Applicability of conventional sub-occipital approach for resection of foramen magnum meningiomas (FMM): Early experience

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Introduction

Foramen magnum meningiomas (FMM) are essentially technical demanding lesions. The challenge is even heftier with early experience specially in conditions with limited access to up to date neurosurgical gadgets, which usually help mitigating the mission. In addition, the anatomical complexity of the region and the fact that FMM tend to grow in proximity to eloquent structures thus rendering them even more arduous. Multiple approaches have been advocated to manage such lesions, nevertheless, adopting an approach according to your experience and circumstances is most appropriate. Posteriorly situated FMM are commonly accessible via the conventional median suboccipital approach, in addition to some laterally and anterolaterally situated lesions with specific criteria.
Methods
With approval from our Institutional review board the records of 8 patients with FMM operated using the midline sub-occipital approach, between 2014 to 2019, in the Department of Neurosurgery, Benha University Hospital, Egypt. Patient’s imaging was standardized with brain magnetic resonance imaging (MRI) with contrast, in addition to computed tomography (CT) brain angiography; including neck for diagnosis and planning purposes. Outcome variables analyzed included the extent of tumor excision (Simpson grading), postoperative complications and follow up.

Patients selection was customized according to our early experience. Anterior lesions and lesions with vertebral artery encasement were excluded. Gross total removal was defined as no visible enhancing/non-enhancing tumor on postoperative imaging. We always favored patient's safety in the extent of tumor extension, with considering Stereotactic radiosurgery as a viable option to manage any residuals.
Results

Our records show female predominance with 6 females and 2 males with a mean age of 40.62 years (range 29-56 years). The most common presentation was neck pain refractory to medical management. Other patient data breakdown is outlined in (table1). Medullary upper spinal cord compression symptoms were appreciated in four cases that had IX, X and XI cranial nerve symptoms.

Average hospitalization was 6 days. Pain and dysesthesia improved in all patients over a period of 15-45 days (most pain was attributed to incisional pain in the first week). A progressive neurological improvement was observed in the 2 patients that suffered weakness in the lower limbs, with improvement of the Modified Rankin Scale (mRS) scores to 2/5 from an initial mRS of 3/5 at 6-12 months follow up. Paraparesis was unchanged in 1 patient, probably because of longstanding preoperative compression of the upper spinal cord by the tumor. 2 patients with bulbar symptoms that improved over a 6-12 months period.
Extent of tumor resection was assessed by a 2-3 months post-operative MRI with contrast. Total resection was achieved in 5 cases (3 cases grades I, 2 cases grade II) and subtotal resection in 3 patients (2 cases grade III, 1 case grade IV). High vascularity and vertebral artery/cranial nerve proximity/encasement to the lesion were the main reasons to stop the surgery. All 3 cases with residual tumors were managed with Gamma knife, aiming for tumor growth control.

Our most common reported complication was cerebrospinal fluid (CSF) leaks, seen in 62.5% of our cases. One case had a huge pseudomeningocele that required surgical correction, while the remaining cases were managed with conservative measures. Two patients presented transient worsening of neck pain. Motor power worsening after surgery occurred in 2 cases, never the less, both showed slow gradual improvement over follow up. No mortalities were recorded.
<table>
<thead>
<tr>
<th></th>
<th>Gender</th>
<th>Age</th>
<th>Main symptomatology</th>
<th>Tumor location</th>
<th>Post-operative complication</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Female</td>
<td>39</td>
<td>Neck pain</td>
<td>Posterior</td>
<td>CSF leak, managed conservatively</td>
</tr>
<tr>
<td>2</td>
<td>Female</td>
<td>29</td>
<td>Lt. arm pain, diffuse paresthesia, lower limbs weakness, bulbar symptoms.</td>
<td>Left antro-posterolateral</td>
<td>CSF leak, meningocele, reoperation to manage, Transient worsening neck pain, weakness.</td>
</tr>
<tr>
<td>3</td>
<td>Male</td>
<td>40</td>
<td>Neck pain, Lt. arm pain, lower limbs weakness, bulbar symptoms.</td>
<td>Left post-lateral</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Female</td>
<td>47</td>
<td>Neck pain</td>
<td>Posterior</td>
<td>CSF leak, managed conservatively</td>
</tr>
<tr>
<td>5</td>
<td>Female</td>
<td>30</td>
<td>Neck pain, Rt. Arm pain, diffuse paresthesia, bulbar symptoms.</td>
<td>Right Post-lateral</td>
<td>CSF leak, managed conservatively.</td>
</tr>
<tr>
<td>6</td>
<td>Female</td>
<td>36</td>
<td>Neck pain, dysthesisa</td>
<td>Posterior</td>
<td>Transient worsening neck pain</td>
</tr>
<tr>
<td>7</td>
<td>Female</td>
<td>48</td>
<td>Neck pain, bilateral -brachialgia, weak grasp, walking difficulty, bulbar symptoms</td>
<td>Right antro-posterolateral</td>
<td>Transient motor power worsening</td>
</tr>
<tr>
<td>8</td>
<td>Male</td>
<td>56</td>
<td>Neck pain</td>
<td>Posterior</td>
<td>CSF leak</td>
</tr>
</tbody>
</table>
Discussion

FMM classifications are important for implementing surgical strategies. Bruneau & George introduced their classification based on insertion within the FM limits; depending on their compartment of development, dural insertion, and relation to the vertebral artery.

Extreme lateral, far-lateral and sub-occipital approach are the most approaches adopted. The utilized approach is mainly dictated by the surgical created by the tumor, in addition to technical experience. In view of this it is curtail to review the pre-operative MRI to determine the appropriate surgical corridor.

Transcondylar procedures have a steep learning curve, that's why in our early experience we choose both sub-occipital approach and specific cases accordingly, aiming to implement an increasing learning curve. The sub-occipital approach being more familiar to surgeons provided adequate working space for tumor excision has without condylar drilling.
Summary Points

In our experience, utilizing the midline sub-occipital approach was a feasible and reasonable option for managing the appropriate FMM with the advantage of avoiding more extensive skull base procedures. Knowing the limits and the exposure of the approach makes better understanding of proper lesions managed.

Building a learning curve for such crucial lesions and approaches enhance patient’s safety and advocates better outcome. In addition, one must consider Gamma knife as an effective adjunct for residual tumor control.