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CLINICAL CASE

Muscle fascia graft as a potential treatment for cervical dura defects: A case report of a C2-C3 dumbbell schwannoma

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Abstract

Although 25% of spinal schwannomas are intradural, only 15% have an intradural-extradural component. The ideal treatment consists of complete excision of the tumor. However, one of the most common complications of this procedure is cerebrospinal fluid leak. The following report presents the case of a 40-year-old male patient with a history of Arnold's (or occipital) Neuralgia, who was diagnosed with intradural-extradural cervical schwannoma at C2-C3 level with dura defect that required resection, instrumentation, transverse duroplasty, and muscle fascia graft.

Keywords: *Cerebrospinal fluid leak. Duroplasty. Schwannoma. Spinal tumor.*

Introduction

A quarter of spinal schwannomas are located within the dura, with no difference between men or women, of these, 15% present an intradural and extradural component (dumbbell tumors)[1] and 18% originate at a cervical level[2]. The ideal treatment for this condition is a complete resection. However, cerebrospinal fluid (CSF) leakage is one of the most common complications after these procedures[3]. In addition, the cervical spine is prone to instability after manipulating the posterior column[4]. For this reason, we present the case of a patient who was previously assessed for occipital (or Arnold's) neuralgia, with a cervical schwannoma at the C2-C3 level that required cervical instrumentation, duroplasty, and laminoplasty.

Case report

A 40-year-old male patient with no history of neurofibromatosis began his current condition in November 2020 with an intense headache located in the left retroauricular region followed by paresthesia and weakness in the left upper limb at the level of the hand and forearm beginning in January 2021. A diagnosis of occipital neuralgia was made and treated with local infiltrations in March 2021, significantly improving pain. However, the symptoms of weakness and paresthesia had no improvements after the infiltration therapy, so he was referred to the Orthopedic Ward of the General Hospital of Morelia and was assessed by the Spine Surgery Team. Findings on physical examination were: complete higher cerebral functions; in the left upper limb, strength decreased by 3/5 and alteration in two-point discrimination was found; muscle stretch reflexes in all four limbs; and bathyesthesia was present. A head and cervical contrast-enhanced magnetic resonance imaging (MRI) was ordered (Fig. 1).

A tumor excision was performed using a posterior approach with a craniotome-assisted laminoplasty between C2-C4 and durotomy. The tumor was located

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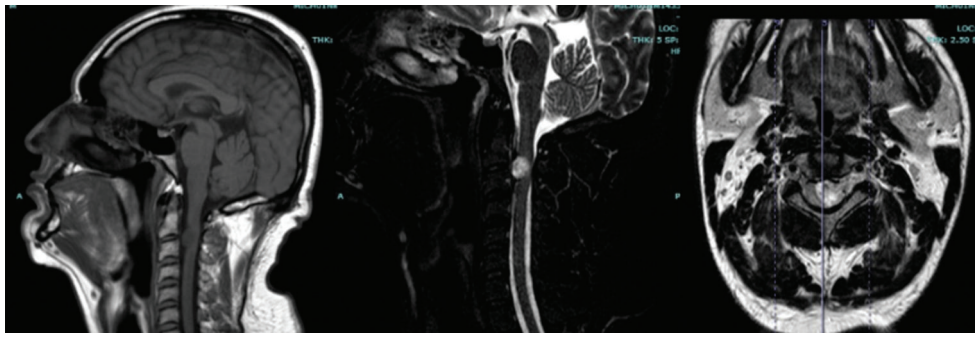

Figure 1. Cervical magnetic resonance imaging showing a compressive mass lesion with a size of 2 × 2 cm.

anteriorly and lateralized to the left, with extrusion to the root, in the shape of a dumbbell. The technique was modified by Tapia-Carrillo; the intradural and intracapsular segment was removed with a disc forceps and leaving a space of considerable size. Part of the tumor was traced at lower levels, C3 and C4, with the facet removed and located 2 mm apart from the vertebral artery. A duroplasty was performed with Ethibond 5-0, by making inverted stitches and performing a transverse incision (in T) to facilitate closure (Fig. 2). A muscle fascia graft from the vertebral muscles was attached with Ethibond 5-0 to close the remaining defect. An intraoperative Valsalva maneuver was performed to confirm the absence of CSF leakage.

C2 was instrumented with transpedicular screws, C3 with the right transpedicular and left transfacet screws, and C4 with transpedicular screws (Fig. 3). A laminoplasty was performed with Ethibond 5 from C2 to C4, perforating the base with the needle, then was directed in a reverse direction between the lamina to finally ending with an interspinous anchor (Fig. 4).

