

Research/Technical Note

Surgical Treatment of Craniocervical Junction Tumors: Neurosurgery Department Experience of “Hôpital Principal De Dakar”

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Abstract

Introduction: Craniocervical tumors are uncommon but represent a medical emergency for diagnosis and treatment. Their approaches require of course surgical expertise in addition to adapted technical platform. In light of the limited resources available in our practice, we consequently made the decision to share our experience with the surgical treatment of this pathology. **Patients and method:** We performed a retrospective analysis on eight observations of patients treated in the neurosurgery department of “Hôpital Principal de Dakar” between July 2015 and December 2022 for progressive tumor spinal cord compression at the craniocervical junction. **Results:** We observed a 10% frequency, a mean age of 39.25 years, and extremes between 8 and 62 years. There was a 0.6 sex ratio. The most common risk factor was type I neurofibromatosis, and one case of Von Hippel-Lindau disease. All of our patients had pyramidal syndrome. Overall, there were 2 tumors with posterolateral extradural site and 4 tumors with extramedullary intradural location, including 2 posterolateral and 2 anterolateral. The location was intramedullary and cerebella-medullary in one case each. The posteromedial occipitocervical approach, which was employed on six patients, was the most utilized method. Five patients had total tumor resection, whereas three had partial resection. Two of our patients had postoperative complications: a worsening of motor deficit and a death following dependence on mechanical ventilation. We only received four histological confirmations for the anatomopathological samples. Our patients' evolution was positive over an average follow-up of 21 months, with neurological improvement and walking autonomy. **Conclusion:** Tumors affecting the craniocervical junction are still treated surgically. Despite the need for improvement in our working conditions, our results appear to be satisfactory.

Keywords

Tumor, Craniocervical Junction, Spinal Cord Compression, “Hôpital Principal de Dakar”

1. Introduction

By carefully planning the surgery and preserving the vascular and neurological elements of the tumor, surgical man-

agement of craniocervical junction tumors has succeeded in a reduction in morbidity and mortality [1, 2]. However, a

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number of variables, such as the tumor's histological type and the quality of the excision, affect the outcome and prognosis [3, 4].

Our study's goal was to share the neurosurgery department experience of “Hôpital Principal de Dakar” with craniocervical junction tumors within the practice context of an impoverished country with a limited technological.

2. Patients and Method

Our study is a retrospective analysis of eight observations of patients treated in the neurosurgery department of “Hôpital Principal de Dakar” between July 2015 and December 2022 for progressive tumor spinal cord compression of the craniocervical junction.

We included patients who had imaging evidence of a tumor origin in addition to a clinical indicating progressive spinal cord compression at the craniocervical junction between C0 (occiput) and C2 (Atlas). Therefore, tumors of the posterior cerebral fossa without extension below C0, low cervical tumors, and non-tumorous compressions were not included.

All of our patients had tumor excision while under general anesthesia, with their heads flexed and supported on a horseshoe. Posteromedial cervical approach was the most frequently used approach, with six cases performed. In two patients, the posterolateral approach was employed. We collected information on our patients' neurological symptoms, anatomopathological findings, pre- and postoperative imag-

ing, and clinical evolution.

3. Results

We collected 80 cases of combined brain and spinal tumors during the period of our study, including 8 cases of craniocervical junction tumors. This indicates a 10% frequency of craniocervical junction tumors during the relevant period in our structure.

With extremes of 8 and 62 years old, the average age of our patients was 39.25 years.

The male/female sex ratio was 0.6.

One patient with VHL (Von Hippel-Lindau) illness in our study has been followed for a recurrent posterior fossa tumor since 2015. Von Recklinghausen illness affected two other patients.

With an average of 17.8 months, the mean delay between the start of symptoms and diagnosis ranged from 1 to 48 months. We diagnosed all our patients with pyramidal syndrome, whether deficient or not. All of our patients had MRI (Magnetic Resonance Imaging) before their surgery.

