Original Article

Far Lateral Retrocondylar Approach in Management of Anterior and Anterolateral Foramen Magnum Meningioma. Local Experience at Sohag University

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ABSTRACT

Background: *Foramen Magnum Meningiomas (FMMs) represent a neurosurgical challenge because they grow in close contact with osteoarticular, nervous, and vascular structures that cannot be sacrificed or retracted.* ***Objective:*** *To evaluate our strategy and results in six patients with FMMs and analyze factors affecting the decision-making process, resection, and outcome.* ***Patients and Methods:*** *Six patients with foramen magnum meningioma operated at Sohag University hospital in the period between 2007 and 2012 with an age ranged from 25-65 years and the sex distribution showed four females and two males. All cases were examined clinically preoperative for the neurological status. Cranial MRI was done for all cases preoperatively. One stage operation was done for complete excision of the meningioma using a posterolateral retrocondylar approach in the three quarter position. Postoperative assessment for the neurological function and imaging study was done.* ***Results:*** *After surgical excision of the meningioma assessment of the neurological state was done and all patients were active and independent. One patient developed exaggerated and permanent ipsilateral lower cranial nerve palsy. All patients improved in their motor power. Paresthesia and sensory deficits resolved completely in four patients (60%). Respiratory dysfunction in one patient resolved completely. No cases showed recurrence during the period of follow up.* ***Conclusion:*** *Anterior and anterolateral FM meningiomas that displace the medulla/spinal cord can be safely and completely resected via a posterolateral suboccipital retrocondylar approach. A tumor remnant should be left on critical neurovascular structures in cases with poor arachnoid dissection planes.*

INTRODUCTION

Foramen magnum (FM) meningiomas account for approximately 1.5% of all intracranial meningiomas and constitute about 6.5% of the meningiomas located in the posterior cranial fossa[1] The main classification system of these lesions depends whether the tumor is anterior or posterior to the first dentate ligament.[2] The localization of the tumor determines the surgical approach. FMM are slow growing tumors, the clinical presentation is often a long history of occipitocervical pain associated with long tract signs and lower cranial nerve deficits. [3-8]

MRI scans accurately delineated tumor attachment and extension and the tumors' involvement with blood vessels and the neuraxis[7]

Several surgical approaches have been proposed for the removal of these tumors. Such approaches include the anterior transoral[30], lateral transcervical[31], and posterolateral suboccipital approaches[32]. Particular controversy exists regarding the optimal treatment of FM meningiomas located on the ventral aspect of the medulla and upper cervical cord. To accomplish a complete, safe removal of these tumors, approaches that include partial resection of the occipital condyle, usually in combination with transposition of the vertebral artery (VA), have been increasingly advocated in recent years[1,2,25,33,34]. We have micro- surgically treated a consecutive series of 6 patients harboring anteriorly or anterolaterally located FM meningiomas using a posterolateral suboccipital retrocondylar approach. Clinical follow-up results in these patients are discussed in light of the surgical results reported in recent publications.

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PATIETNS AND METHODS

Patient Population

From 2007 to 2013, 6 symptomatic patients (4 women, 2 men, ages 25-62 years, mean 42.8 years) were consecutively referred to the Department of Neurosurgery at Sohag University Hospital suffering

from foramen magnum meningiomas (FMM). The clinical and radiological characteristics of patients are summarized in Table 1. Chronic headache and/or neck pain were the symptoms mentioned in the six patients. Gait disturbance was the second most frequently reported symptom (4 of 6 patients). Neurologically, uni- or bilateral pyramidal paretic syndrome, caused by spinal cord compression, was found in the majority of patients.

