

Morbimortality associated with the foramen magnum meningioma surgery: a case report.

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Meningiomas are tumors of the central nervous system that represent around 14.3% to 19%. Of them, only 1.8% to 3.2% arise in the foramen magnum. For years the approach of this class of tumors entailed high associated morbidity and mortality because the foramen magnum contains a series of critical anatomical and neurovascular structures. However, with the progress of surgical techniques, the management of neurological anesthesia, and the training of neurosurgeons with experience in skull base surgeries, it has been possible to reverse these results and make surgery a safe alternative with low complication rates. The present work aims to review the literature about morbidity and mortality associated with meningiomas of the foramen magnum and present a case addressed in our center.

Keywords: Far lateral, meningioma, foramen magnum, skull base.

Introduction

Meningiomas are benign tumors that grow slowly. They represent a considerable proportion of all primary intracranial neoplasms (14,3–19%), of which only 1,8 to 3,2% arise in the foramen magnum.¹ The latter can arise in any location of the foramen magnum perimeter. They are divided into two main types: craniospinal (whose origin is intracranial and extends caudally) and spinocranial (whose origin is in the upper spinal canal and extends intracranially).²

The literature asserts that the most frequent location of the tumor in the foramen magnum is anterolateral (17,9%), followed by lateral (21,4%).³ Foramen magnum meningiomas are

particularly challenging because they are closely related anatomically to noble structures, such as the brainstem, and critical neurovascular structures, such as the lower cranial nerves and the vertebrobasilar system.

In this study, our goal is to conduct a literature review and highlight the morbimortality associated with the foramen magnum meningioma surgery in relation to a clinical case.

Materials And Methodology

A review of the available literature was conducted using the PubMed virtual medical library, with keywords such as meningioma, foramen magnum, treatment, surgery, morbidity, and mortality. The search yielded 75 studies. We se-

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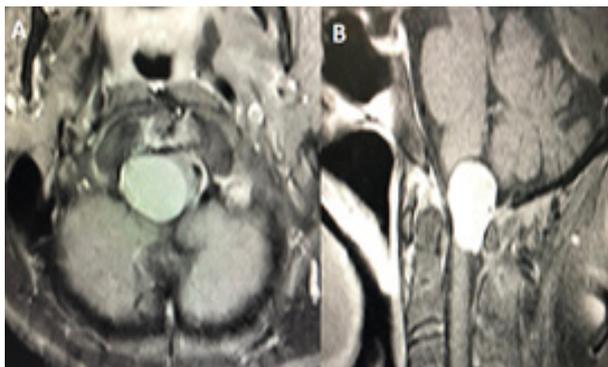
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lected those that described the surgical technique and the surgical approach used, and that indicated the morbimortality associated with the surgery. Thus, 14 studies were selected, which will be commented in this study. Furthermore, a clinical case which was attended in the Coquimbo San Pablo Clinical Hospital is described.

Clinical Case

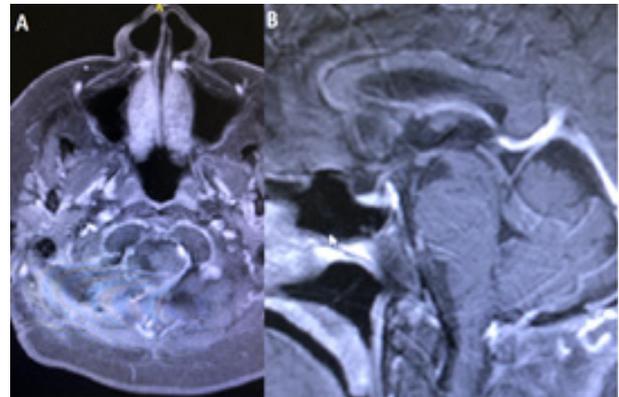
Eighty-two years old patient with a history of HTN and moderate to severe aortic stenosis, who in 2018 began to suffer from progressive paresis of upper and lower extremities. In February 2019, in the outpatient clinic, paresis was evidenced in upper extremities with an MRC Scale score of 4, and it is also evidenced in bilateral lower extremities with a score of 3, with no alterations in the lower cranial nerves. An MRI study shows an extra-axial expansive process in the foramen magnum, with right Dural anterolateral implantation, medulla oblongata compression, and the appearance of a Meningioma (Figure 1). Intraoperative electrophysiological monitoring surgery is conducted in parkbench position. The surgical approach is far-lateral transcondylar, and a partial resection of the posterior right arch of C1 is conducted, achieving complete macroscopic resection. The surgery lasted 7 hours, and there were no incidents nor hemodynamic alterations. The patient recovered in good general conditions, with progressive recovery of strength in both upper and lower extremities, and without alterations in the lower cranial nerves. Four weeks after surgery, the patient is evaluated. The patient can walk with a walker and perform basic