Overall, there were 2 tumors with posterolateral extradural site (figure 1) and 4 tumors with extramedullary intradural location, including 2 posterolateral and 2 anterolateral (figure 2). The location was intramedullary and cerebella-medullary (figure 3) in 1 case each. Five patients had total tumor removal, three had partial resection, including surgical revision in our patient with VHL illness.

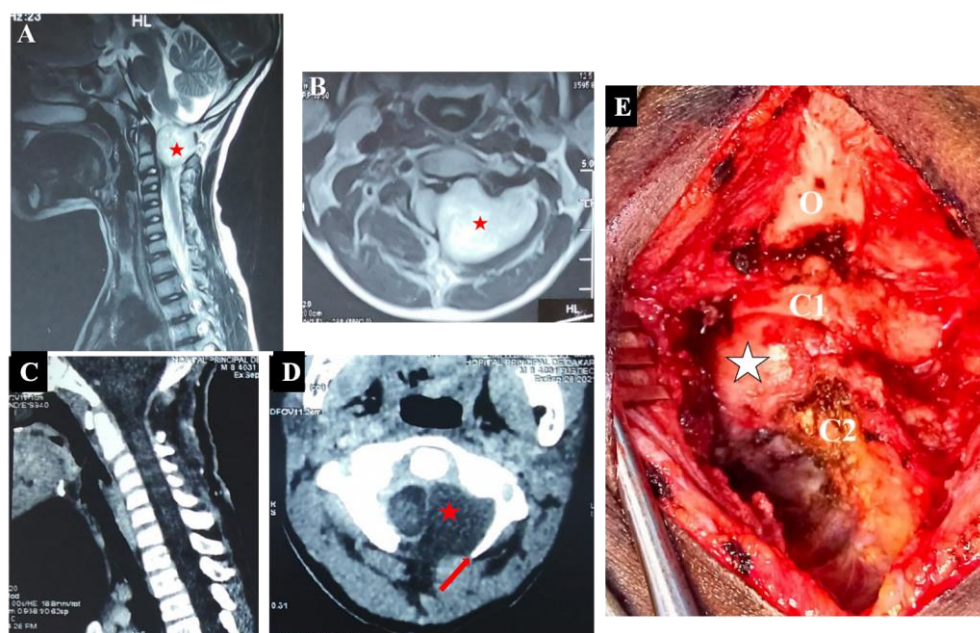


Figure 1. Preoperative MRI images of patient P7 objectifying a posterolateral tumor (red stars on A and B) and postoperative CT control showing a total excision by hemilaminectomy (red stars and arrow on C and D). Intraoperative view showing the tumor after posterior medial approach (white star on E).

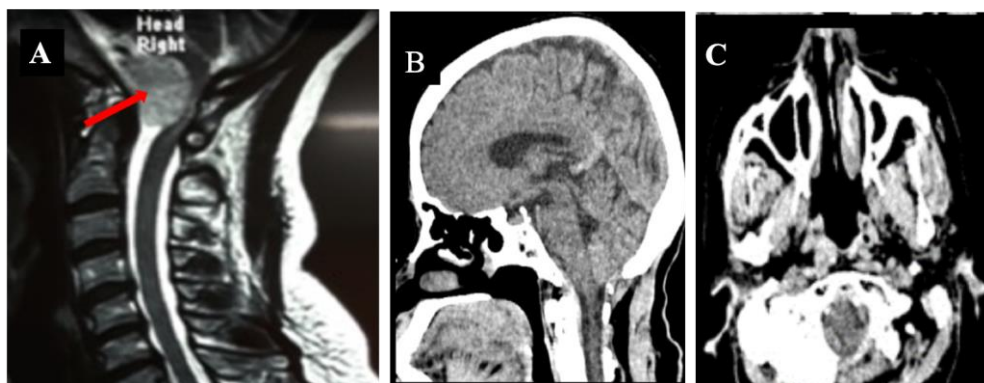


Figure 2. Preoperative MRI imaging of patient 3 reveals an anterior intradural extramedullary tumor (red arrow on A), and the control CT scan (B and C) confirms full excision.