Table 1: Shows the clinical and radiological characteristics of the patients

	UL&LL wk.	CN	sphincter	Location	extent	VA
Patient(1)	G 4B	-ve	-ve	Anteromedial FMM	craniospinal	Encased
Patient(2)	G 4A	bulbar	-ve	Anteromedial FMM	craniospinal	Displaced
Patient(3)	G 4A	bulbar	+ve	Anteromedial FMM	craniospinal	Displaced
Patient(4)	G 3	bulbar	-ve	Lateral FMM	spinocranial	Displaced
Patient(5)	G 4B	-ve	-ve	Lateral FMM	spinocranial	Displaced
Patient(6)	G 4B	-ve	-ve	Anteromedial FMM	craniospinal	Encased

Preoperative Imaging

All patients underwent a complete radiological workup including a computed tomography (CT) scan and a multiplanar T1- (with and without gadolinium enhancement) and T2-weighted and fluid-attenuated inversion recovery magnetic resonance imaging (MRI) (Fig. 1-3). All patients showed strong and rather homogeneous enhancement after gadolinium injection.

The meningioma was median anterior in 4 patients, antero lateral in 2 patients. The extension of the tumor was craniospinal in 4 patients, spinocranial in 2 patients. The vertebral artery was displaced in 4 patients, totally encased in 1 patient with median anterior tumor, and not affected in the patient with antero lateral tumor.

Surgical Approach

All patients were operated on in the three quarter position. An inverted hockey-stick skin incision was used and was initiated at the mastoid process. It was then carried superiorly to the superior nuchal line, curving toward the inion and proceeding from there to the spinous process of C4 (Fig. 4).

After dissecting the suboccipital muscles, a posterolateral retrocondylar suboccipital cranioctomy, including the rim of the FM, was elevated. This approach was previously described by Rhoton [29].

The VA was identified in its sulcus arteriosus on the posterior arch of C1, but was neither dissected nor transposed. A laminectomy of C1 (2 patients) or of C1 and C2 (three patients) was tailored to the caudal extent of the tumor in the upper cervical spinal canal.

The dura was opened microsurgically just behind the dural entry of the VA. The spinal portion of the accessory nerve, the posterior root of C1 (if present), and the posterior root of C2 lying posterior to the tumor were identified and preserved. In anterolateral tumors, the intradural segment of the VA and its branches could be seen after partial removal of meningiomas

The patients had tumors of firm consistency, and internal debulking was achieved by piecemeal resection using microscissors and cupped forceps. A self-retaining retractor was routinely used to gently elevate the cerebellar hemisphere and tonsil, but this retractor was never applied to the medulla or spinal cord.

RESULTS

In 5 patients, the tumor was completely resected as described. In one patient, part of the tumor adherent to the junction of the vertebral artery with the posteroinferior cerebellar artery (PICA) was left behind to avoid possible injury. Postoperative MRI scans were obtained for all patients (Fig. 5-7). The patients have been followed up after surgery with an average follow-up period of 43 months.

All patients were active and independent. One patient developed exaggerated and permanent ipsilateral lower cranial nerve palsy. There was no significant postoperative complication in any other patients. All patients improved in their motor power. Paresthesia and sensory deficits resolved completely in four patients (66.6%). In two patients, both the dysesthesia and the sensory deficit persisted although to a significantly lesser extent. The improvement in motor power was early and marked as compared with improvements in sensory deficits and lower cranial nerve paresis, which were delayed and incomplete. Pre operative Respiratory dysfunction in patient (4) resolved completely.

