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Operative Techniques in
Orthopaedics

Lateral Approach to the Craniovertebral Junction

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The removal of craniovertebral lesions localized in front of the spinal cord is demanding owing to its overlying anatomical structures. A transoral approach with removal of parts of the C1 and C2 vertebra may be accompanied with a postoperative instability and the need for further stabilization. A modified "far-lateral" approach with partial removal on lateral parts of the C1 and C2 lamina allows a very good exposure of the ventral and ventrolateral parts of the spinal canal without producing an instability. This retrospective study analyzes 9 patients with lesions in the ventral spinal canal and summarizes the advantages and complications of the lateral approach to the craniovertebral junction. Surgical resection was done in most of the cases for meningioma or neurinoma. In all cases the tumor was completely removed by this approach. No postoperative instability persisted. Major complications like paraplegia did not occur. One patient developed a partial atrophy of the trapezius muscle. One patient showed a transient palsy of the facialis nerve. This far-lateral approach offers the advantage of a direct visualization of the lateral and ventral aspect of the upper cervical spine without the need of an additional stabilization.

KEYWORDS craniovertebral junction, spinal canal, lateral approach

The surgical removal of craniovertebral lesions in the ventral and the ventrolateral spinal canal is demanding owing to the anatomical region with the vertebral artery, upper spinal cord, as well as overlying muscular structures.

To remove C1-C2 lesions in the ventral aspect of the spinal canal, transoral approaches have to be done.[1] For its exposure, parts of the anterior arch of the atlas and the odontoid have to be removed. Depending on the amount of bone removal an instability can be produced hereby. This may lead to the need for further surgery with a dorsal fusion.

A dorsal approach has advantages to expose the dorsal and lateral aspects of the spinal canal or the dorsolateral region of the vertebra.[2] For pathologies of the ventral spinal canal this technique is limited. One disadvantage of this approach is the extensive mobilization of the neck muscles for exposure of the lateral C1 and C2 vertebra, which can be accompanied by an enhanced muscular atrophy due to the damage of the local innervation. Additionally, the management for the exposure of the vertebral artery is hindered by the dorsal approach. The vertebral artery leaves the vertebral canal far laterally with a loop before entering the foramen magnum. This would be identified at the end of the preparation from the dorsal side. Distinct traction on the paravertebral muscles is necessary to expose the transverse process of C1. Owing to the muscle mass, which has to be mobilized into the lateral direction, the view inside the ventral spinal canal is restricted.

Bypassing the submandibular gland, cutting parts of the digastric muscle, and mobilizing the hypoglossal nerve, a retropharyngeal approach is an additional alternative to reach this area. This approach puts several anatomical structures at risk.[3,4]

Already in 1917 a lateral approach to the upper cervical spine was described for treatment of vertebral artery aneurysms.[5] This approach was varied for surgery in the ventral portion of the spinal canal from the foramen magnum to the superior portion of C3.[6] By this approach, an incision is made at the anterior border of the sternocleidomastoid muscle. After identification of the tip of the transverse process of C1 and muscle detachment, the C1 and C2 lamina is resected for intraspinal tumor removal. This approach is orientated to the ventral part of the spinal canal. In this paper we describe a retrospective analysis of 9 patients with ventral intraspinal processes of the craniovertebral junction, which were treated by a lateral approach.

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Patients and Methods

Surgical Technique

The patients were fixed in a lateral position. The head was extended slightly and flexed downwards so that the contour of the sternocleidomastoid muscle was visible. In this position, the head was fixed via a Mayfield clamp. The upside shoulder was taped down slightly together with the elongated arm. The bottom-side arm was fixed in a bent manner at the patient's chest (Fig. 1). A hockey stick–shaped skin incision starting at the mastoid running on the ventral side of the sternocleidomastoid muscle was made (Fig. 2). The platysma muscle was divided. The anterior margin of the sternocleidomastoid muscle was bluntly dissected. By slight retraction, the deep fascia was identified and divided. After exposure of the internal jugular vein and the accessory nerve, the tip of the transverse process of C1 was identified by blunt preparation. To avoid a damage of the accessory nerve, only moderate traction was applied on the sternocleidomastoid muscle. The anterior insertion of the splenius capitis muscle was separated from the scull base. Levator scapulae muscle and obliquus capitis muscle insertion were detached from the transverse process, and the vertebral artery was identified. After opening of the C1 vertebral artery foramen, the vessel was mobilized for further resection of the lateral parts of the C1 and C2 lamina. Only little epidural fat overlies the lateral dura at the craniocervical region. Blunt removal or electrocautery exposed the dura. The dura was opened by a longitudinal incision. Using a microscope, the lateral part of the spinal cord and the ventral aspect of the spinal canal became visible for the tumor removal (Fig. 3). After resection of the tumor, the dura was closed by a continuous suture. Then the retractor was removed, and the wound was closed with subcutaneous and cutaneous sutures in a multilayer fashion without any drainage in the wound.

Patients

Five men and 4 women were treated. The mean age of the patients was 67 years. In all cases, the tumors were identified by contrast-enhanced magnetic resonance imaging. The course of the vertebral artery was demonstrated by computed tomography angiography preoperatively. After surgery, the patients received a soft collar for 3 weeks to reduce motion-derived neck pain. The patients were allowed to mobilize at the first day after surgery. Anticoagulation treatment with low-molecular heparin was started at the third day after operation. The patients were discharged from hospital 8-12 days after surgery.

Figure 1 Lateral positioning of the patient. The head is fixed with a Mayfield clamp. The left shoulder is pulled down by tape. (Color version of figure is available online.)

Figure 2 Hockey stick incision for lateral exposure of the craniovertebral junction.

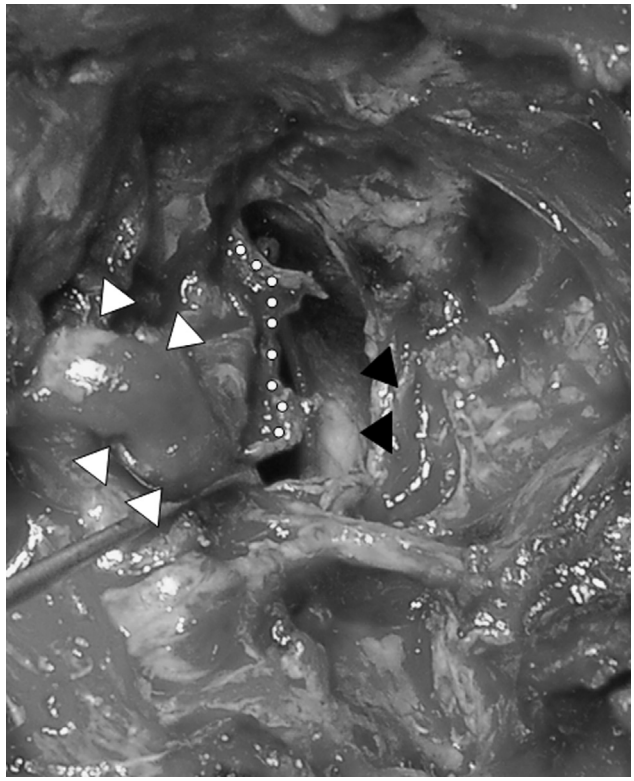

Figure 3 Operative view into the spinal canal from a right hand–side approach. Vertebral artery (white arrows) is pulled back dorsally. After opening of the dura (white spotted line) and tumor removal, the spinal cord (black arrows) is shifted ventrally.