**Introduction**

The odontoid process of the second cervical spine is the main axis of rotational movement between the first and second cervical spines and prevents dislocation of atlantoaxial joint. The stability of the atlantoaxial joint is maintained by bones (odontoid process and anterior arch of C1) and ligamentous structures (transverse ligament, alar ligaments, accessory atlantoaxial ligaments, and tectorial membrane). Abnormalities in these structures can lead to atlantoaxial instability. Among numerous causes, hypoplasia of the odontoid process is rare and may be associated with atlantoaxial instability. If the atlantoaxial instability has occurred from odontoid process hypoplasia, neurological symptoms may develop due to vascular compromise or spinal cord compression.

The internal fixation has been performed to treat the atlantoaxial instability. Surgical stabilization is accomplished through posterior approach or through combined transoral and posterior approach. For stabilization of the C1-C2 joint, posterior transarticular screw fixation is widely performed.

**Case Report**

A 38 year-old man was admitted to the hospital complaining of severe neck pain and a tingling sensation on his right upper extremity. The family history was not specific. He said he suffered from temporary quadriplegia after rolling down the stairs. Motor weakness was not checked at the time of the visit.

Physical and neurological findings: His general condition was good and his vital signs were normal. He complained of pain along the cervical spine. The tenderness at his upper cervical spine was checked through physical examination. The muscle power of his upper extremities was normal and there was no finding of muscular atrophy. The hypesthesia along the dermatome of the sixth cervical spinal nerve was observed. The reflexes of deep tendon were normal. There was no abnormal reflex.

Radiological findings: The open mouth view showed odontoid process hypoplasia. The instability between the C1 and C2 spines was visible on cervical hyperextension-hyperflexion plain films. The magnetic resonance imaging revealed a bony defect at the base of the odontoid process and an abnormal soft tissue replacing this defect. This soft tissue protruded posteriorly and compressed the cervical spinal cord on T2-weighted images.

Operation and clinical course: The patient underwent posterior transarticular screw fixation. The screws were inserted toward the dorsal cortex of the C1 anterior arch through the center of the C2 pars interarticularis and lateral...
fluoroscopy images were obtained simultaneo-usly to guide precise screw placement. Two threaded 3.5-mm-diameter screws were inserted. After both screws were fixed, interspi-nous wiring between the C1-2 spinous processes was performed with an iliac crest bone graft (Fig. 4). The pain on the cervical region and the abnor-mal sensation on the right upper extremity were mark-edly reduced immediately after operation. Normal ambulation became possible three days after operation with Thomas collar.

Discussion

C ongenital malformations of the odontoid process are rare and classified into three types: os odontoideum, ossiculum terminale, and aplasia-hypoplasia. Among them, os odontoideum is the most common type. However, their classification is of limited importance, because they usually lead to atlantoaxial instability and clinical features and treatment are identical.

The clinical presentation of patients with odontoid anomalies varies from local discomfort to progressive myelopathy. Minor trauma is commonly associated with onset of symptoms. The symptoms result from atlantoaxial instability. Mechanical symptoms due to local irritation of the atlantoaxial articulation manifest as neck pain, headache or torticollis. Neurological symptoms are due to atlantoaxial displacement and spinal cord compression. Involvement of cranial nerve is rare. Symptoms and signs of cerebral and brain stem ischemia, seizures, mental deterioration, syncope, vertigo and visual disturbances may result from vertebral artery compression.

The management of patients with odontoid anomalies can be difficult. Patients with local symptoms or transient myelopathies may recover temporarily. Cervical traction or immobilization may be helpful in such situations. Management of patients whose symptoms are minimal is controversial. Prophylactic stabilization is usually advised to these patients to prevent the catastrophic dangers of instability with secondary cord pressure. The main objectives of surgical treatment are to decompress the cervical cord and to stabilize the atlantoaxial joint. Surgical stabilization is indicated if there is neurological involvement, if there is instability of 10mm or more in flexion and extension, if there is progressive instability, or if there are persistent neck complaints associated with atlantoaxial instability. The atlantoaxial displacement should be reduced before operation by positioning of the head or skull traction. Then the patient should be maintained in the reduced position one to two weeks before operation to allow recovery of neurological function and to lessen spinal cord irritation. Open reduction during surgery should be avoided, because it may cause respiratory distress, apnea or death.

Several methods have been devised to stabilize the C1-C2 joint. Anterior approach through oral cavity has a high risk of infection and additional posterior instrumentation is usually required due to possibility of postoperative progressive instability. Posterior atlantoaxial fusion methods include wiring techniques, interspinous fusion, interlaminar Halifax
clamps, and posterior transarticular screw fixation. These methods except for posterior transarticular screw fixation are easy to perform and the incidence of associated neural injury is low. However, they do not provide rigid internal fixation and the postoperative fusion rate is not so high unless supplemented with a halo brace\(^{1,3}\). The posterior transarticular screw fixation, which was first developed by Magerl and Seemann in 1982 provides rigid internal fixation and high fusion rate\(^{11}\). Preoperatively, the alignment of C1-C2 and the architecture of the C1 lateral masses and C2 facets should be evaluated. C1-C2 alignment must be restored to obtain the proper screw trajectory. The course of vertebral artery at the C1-C2 joint also should be assessed. Comminuted fractures of C1 and C2, tumors involving the C1 lateral masses, and an abnormal vertebral artery are contraindication to this technique. Care should be taken while penetrating the bone. If the direction of puncture is far lateral or inferior, injuries on the vertebral artery may occur and if far medial, injuries on neural structures may also occur\(^{12}\). The posterior transarticular screw fixation is always supplemented with an autologous bone graft to gain fusion. The posterior arches of C1 or C2 should evaluated preoperatively not to preclude wire or cable fixation. When the atlantoaxial displacement cannot be reduced before operation, there are several treatment options. For patients with no neurological deficit, a simple posterior fusion is the choice of treatment. When there is a neurological deficit, and decompression is needed, the combined transoral and posterior approach is suitable\(^ {6,7}\).

In authors’ case, surgical management was needed because the causative atlantoaxial instability due to odontoid process hypoplasia and the resultant clinical manifestation were evident. After preoperative evaluation, to obtain rigid internal fixation and postoperative fusion, posterior transarticular screw fixation was performed. The symptoms of the patient were improved after operation and stabilization of the atlantoaxial joint was obtained.

**Conclusion**

The authors report a case of atlantoaxial instability due to odontoid process hypoplasia, with posterior C1-C2 transarticular screw fixation and interspinous wiring after careful preoperative evaluation and obtained the satisfactory postoperative results.

**References**