A tumor sample was delivered to the pathology department, which reported a circumscribed lesion with a random cell arrangement arranged in areas of Antoni A and Antoni B that arrange in Verocay bodies; with diagnosis of a conventional schwannoma. The patient was extubated in the intensive care unit for 3 days for surveillance, presenting an acute episode of urinary retention that was solved with a replacement of a Foley catheter. He then was transferred to the orthopedics ward for aftercare and was discharged from the hospital 4 days later; when the patient was able to sit up, maintain head support, and walk in an assisted manner. A post-operative cervical MRI was performed before discharge to confirm the complete absence of the tumor and CSF leakage was not present during this

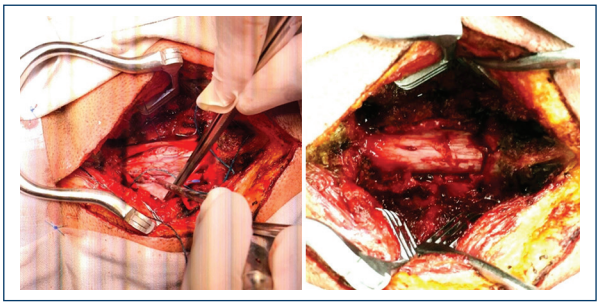

Figure 2. Left: the T-incision made in the dura to facilitate closure with the 5-0 Ethibond suture. Right: the closure of the defect with inverted stitches and muscle fascia.

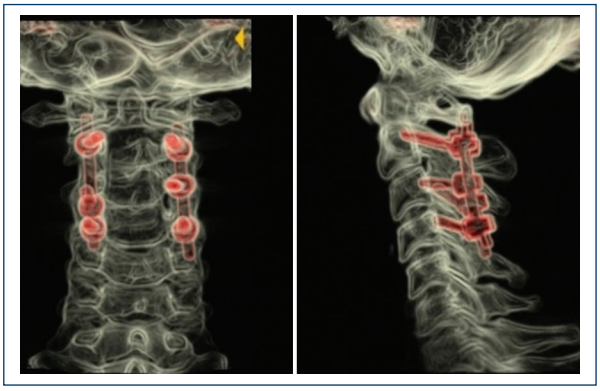

Figure 3. Post-operative computed tomography with metallic suppression showing the arrangement of screws and rods.

time. At the 2-month follow-up, the patient had full brain function, strength in four limbs 5/5, muscle stretch reflexes of ++, and gait dependent on a walker. At the 6th month follow-up, a cervical MRI was ordered which shows no sign of CSF leakage or tumor relapse. The

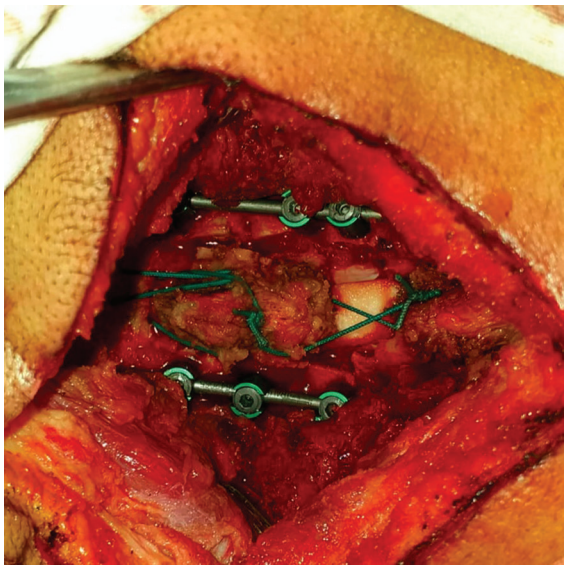

Figure 4. Arrangement of the screws and the suture in the laminoplasty performed.

patient is no longer using a walker and reports feeling satisfied with the evolution he has experienced.

Discussion

The greater occipital nerve originates at the level of C2, is located at the posterior root of the second vertebra, and receives concomitant branches from the 1st and 3rd cervical nerves. It has branches that contribute to the innervation of the skin in the head and neck through the posterior cervical plexus. Tumors originating in this area can cause occipital neuralgia[5]. In this case, we could assume that there is a relation between intracervical schwannoma and the retroauricular pain. The constant muscle hypertonia caused by the compression of the tumor to the spinal cord could have likely irritated the nerve chain. Furthermore, paresthesias, weakness, and hyperreflexia persisted after analgesic treatment with retroauricular infiltrations.