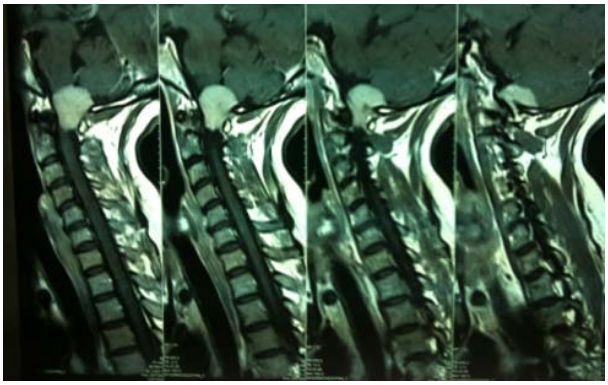

Fig. 1: Pre operative MRI T1image post contrast (patient no.2) Show anterior FMM

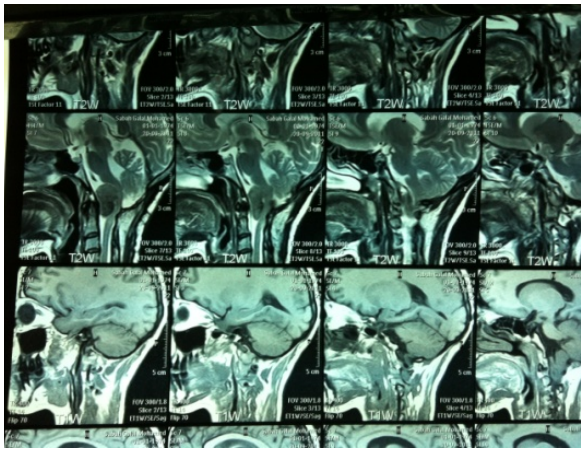

Fig. 2: Pre operative MRI T2 Image (patient no.3) show antero medial FMM

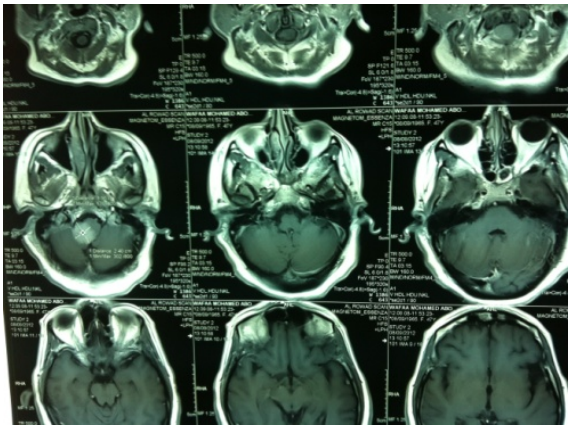

Fig. 3: Pre operative MRI T1 post contrast (patient no.4) showing lateral FMM

Fig. 4: Position and approach

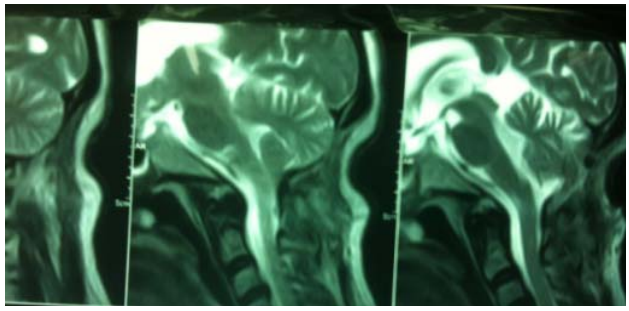

Fig. 5: Post operative MRI T2 Image (patient no2) show complete excision.

