Disposal of Occipital Condyle in Far Lateral Approach for Ventrolateral Foramen Magnum Meningiomas

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OBJECTIVE: **To investigate the necessity of drilling the occipital condyle in a tailored far lateral approach for resection of ventrolateral foramen magnum meningiomas (FMMs).**

METHODS: **Clinical data of 15 patients with ventrolateral FMMs who underwent surgery during a 6-year period were reviewed retrospectively.**

RESULTS: **A retrocondylar approach was performed in 8 cases (6 above the vertebral artery [VA] and 2 below the VA) in which the dural attachment was surgically accessible with no restriction of the initial part of the V4 segment of the VA, and a partial transcondylar approach was performed in 7 cases on both sides of the VA where the dural attachment associated with the VA auxiliary space was reached by superolateral displacement of the VA by drilling of the condyle. Exposure of the V3 segment of the VA was performed in all patients, but no circumcision of the dural ring along with transposition of the VA was needed. Simpson grade II resection was achieved in all patients. Postoperative complications were encountered in 20% of patients, predominantly associated with cranial nerve impairment. No tumor recurrence was demonstrated during follow-up lasting 7–68 months (mean 29.2 months).**

CONCLUSIONS: **The surgical approach for ventrolateral FMMs varies depending on the location of dural attachment with reference to VA dural entry. Bone removal is warranted in FMMs arising from both sides of the VA to allow superolateral displacement of the VA to some extent, improving surgical accessibility to the hidden VA auxiliary space and achieving a more radical tumor resection. It should be a reasonable alternative to the conventional aggressive VA transposition in cases of ventrolateral FMMs.**

INTRODUCTION

The far lateral approach has become widely accepted as an essential technique for lesions involving the foramen magnum.[1-3] However, controversy still exists regarding the optimal management of ventral or ventrolateral lesions.[4-9] There is still no consensus available in the literature in terms of the drilling of the occipital condyle in surgery for ventrolateral foramen magnum meningiomas (FMMs). Some authors affirmed that these lesions should always be resected by a retrocondylar approach exclusively.[1,2,5,6,10] Others adopted either a retrocondylar or a partial transcondylar approach but provided no specific indications.[3,8,11,12] Because ventrolateral FMMs can be classified into 3 subgroups based on the relationship of dural attachment to the vertebral artery (VA) dural penetration (i.e., above, below, or on both sides of the VA), a question arises: Is there a tailored surgical approach available for such cases in terms of the tumor characteristics related to the VA—in other words, in which cases should bone drilling be done in the far lateral approach? We present our experience with surgical treatment of ventrolateral FMMs via the far lateral approach, with the goal to identify a tailored approach for the resection of the occipital condyle.

MATERIALS AND METHODS

Patients

From September 2009 to August 2015, 15 patients with ventrolateral FMMs underwent surgery at our institution. All patients were

Key words
- Far lateral approach
- Foramen magnum
- Meningioma
- Occipital condyle

Abbreviations and Acronyms
CSF: Cerebrospinal fluid
FMM: Foramen magnum meningioma
MRI: Magnetic resonance imaging
VA: Vertebral artery

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Supplementary digital content available online.

Citation: World Neurosurg. (2016) 93:29-37.
http://dx.doi.org/10.1016/j.wneu.2016.05.048

Journal homepage: www.WORLDNEUROSURGERY.org

Available online: www.sciencedirect.com

operated on for the first time for the tumors, with no history of prior radiotherapy. The medical records were reviewed with respect to the clinical, radiologic, and surgical aspects of the tumors as well as the outcome after midterm follow-up.

Neuroimaging Studies

All patients underwent magnetic resonance imaging (MRI) preoperatively. As depicted on the preoperative MRI scans along with the intraoperative findings, ventrolateral FMMs were defined as tumors with dural attachment between the midline and the dentate ligament. Additionally, according to the location of the dural attachment with reference to the VA dural entry, ventrolateral FMMs were subdivided into 3 groups: above, below, or on both sides of the VA.[2] The largest diameter of the lesions in axial and sagittal slices on MRI was measured.

Surgical Approach

The patients were placed in the lateral position with the predominant side of the tumor up and the head in neutral position. A C-shaped retroauricular incision was made with inferior extension to approximately the level of C3. The superficial and middle lateral neck muscle layers were incised to expose the deep suboccipital triangles. The oblique muscles were dissected from the transverse process of C1 and reflected to expose the complete horizontal portion of the V3 segment of the VA. The posterior condylar emissary vein was found in the condylar fossa, which was coagulated and cut. The venous plexus surrounding the VA was kept in place. Neither opening the Cl transverse foramen nor transposing the VA was performed (Figure 1A and B).