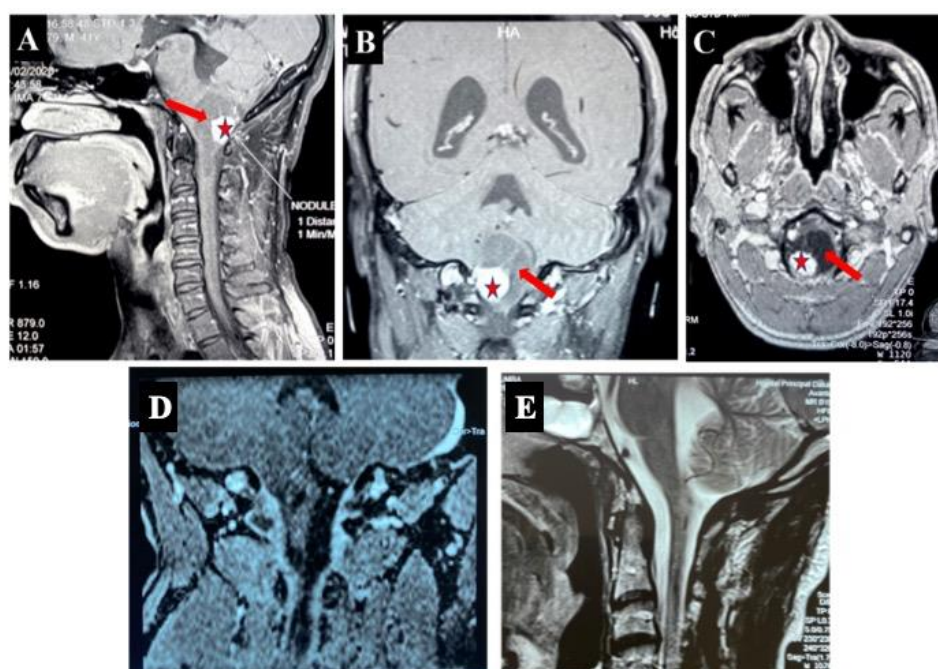


Figure 3. MRI of patient 4 showing a mixed intrabulbar cystic tumor (red arrows A, B, and C) with fleshy mural nodule (red star A, B, and C) and total excision leaving a residual cavity (D and E).

In all of our patients, this excision was carried out after a laminectomy; in two cases, it was combined with a hemi-laminectomy. We sectioned the C2 root in addition to performing coagulation in 2 patients. We had perioperative events included significant venous plexus bleeding in three cases and a dural breach without postoperative cerebrospinal fluid leak. In one case, there was a transient exacerbation of the neurological deficit. Another patient required mechanical breathing after surgery due to a lack of respiratory autonomy. He died on the seventh postoperative day. All these 2 patients had an anterior intradural extramedullary tumor. Neither radiation nor chemotherapy had been administered to any of our patients.

Four histological confirmations were found during the anatomopathological examination: 2 benign schwannomas, 1 neurofibroma, and 1 cavernous hemangioma. A specimen's

histological analysis revealed a neurofibroma versus a low-grade MPNST (Malignant Peripheral Nerve Sheath Tumors). An immunohistochemical test was recommended, but not performed.

One surgical specimen's histological result was non-contributory (the imaging was in favor of pilocytic astrocytoma versus hemangioblastoma) while the other two patients' results were unreported (meningioma was indicated by imaging).

Seven of our patients had control imaging, which revealed tumor residue in two of them and total excision in five of the patients.

Patients had postoperative follow-up for an average of 21 months, with a range of 1 month to 5 years (60 months). We observed a satisfactory clinical progression, with three patients showing a complete regression of the motor deficit and

four showing motor recovery with independent walking. During the follow-up period, we recorded no recurrences in our series.

Our patients' data summary is provided in Table 1 (manuscript end).

Table 1. Our patients' data summary.