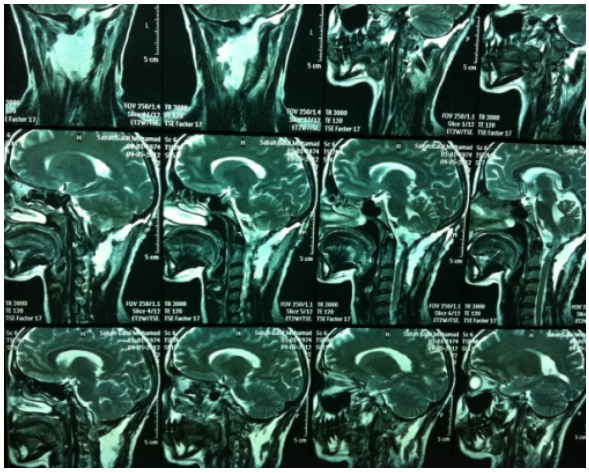

Fig. 6: Post operative MRI T2 Image (patient no.3) complete excision

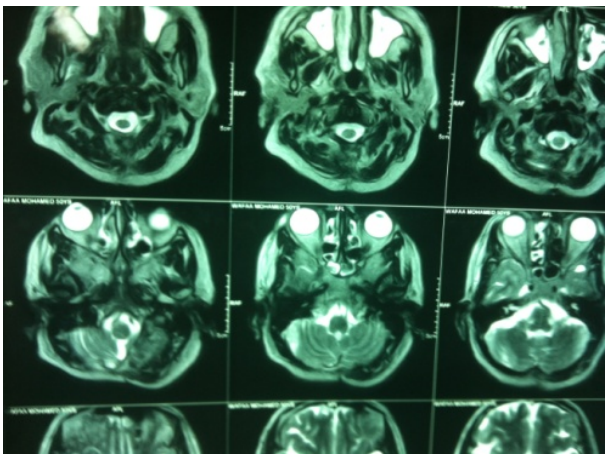

Fig. 7: Post operative MRI.T2 (patient no.4) complete excision

DISCUSSION

The surgical aspects to the foramen magnum have a unique consideration, due to its important neurovascular anatomy. Various surgical approaches have been described to reach the anterolateral portion of the foramen magnum. The posterolateral transcondylar approach provides a good viewing access ventral to the brainstem and lower clivus. In addition, the far lateral approach does not affect the craniocervical stability when done with minimal removal of the occipital condyle [1,10].

The far lateral approach provides an adequate exposure and viewing angle to the ventral brainstem with minimal retraction of important neurovascular structures in the region. The viewing angle is satisfactory even without mobilization of the VA and its branches could be safely managed without jeopardizing the neurological status of the patient [11-14]

This small series illustrated that clinical symptoms and signs of FMMs are non specific nor typical. Chronic long-lasting neck pain was the most frequently reported symptom in more than 60% of the cases. Moreover, medullar signs were late and inconsistent (about 40% of the cases), and the average patient age was about 42.8 years. Radiologically, FMMs are characterized by a large variability of presentation (narrow, large, or extended dural insertion basis; different patterns of vertical extent; anterior or lateral location; and a variable relationship with the VA).

George et al, classified foramen magnum meningiomas according to their zone of insertion and its relation to the midline and denticulate ligament into anterior, lateral, and posterior lesions.[15] It is very important to define the exact site and extent of the dural attachment of foramen magnum meningiomas, and the degree of encasement of the VA.[16] These are the main factors regarding the extent of removal and the outcome.

In the present work it is found that the far lateral approach offers a good working angle for lateral and antero-lateral meningiomas. Yet, with an entirely anterior meningioma this approach needs more extensive extradural bony work and to access the anterior foramen magnum dura.

Intraoperative we can avoid the injury to the vertebral artery by micro dissection and identifying of the vertebral artery in its course on C1. In the cases when the tumor encases the vertebral artery using of Doppler ultrasound intraoperative has a golden role.

All patients included in this study were followed up for a period ranging between 6 months to 6 years. In our patient there were one patient with transient respiratory problem which recovered within one day. The respiratory hypofunction may be contributed to the edema within the respiratory system during the intraoperative manipulation.

None of the patients showed any signs of instability of the craniocervical junction. Several reports in literature have assessed the stability of the craniocervical junction both preoperatively and postoperatively[17-21]. These reports came to the conclusion that the far lateral approach can offer a good avenue to the anterolateral portion of the foramen magnum without jeopardizing the craniocervical stability. Most authors agree that far lateral approach could be carried out without the need of occipito-cervical stabilization [5, 22, 23, 24].

The amount of occipital condyle removed is the main factor for doing craniocervical stabilization at the end of surgery. The more the surgeon has to remove from the occipital condyle the more the need for stabilization. The lateral approach of the foramen magnum offers a good surgical trajectory to the ventral brainstem and upper cervical cord. This approach can be modified whenever needed to reach lesions reaching the jugular tubercle or entirely anterior placed lesions [25-28].

CONCLUSION

A consecutive series of 6 patients, each harboring a FM meningioma, was prospectively reviewed for clinical outcome after microsurgical resection. All patients were operated on via a far lateral approach. The approach provided adequate exposure of the meningioma in each case to allow complete tumor resection without retraction of the medulla or upper cervical cord. The study emphasizes that surgical morbidity, mortality, and resection rates are comparable with those from reports in which the transcondylar route has been used. Although a complete resection of the meningioma should always be the goal of surgery, we recommend leaving a tumor rim on important neural and vascular structures in cases with poor arachnoid dissection planes. In these cases, stereotactic radiosurgery may be an important adjunctive treatment option.

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