Case reports

Computer-assisted Magerl’s transarticular screw fixation for atlantoaxial subluxation

YOSHIHARU KAWAGUCHI, HIROKAZU ISHIHARA, KAZUO OH MORI, MASAKI KANAMORI, and TOMOATSU KIMURA

Department of Orthopaedic Surgery, Toyama Medical and Pharmaceutical University, Faculty of Medicine, 2630 Sugitani, Toyama 930-0194, Japan

Abstract We report two patients with rheumatoid arthritis in whom posterior atlantoaxial fixation was carried out using transarticular screws with computer assistance. Two bilateral transarticular screws were inserted in one patient; however, in the other patient, only a unilateral screw was used, because computerized images showed that the vertebral artery at the other side was placed too medially to allow insertion of the screw. Neither of these patients had any neurovascular complications after surgery. Computer-assisted surgery is useful for avoiding neurovascular complications with transarticular screw fixation of C1-2.

Key words Atlantoaxial subluxation · Transarticular fixation of C1-2 · Computer-assisted surgery

Introduction

In recently years, computer-assisted surgery has been employed for spinal surgeries. Computer-assisted systems can provide precise three-dimensional surgical guidance intraoperatorily by matching the preoperative computed tomography (CT) image and intraoperative information on the spinal contours. Many reports have shown that pedicle screws can be inserted safely and accurately in surgery in the clinical setting and in laboratory investigations. There have been several reports describing the usefulness of this system in large series undergoing posterior atlantoaxial fixation using transpedicular screws with computer assistance. We have been using a commercially available computer-assisted navigation system (StealthStation; Sofamor Danek, Memphis, TN, USA) for various spinal surgeries since 1998. Here, we report two patients with rheumatoid arthritis (RA) in whom posterior atlantoaxial fixation was carried out using transarticular screws with computer assistance. Two bilateral transarticular screws were inserted in one patient; however, in the other patient, only a unilateral screw was used because computerized images showed that screw insertion would have entailed a high risk of penetration of the vertebral artery (VA). From the findings in these patients, we recognize that the system is useful for avoiding neurovascular complications.

Case reports

Case 1

History. Case 1 was a 63-year-old woman who had a history of RA of 30 years’ duration. Her RA stage by the Steinblocker classification was IV and the class was 3. Her Lansbury index on admission was 60%. She complained of severe pain in the neck and occipital region and the symptoms had gradually worsened. She had developed dyspnea and numbness in her left hand. Neurological examination revealed C2 myelopathy and the status was classified as IIIA according to Ranawat et al.

Radiographic studies. Plain X-ray showed atlantoaxial instability. The atlantoaxial interval (ADI) was 10mm on the flexion lateral radiograph (Fig. 1). Slight compression of the spinal cord by the odontoid process was observed on CT myelogram.

Surgical plan. The surgical plan was made 1 day before surgery, using a three-dimensional CT image (Somatom Plus-S; Siemens, Erlangen, Germany). The slice thickness of the CT was 1mm. The bilateral isthmuses of C2 were large enough to insert screws of 4.0-mm diameter (Fig. 2).
Operation and postoperative course. Posterior atlantoaxial fixation was carried out using the technique of Brooks and Jenkins,4 and Magerl and Seeman.17 Both screws were inserted steadily and safely, using intraoperative navigation (Figs. 3 and 4). The fixation provided satisfactory stability at the atlantoaxial joint. At the 6-month follow-up review, the patient demonstrated complete recovery from the symptoms.

Case 2

History. Case 2 was a 60-year-old woman who had a ten-year history of RA. She gradually developed severe neck pain that had begun 2 months before consulting our hospital. The pain had worsened and she had felt a click in her neck. On admission, numbness in the bilateral upper extremities was also a symptom. Her RA stage and class were IV and 3, respectively. Although neurological examination showed no abnormal findings, her status was IIIA according to Ranawat et al.22 because of the severe neck pain.

Radiographic studies. Anterior atlantoaxial subluxation was clearly observed on a lateral radiograph with neck flexion. The ADI on flexion radiograph was 15 mm (Fig. 5). On magnetic resonance (MR) imaging (Magnetom; Vision, Siemens), the lesion appeared to be spinal cord atrophy at the C1 level. CT revealed an asymmetrical position of the C2 transverse foramina. The foramen on the right side was located posteromedially compared with that on the left side (Fig. 6).

Surgical plan. A surgical plan was made, as was done for case 1. The images revealed that it would be possible to insert the transarticular screw on the left side of the C1-2 joint. However, screw insertion on the right side would have entailed a high risk of penetration of the VA (Fig. 7).

Operation and postoperative course. Posterior atlantoaxial fixation was carried out using the technique of Brooks and Jenkins,4 and Magerl and Seeman.17 A unilateral screw was inserted safely on the left side using intraoperative navigation. Screw insertion on the right side was avoided (Fig. 8). This method gave satisfactory stability. There was no complication during or after surgery. The patient had complete remission of neck pain 2.5 years postoperatively.

Discussion

Atlantoaxial instability is often observed in RA, trauma, os odontoideum, and congenital anomalies, as