Unilateral extended suboccipital approach for a C1 dumbbell schwanoma

R.M. Gorgan, Angela Neacşu, A. Giovani

Clinical Emergency Hospital "Bagdasar Arseni", Bucharest

Abstract: Craniovertebral junction tumors represent a complex pathology carrying a high risk of injuring the vertebral artery and the lower cranial nerves. Dumbbell C1- C2 schannomas are very rare tumors in this location. We present a case of a 66 years old male accepted for left laterocervical localized pain, headache and vertigo, with a large C1 dumbbell schwannoma extending in lateral over the C1 arch and displacing the C3 segment of the vertebral artery superiorly and anteriorly. Complete removal of the tumor was achieved using a far lateral approach. The approach is discussed with focus on the vertebral artery anatomy as the approach should give enough space to gain control of the artery without creating instability. Safe removal of C1 nerve root schwanomas can be achieved even if they compress and displace the vertebral artery by entering a fibrous tissue plane between the tumor and the vertebral artery.
Key words: dumbell schwanoma, craniocervical junction, far lateral.

Introduction

Meningiomas and chordomas are the most frequent pathology at the level of the craniocervical junction. Even if scwanomas represent 5-10 % of all intracranial tumors most of them being located on the vestibular nerve, their location at the craniospinal junction is quite rare. [1] With the rapid advancing of neurosurgical technology the goal of resecting these tumors shifted from lowering mortality to lowering morbidity and preservation of the vascular and nervous elements involved by the tumor [2, 3]. Most sudies report using some variant of far lateral approach for removal of these tumors as it gains access to the posterior, lateral and anterolateral aspect of the foramen magnum, the upper cervical spinal canal and even the clivus where the lesion has an important anterior extension. [4, 5]

Case presentation

A 66 years old male presented for left laterocervical localised pain, headache and vertigo. He showed no motor or sensitive impairment on neurological exam. A contrast MRI showed a dumbell gadolinophil tumor with a 3,3 cm largest diameter located extradurally inside the spinal canal with

extension outside the canal above the C1 arch. The tumor displaced superiorly the vertebral artery. (Figure 1)

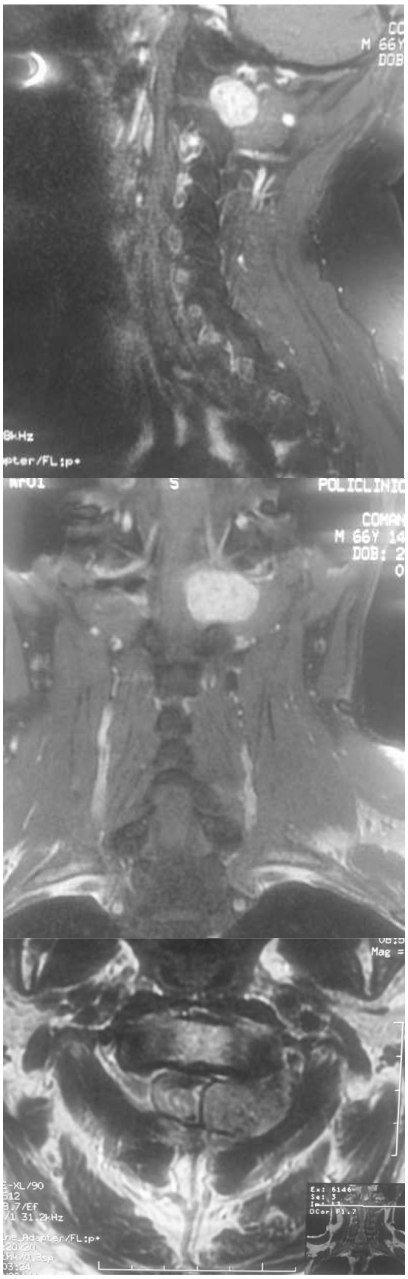


Figure 1 - T1 MRI with contrast showing a large filling tumor extending laterally from the spinal canal, displacing anteriorly and superiorly the vertebral artery which feeds the tumor through a few small branches

An angiography showed that the tumor was highly vascularized, injected from the vertebral artery and the displacement and narrowing of the V3 portion of the vertebral artery. As no other comorbidities were encountered the patient was accepted for surgery.

Surgical technique

The patient was positioned prone with the head slightly rotated to bring the lesion closer to the surgeon, flexed and fixed with tape to the horseshoe headrest. The table is than flexed to place the lesion higher in the operating field. A hockey stick incision centered on the lesion was used to access the craniospinal junction starting from the C4 over the midline, curved over the superior nuchal line and ended over the mastoid.

The posterior neck muscles are detached from the occipital bone leaving a muscle cuff on the superior nuchal line and the paravertebral muscles are skeletonized bilateral from C1 to C3. A suboccipital craniectomy extended to the left occipital condile and a posterior C1 arch resection were performed in order to gain access and control to the vertebral artery before it pierces the dura. The operative microscope was introduced at this step of the surgery.

