

Osteochondroma of the C2 Vertebral Body Totally Resected Using an Intraoperative O-arm Navigation System: A Case Report

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The incidence of osteochondroma in the vertebrae is very low¹. Only a few cases of osteochondroma at the C2 vertebra are reported in the literature². Removing the tumor at the C2 vertebral body is technically demanding. Removing the tumor from the anterior might be a more rational method; however, an invasive transoral approach with occipitocervical fusion might be required³. Removing the tumor using a posterior approach is less invasive, though it might cause spinal cord deterioration, unless the procedure is precisely and carefully performed. Several authors have reported the usefulness of the O-arm for upper cervical spine surgery⁴⁻⁶. However, there have been no reports of the removal of a bone tumor at the C2 vertebral body using the O-arm. Here we describe a patient with osteochondroma at the C2 vertebral body, which was totally resected by a posterior approach using the O-arm.

A 77-year-old man came to our hospital with numbness of the right upper limb and gait disturbance. Preoperative contrast-enhanced 3D CT revealed a bone tumor at the C2 vertebra body (Fig. 1). MRI T2-weighted images showed the tumor compressed the spinal cord from the right ventral side (Fig. 2). Surgery was planned because of his neurological symptoms. Because the tumor was partly located at the ventral side to the spinal cord, knowing the accurate location of the tumor was required to remove the tumor safely and completely. Therefore, the O-arm was used for surgery.

After the induction of general anesthesia, the patient was placed in a prone position. MEP monitoring was used during surgery. A midline incision was made to expose the C1 posterior arch and the C2 lamina. The right venous plexus at the C1-2 was shrunk, and no massive bleeding was observed. The right C2 nerve root was compressed to a cranial

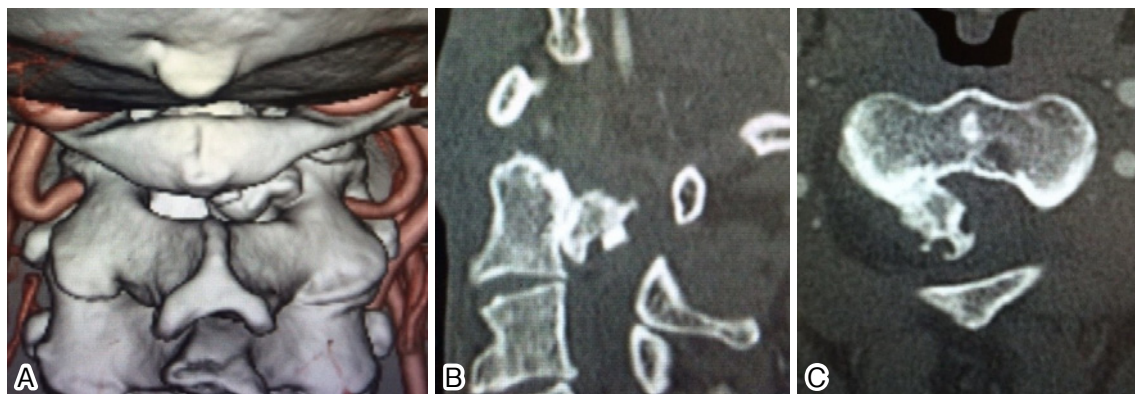


Figure 1. Preoperative contrast-enhanced computed tomography showing the location of the tumor. (A) 3D reconstruction (B) Sagittal (C) Axial view.