The segment with the highest risk of instability is the cervical spine[4]. This segment has the greatest range of motion. Within this region, the C1-C2 joint is the one with the greatest mobility, with a flexion-extension range of between 10° and 20°; axial rotation ranges between 23° and 38°, and a lateral flexion of 6.7°[6]. Therefore, it was decided to perform cervical instrumentation, which has been recommended by Wilkinson and Galgano (2020), since at this level, the spine is more susceptible to deformities after a laminectomy or laminoplasty[4]. Laminoplasty was performed using a similar synthetic braiding technique with Ethibond 5, similarly to that described by Sinha and Jagetia (2011) in the cervical spine[7].

Jenkinson et al. (2005) reported that CSF leakage is present in 10% of complications, followed by meningitis[3]. Normally, CSF leakage can be treated using two strategies: the first one consists in changing the CSF pressure, which can be achieved by changing the patient position, decreasing the subarachnoid pressure by shunting with a catheter or increasing the epidural pressure with a drain or a blood patch. The second strategy consists on direct closure with suture or with a water sealant, including dural substitutes[8]. Several autologous materials have been used to prevent or treat CSF leakage, including fat[9], pericranium, ligamentum nuchae, or fascia lata muscle[10]. In this case, a duroplasty was performed with a T incision in the dura to facilitate closure of the dura, and a cervical muscle fascia graft was placed. Zhao et al. (2020) reported in a retrospective study the use of a similar technique in patients operated for tumors of the posterior fossa, finding a lower incidence rate in infections and CSF leakage[11]. Arnautovic and Kovacevic (2016) used abdominal autologous fat graft for CSF leakage caused by intradural tumors with no relapses, still, a fibrin glue must be applied to ensure the efficacy of the technique[12]. In this case, we used a cervical muscle fascia graft to patch the defect. Furthermore, inverted stitches with Ethibond 5-0 were performed, leaving the knots within the subdural space and no transoperative or post-operative CSF leakage was seen.

Ethibond is a braided, non-absorbable suture made up of heavy chains of polybutylate-coated polyester molecules, which gives it good mechanical properties and less risk of tissue reactions. However, the use of Ethibond in this type of surgery is controversial; several cases of adverse reactions have been reported, some as severe as osteolysis[13] and in experimental models, compared with FiberWire and polypropylene monofilament, Ethibond caused the most inflammatory reaction at the muscle and tendon level in the first 3 weeks, however, after 6 weeks, had the least tissue reaction[14]. Literature regarding the use of this suture in spine surgery is scarce. Sutipornpalangkul and Thanapipatsiri (2013) reported few complications with the use of this material in C1-C2 fixation and fusion, even in patients with rheumatoid arthritis[15]. In our experience, we have not presented any complications with the use of this type of suture in the past.

Although dumbbell schwannomas are relatively uncommon, the present case is relevant due to an unusual presentation with occipital neuralgia followed by upper extremity weakness. Furthermore, when a laminoplasty or laminectomy is carried out, the spine should be stabilized. On the other hand, we were unable to find any other report with muscle fascia grafting and inverted stitches for duroplasty. In this case, we did not observe any CSF fluid leakage during hospitalization and afterward. We consider that in our technique, using inverted stitches, we can prevent CSF leakage. Furthermore, the cost of the surgery is reduced using muscle fascia from the patient instead of cervical dural substitutes. Yet, this is the 1st time this technique is used in a patient, we consider it as a potentially useful and safe procedure for the treatment of cervical dura defects secondary to intradural tumors.

Conclusions

Occipital neuralgia is an uncommon form of headache that should rule out secondary causes. Dumbbell schwannomas at C2 level can be treated successfully with a total excision of the tumor and spine stabilization. Muscle fascia graft, duroplasty in T, and inverted stitches can be a safe technique for dura defects at this level.

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Conflicts of interest

The authors declare that they have no conflicts of interest.

Ethical disclosures

Protection of human and animal subjects. The authors declare that the procedures followed were in accordance with the regulations of the relevant clinical research ethics committee and with those of the Code of Ethics of the World Medical Association (Declaration of Helsinki).

Confidentiality of data. The authors declare that they have followed the protocols of their work center on the publication of patient data.

Right to privacy and informed consent. The authors have obtained the written informed consent of the patients or subjects mentioned in the article. The corresponding author is in possession of this document.

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