A low suboccipital retrosigmoid craniotomy was performed through the foramen magnum with exposure of the sigmoid sinus. The homolateral posterior arch of C1 was removed. Hemilaminectomy of C2 was also necessary in some cases. The removal of the occipital condyle was individualized according to the location of dural attachment with regard to the dural entry of the VA. If needed, no more than the medial third of the occipital condyle was drilled away. The dura mater was opened posterior to the sigmoid sinus, and the incision was extended downward and posterior to the dural entry of the VA in a curvilinear fashion, allowing lateral mobilization of the VA when the dura mater was

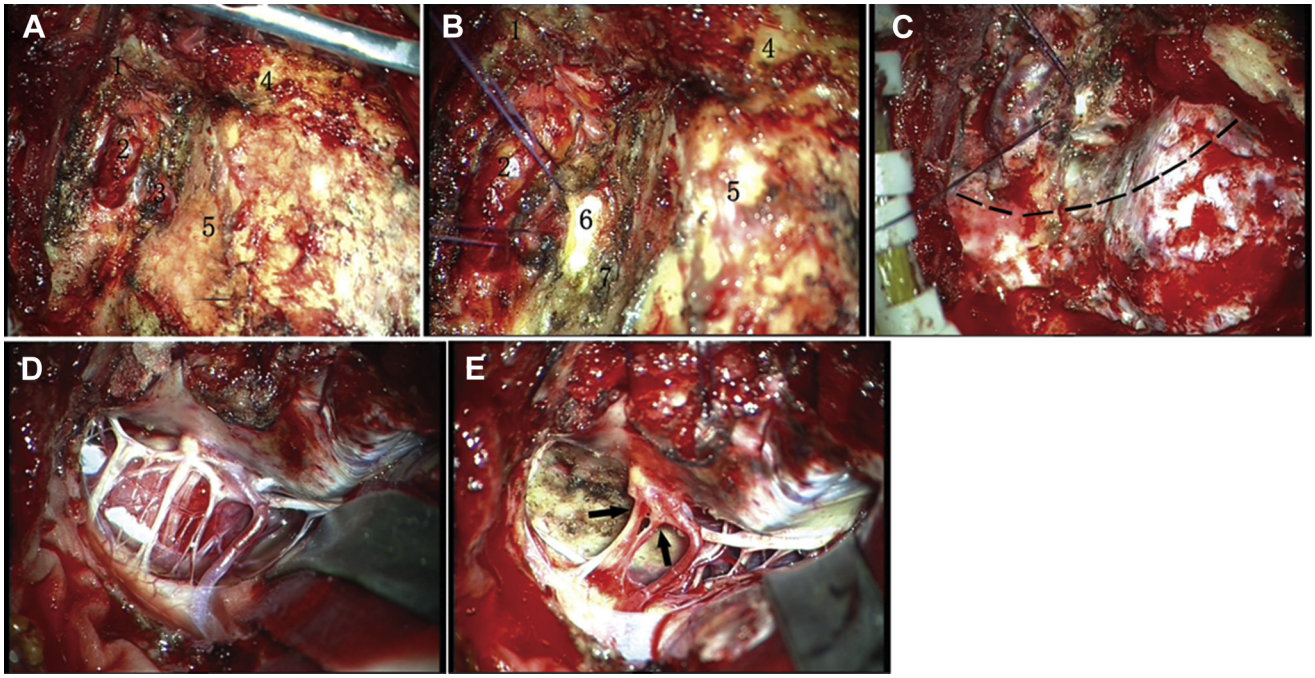

Figure 1. Intraoperative photographs showing steps of the partial transcondylar approach for a ventrolateral foramen magnum meningioma on both sides of the vertebral artery (VA). (**A**) Exposure of the horizontal portion of the V3 segment of the VA running in the VA groove above the posterior arch of the atlas, from the C1 transverse process to its dural penetration, without dissecting its plexus. The posterior condylar emissary vein was visible in the canal, which communicates between the distal end of the sigmoid sinus and the vertebral venous plexus. (**B**) Exposure of the atlanto-occipital joint followed by coagulation and cutting of the posterior condylar emissary vein with the condylar canal in sight serving as an anatomic landmark. (**C**) Suboccipital craniectomy along with C1 hemilaminectomy and partial mastoidectomy was performed with exposure of the sigmoid sinus, followed by partial condylar resection with reference of the condylar canal. An interrupted curve line indicates the site of dural incision starting from the junction of the sigmoid sinus and transverse sinus, descending just behind the sigmoid sinus to the level of the foramen magnum, where it crosses the VA dural penetration posteriorly and then turns inferolaterally to the level of Cl-2 interspace. (**D**) Dura mater was opened, and the dural flap was reflected laterally with the VA to show the profile of the tumor, which incompletely encased the VA proximal to its dural entry with involvement of the VA auxiliary space. (**E**) The tumor was completely removed, leaving the VA auxiliary space vacant (*black arrows*). Partial spinal root of accessory nerve was sacrificed to facilitate tumor resection. 1, C1 transverse process; 2, VA; 3, posterior condylar emissary vein; 4, mastoid; 5, occipital squama; 6, occipital condyle; 7, condylar canal.