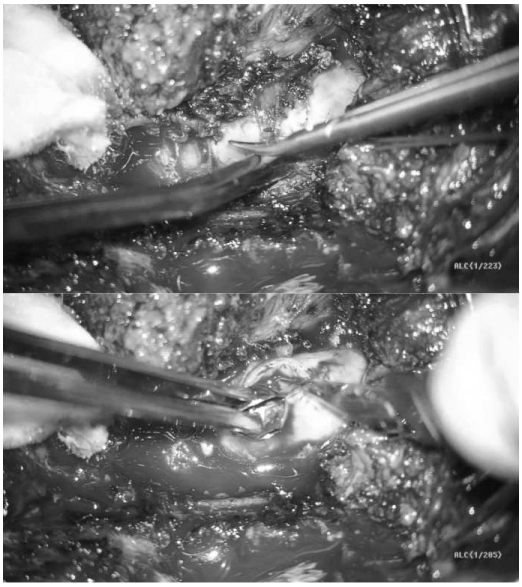
A well encapsulated 2/3 dumbell shaped, redisch tumor is seen over the C2 vertebral arch and pushing on the vertebral artery. The tumor was firm and elastic and appeared to have developed from the C1 nerve steath.

The tumor was covered by fibrous attachments and dissecting it from these created a superior clavage plane. A cottonoid introduced in these plane protected the vertebral artery over the rest of the surgery. After the internal debulking the tumor is than circumferentially dissected to see the C1 nerve entering and exiting the tumor .The tumor was completely resected using a distal and a proximal cut in the nerve. In order to avoid a CSF fistula, the nerve was ligated before the proximal cut. (See Figure 2)

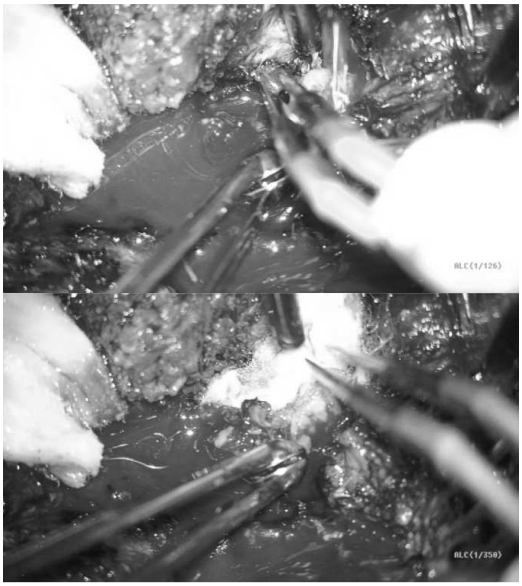
As the tumor was extradural there was no need to open the suboccipital dura. No fixation was needed as the bone resection did not include the occipital condile.

Hemostasis from muscles was achieved with the bipolar and saline solution and tight muscles and fascia suture was performed.

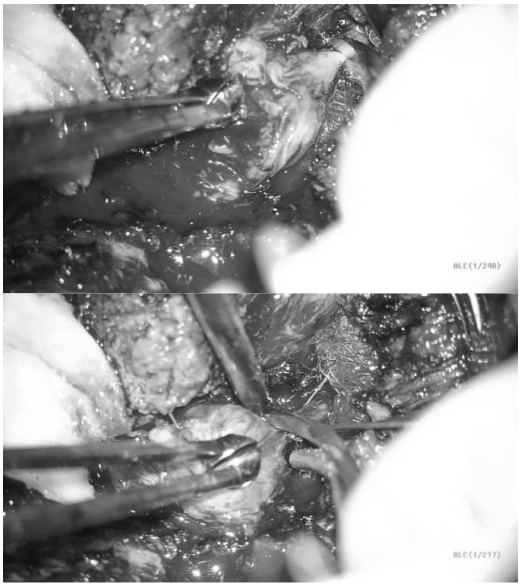
The postoperative course was uneventful and the patient did not complain of the headache and cervical pain.



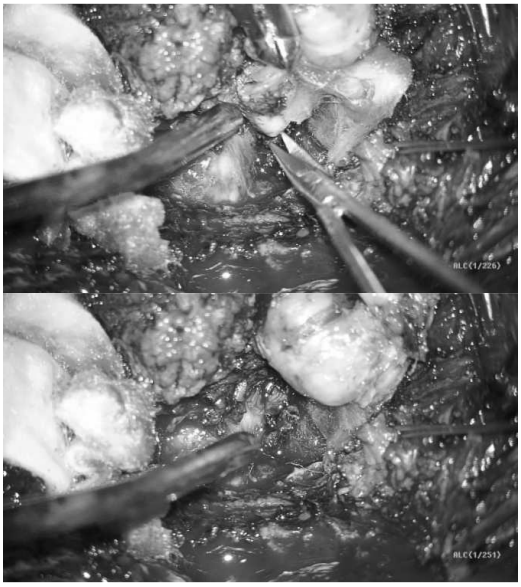
A - the ferm tumor was detached from the surrounding fibrous adherences and internally debulked



B - a branch from the vertebral artery irigating the tumor was coagulated and disected and a cottonoid was inserted over the superior aspect of the tumor to separate it from the vertebral artery