Figure 1. Preoperative MR in axial cut (A) and sagittal cut (B) that shows an anterior FM meningioma



activities without help. No alterations in the lower cranial nerves are seen during the neurological examination, in the Figure 2. The macroscopic resection performed can be observed

Figure 2. Postoperative MR in axial cut (A) and sagittal cut (B) shows insignificant Dural reinforcement and complete macroscopic resection.



Discussion

The foramen magnum meningiomas arise from the lower third of the Clivus to the upper border of C2.⁵ The average age of presentation of these tumors—at the time of diagnosis—is approximately 55 years.⁶⁻⁷ The foramen magnum contains several critical neuroanatomical and vascular structures, such as the lower cranial nerves, the vertebrobasilar system, and the brainstem, which is why it is challenging for the neurosurgeon.⁸⁻⁹⁻¹⁰

Historically, the general surgical results of resection conducted on meningiomas of the foramen magnum have been deficient, especially those with ventral implantation. However, advances in surgical techniques, the management of neurological anesthesia, and neuromonitoring have led to better results. In 2000, Arnautovic et al. reported a statistically significant improvement in the Karnofsky scores in 18 patients. In addition, it was reported that deficiencies in cranial nerves IX and X were the most frequent complication and that there was no perioperative mortality.⁸

In 2012, Talacchi et al. reported a series of 64 cases in which the most frequent difficulty was the disorder of the cranial nerves IX-X and XII (with a percentage of 44% and 33% respectively). It should be noted that the mortality rate in this series of patients was zero.¹¹

In Yasargyl's review of the series published before 1976, the general mortality rate was 13%, though it could rise to 45% in other series. However, series published in the last 20 years show a global mortality of 6,2%.¹²

The literature refers to several factors that can complicate surgery and have a negative influence on the morbimortality: Previous tumor location¹³⁻¹⁴, tumor size (smaller injuries are harder to resect for the surgical corridor is smaller), tumor invasiveness, extradural extension, 13, vertebral artery covering¹⁵

In a meta-analysis of studies that used the Far-lateral approach, Komotar et al. reported that 80,6% of patients improved, 6,7% remained the same, and only 9% deteriorated¹⁶.

Furthermore, craniocervical junction stability in regular surgical approaches is not altered, as biomechanical studies have shown. Thus, the execution of instrument procedures in this surgery would not be recommended.¹⁵

The rate of macroscopic tumor resection, when conducted by a neurosurgeon with experience in skull base surgery, tends to be 94%¹⁷, which is closely related to long-term mortality.

Conclusion

Foramen magnum meningiomas are tumors that challenge neurosurgeons because they are closely related to noble structures, such as the brainstem, the vertebral artery, and the lower cranial nerves. The literature describes that, over time, morbimortality associated with these types of injuries has diminished, and most difficulties associated with it can be anticipated. If the surgery is conducted by a neurosurgeon with experience in skull base surgery, and if a full macroscopic tumor resection is achieved successfully, the morbimortality of the patient tends to be safe. In expert hands, the far lateral approach is safe to tackle this kind of tumor. All of the above is consistent with the clinical case presented. The patient did not suffer any complications and improved favorably.

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