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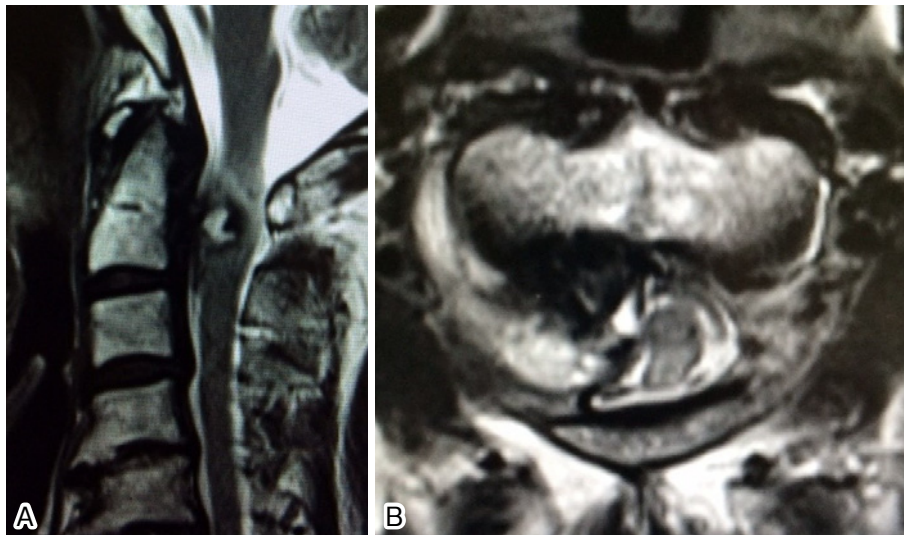


Figure 2. Preoperative magnetic resonance image showing severe spinal cord compression from the right ventral side (A, B).

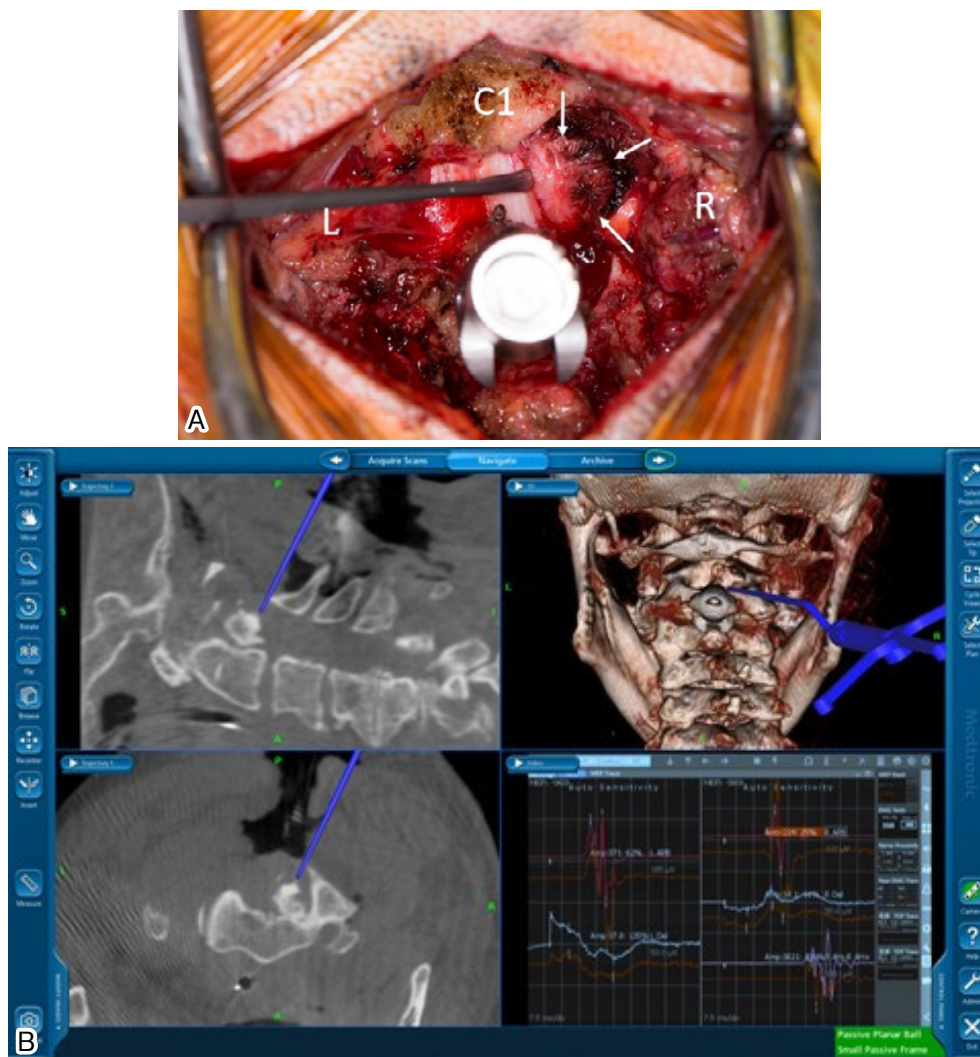


Figure 3. Intraoperative images. Intraoperative photograph showing compression of the spinal cord by the tumor (white arrow) (A). Navigation screen clearly showing the location of the tumor (B).

