, other treatment should be considered because of the potential risk of bilateral vertebral artery injury. We report a case of atlantoaxial instability with bilateral high-riding vertebral artery treated using rod and screw.

Case Report

A 52-year-old female presented with a 3-year history of quadriparenesis and, for 10 years, tingling sensation on four extremities. On neurological examination, she demon-

Fig. 1. A : Lateral x-ray showing atlantoaxial subluxation. B : Extension lateral radiograph showing full reduction of the subluxation.
Therefore we thought that it was impossible to perform atlantoaxial transarticular screw fixation without violating bilateral vertebral artery and we decided to perform atlantoaxial screw fixation using rod and screw though maximum width of bilateral C2 pedicle was only 3.6mm (Fig. 3D).

**Intervention**

Under general anesthesia, the patient was placed in prone position. After identifying medial and lateral edge of C2 pedicle, polyaxial screw of diameter 3.5mm was inserted along superomedial portion of C2 pedicle aiming the base of the odontoid process using fluoroscopy. Then C1 lateral mass screw was placed into atlas aiming anterior tubercle of C1. To pass sublaminar wire under the C1, we performed minimal removal of the occiput. Pulling the sublaminar wire, we performed intraoperative atlantoaxial reduction. Then two screws were connected and fixated with rod. After bilateral fixation, bone graft was fitted and fixated between C1 lamina and C2 spinous process with wire (Fig. 4).

**Postoperative course**

Postoperatively she did not showed any new focal neurological symptoms and signs. CT reconstruction images obtained immediately after surgery revealed bilateral partial compromise of vertebral artery groove (Fig. 5A). Postoperative cerebral angiography showed, however, no evidence of vertebral artery injury (Fig. 5B, C).

**Discussion**

In the present case, we thought that it was impossible to perform atlantoaxial transarticular screw fixation, which provides the highest degree of stiffness as a threepoint fixation. With Occipito-cervical fusion technique, however, long segment should be fixated. Furthermore it does not provide stiffness
bone was present at bilateral C-2 pedicle. Therefore we carefully performed C-2 pedicle screw fixation along superomedial portion of the pedicle. CT reconstruction images obtained after operation revealed bilateral breaching of the vertebral artery groove but bilateral vertebral artery was intact on angiography, as expected.

**Conclusion**

Although technically demanding, atlantoaxial fixation using rod and screw can be one of the treatment options for atlantoaxial instability with bilateral high-riding vertebral artery.

**References**