C - the C1 nerve root was sectioned imediatelly lateral to the tumor. And then the proximal c1 nerve root was ligated and cut



D - total tumor removal

Figure 2 - Intraoperative images – total tumor resection

Discussions

In order to access the lesions coming in relation to the V3 segment of the vertebral artery different teams reported a few positions, including the park bench position, the lateral decubitus position (half and half), three qarter prone and supine position with the head turned towards the lesion. In our department we use the supine position with a roll under the shoulder and the head slightly flexed and turned to the side of the lesion and fixed with tape in a horseshoe. [8, 11] The head rotation is not always adviced as it may change the relation of the vertebral body to the tumor by stretching it, and enough space can be gained in a neureal position with enough bone removal and turning the table opposite to the surgeon. Some authors prefer an S shape incision but we like using the hockey stick incision as we can better identify the bony landmarks which are very useful in identifying the vertebral artery. The disadvantage of this approach is that the view can be obstructed by the bulk of muscles especially when a more lateral trajectory is chosen. [6, 10]

The classic far lateral approach is a suboccipital craniectomy including the margin of the foramen magnum which extends lateral and anteriorly to the occipital condile. The bone resection includes the site where the vertebral artery enters the dura, so removing the bone in the area of the foramen magnum is the essential part of the craniectomy. The last part of the craniectomy near the occipital condile should be drilled as it becomes vertical and can't be removed with the Cloward. Care should be taken not to injure the posterior emissary condilar vein in the condilar fossa. Bleeding from this vein can

be important in tumors of the craniovertebral junction as was the case here, because it is the communication between the sigmoid sinus and the perivertebral venous plexus. In our approach we identified than coagulated, ligated and dissected this vein. We hold the opinion of other authors that opening the mastoid air cells should be avoided as this increases the risk of postoperative CSF fistula. As the schwanoma in this case was attached to the vertebral artery and by the suboccipital craniectomy and by removing the arch of the C1 there was no need for condyle resection. In order to avoid injuring the vertebral artery over the atlantal arch we palpated the posterior margin of the arch becoming thin and sharp under the vertebral artery. [9]

The main complications that could be encountered using this approach were injuring the vertebral artery which was intimately attached to the superior part of the tumor and having a CSF fistula. Both of them were prevented, the second by ligating the C1 nerve and sectioning it between the ligature and the tumor, and the first was prevented by early identifying the vertebral artery and dissecting it up to the point where it pierced the dura and by creating a dissection plane in the fibrous plane between the vertebral artery and the dura and protecting the artery with a cottonoid during the tumor resection.

As craniovertebral junction instability can appear with extended resections, we avoided removing the occipital condyle and the resection of the posterior arch was stopped at the medial margin of the vertebral artery.

Performing a careful multilayer closure of the muscles of fascia is important to avoid having postoperative CSF leaks.

Conclusions

This case report shows that C1 nerve root schwanomas even if they compress and displace the vertebral artery can be safely removed by entering a fibrous tissue plane between the tumor and the vertebral artery.

References

1. Arnautovic KI, Al-Mefty O, Husain M: Ventral foramen magnum meningiomas. J Neurosurg 92:71-80, 2000

2. Banerji D, Behari S, Jain VK, Pandey T, Chhabra DK: Extreme lateral transcondylar approach to the skull base. Neurol India 47:22–30, 1999

3. Bertalanffy H, Gilsbach JM, Mayfrank L, Klein HM, Kawase T, Seeger W: Microsurgical management of ventral and ventrolateral foramen magnum meningiomas. Acta Neurochir Suppl (Wien) 65:82–85, 1996.

4. Goel A, Desai K, Muzumdar D: Surgery on anterior foramen magnum meningiomas using a conventional posterior suboccipital approach: A report on an experience with 17 cases. Neurosurgery 49:102–107, 2001.

5. Hakuba A, Komiyama M, Tsujimoto T, Ahn MS, Nishimura S, Ohta T, Kitano H: Transuncodiscal approach to dumbbell tumors of the cervical spinal canal. J Neurosurg 61:1100–1106, 1984.

6. Hida K, Iwasaki Y, Seki T, Yano S: Two-stage operation for resection of spinal cord astrocytomas: Technical case report of three cases. Neurosurgery 58:ONS-E373, 2006.

7. Hori T, Takakura K, Sano K: Spinal neurinomas: Clinical analysis of 45 surgical cases. Neurol Med Chir (Tokyo) 24:471–477, 1984

8. McCormick PC: Surgical management of dumbbell tumors of the cervical spine. Neurosurgery 38:294–300, 1996.

9. Rhoton AL Jr: The far-lateral approach and its transcondylar, supracondylar, and paracondylar extensions. Neurosurgery 47[Suppl 3]:S195–S209, 2000.

10. Samii M, Klekamp J, Carvalho G: Surgical results for meningiomas of the craniocervical junction. Neurosurgery 39:1086–1095, 1996.

11. Sen CN, Sekhar LN: An extreme lateral approach to intradural lesions of the cervical spine and foramen magnum. Neurosurgery 27:197–204, 1990.