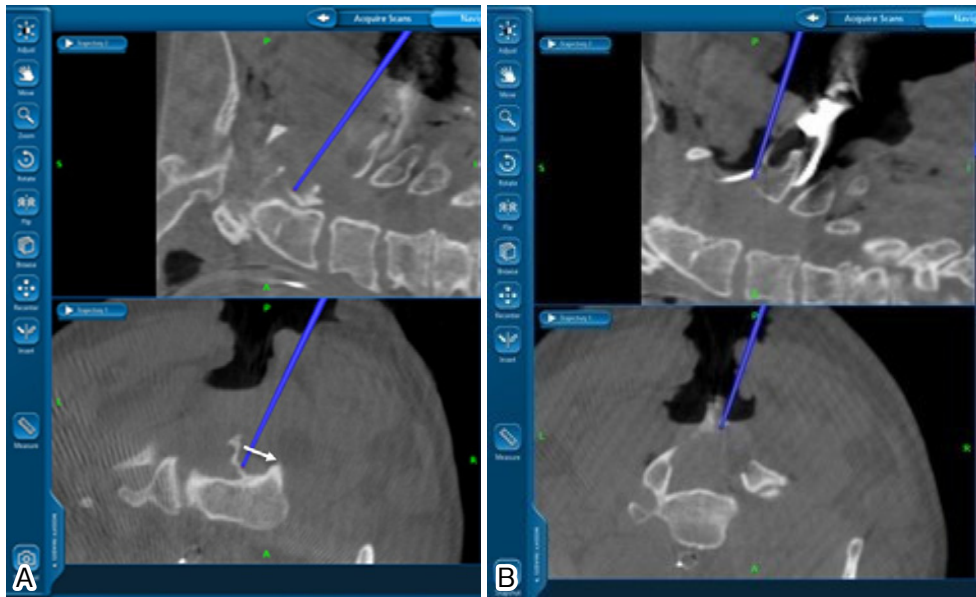


Figure 4. Navigation screen. The inside part of the tumor was removed, and the remnant of the tumor was chipped down and removed (white arrow) (A).

side. The tumor was exposed easily (Fig. 3A). Next, the reference frame was attached to the C2 spinous process, and an O-arm scan was performed. Using O-arm navigation, we could recognize the location of the tumor precisely (Fig. 3 B). First, we removed the inside part of the tumor using a high-speed drill burr, and a second O-arm scan was performed. Then, the remnant of the tumor was chipped down. A third O-arm scan was performed after complete resection of the tumor (Fig. 4). Postoperative histopathology revealed osteochondroma. His neurological symptoms completely disappeared three months after surgery.

The treatment of a bone tumor using the O-arm has been reported^{7,8)}. Ando et al. reported that 18 surgical cases of primary spinal tumors used the O-arm. They concluded that O-arm use improved the safety and oncological results because they could confirm the location of the tumor precisely and reconfirm the complete resection of the tumor during surgery. In our case, the osteochondroma was placed at the C2 vertebral body and compressed the spinal cord from the ventral side. To remove the tumor safely, we needed to recognize the location of the tumor precisely and the status of the tumor resection during surgery. As shown in Fig. 3B, the location of the tumor was clearly seen using the O-arm. In addition, we would know how much of the tumor was resected during surgery, and further strategies could be made (Fig. 4 A). Another advantage is that tumor resection can be confirmed during surgery. We did not perform an intraoperative pathological exam on the tumor because the CT and MRI did not show the typical appearance of a malignant tumor, such as bone destruction or an invasion to the surrounding tissues. In summary, O-arm navigation is useful for the removal of bone lesions in the spine, especially if they are located in an area where an approach is difficult. However, a disadvantage of the O-arm is that the patients are exposed to radiation, as we need to perform a CT scan during the pro-

cedure.

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

Ethical Approval: unnecessary

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

Informed Consent: Written informed consent was obtained from the patient for publication of this case report.

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