Age Genre	Clinic	Preoperative imaging	Treatment	Clinical evolution	Postoperative imaging	histology
Patient1: 54 years (F)	Quadripareisis	MRI: <i>intra- and extradural lesion</i> in extra-intracanal in the left C1–C2 region	Partial excision / posteromedial approach on 08/26/2015	total recovery of motor function	MRI: residual tumors to the foraminal and anterolateral cord	Benign schwannoma
Patient2: 42 years (F)	Quadripareisis	MRI: <i>extradural lesion</i> C1–C2 posterolateral right extra-intracanal	Total excision / posteromedial approach on 09/19/2018	Motor recovery and Walking independently	MRI: spinal cord hypersignal at C2 level without tumor residue	Benign schwannoma
Patient3: 62 years (F)	1) Pyramidal syndrome 2) neck pain	MRI: <i>intradural extramedullary lesion</i> with a broad insertion base that runs from the clivus tip to the odontoid	Total excision / posterolateral approach on 11/14/2018	Transient quadripareisis followed by motor recovery with independent walking	CT scan: absence of tumor residue	Not reported
Patient4: 41 years (M)	Hemiparesia	MRI: <i>Mixed intrabulbar lesion</i> of the FM with a peripheral right posterior-paramedian mural nodule C0–C1 and a retrobulbar cyst	Total excision / posteromedial approach on 02/12/2020	Motor recovery with independent walking and weakness of right-hand grip	MRI: a bulbo-medullary junction excision cavity free of tumor residue	Uncertain
Patient5: 15 years (F)	1) Quadripareisis 2) VRN	IRM: <i>extradural lesion</i> C1–C2 posterolateral right extra-intracanal	Total excision / posteromedial approach on 06/05/2020	total recovery of motor function	CT scan: absence of tumor residue	Neurofibroma versus MPNST low grade.
Patient6: 30 years (M)	1) Quadripareisis 2) Cerebellar syndrome 3) cervical posterior scar 4) VHL	MRI: <i>several mixed intraparenchymal lesions</i> of the FCP, primarily cystic, with an extension towards the diencephalon and cervical cord, a mass effect on the fourth ventricle, and the brain stem	Partial excision / posteromedial approach on 06/09/2021	Recovery of independent walking and partial cerebellar regression syndrome	CT scan: decompression of the brain stem and V4	Cavernous hemangioma
Patient7: 8 years (M)	1) Quadriplegia 2) VRN	MRI: <i>extra- intradural lesion</i> C1–C2 posterolateral left extra-intracanal	Complete excision / posteromedial approach on 09/22/2021	total recovery of motor function	CT scan: left hemilaminectomy C1 and C2 without tumor residue	Neurofibroma
Patient8: 62 years (F)	Quadriplegia	MRI: <i>anterior intradural lesion</i> compressing the cervical spine and medulla oblongata, extending from FM to C2	Partial excision / posterolateral approach on 07/12/2022	Death on 7th post-operative day due to hypotension and lack of recovery of respiratory autonomy	Not realized	Not reported

V4: fourth ventricle; C0: occiput; C1: Axis; C2: Atlas; FM: Foramen Magnum; F: female; M: male; MPNST: Malignant Peripheral Nerve Sheath Tumors; CT: Computer Tomography; MRI: Magnetic Resonance Imaging; VRN: Von Recklinghausen Neurofibromatosis; VHL: Von Hippel-Lindau disease

4. Discussion

According to the information in the literature, just 1.1% to 3.8% of brain and spinal cord tumors are foramen magnum tumors [5]. The reason for our higher percentage could be attributed to the sample's weakness and potential bias in the selection process for brain tumors inside our structure.

In fact, Fann teacher university hospital's neurosurgery department receives admissions for most brain tumors, and it's the first reference center for brain diseases.

There was one case of VHL illness with tumor recurrence in our study. Black Africans were not frequently reported to have VHL illness, according to two studies done in Togo by Belo et al. [6] and Kumako et al. [7].

The research reveals significant regional variations in the duration between the start of symptoms and the diagnosis [8-12]. This could be explained by inequalities in the accessibility of healthcare. In fact, the majority of our patients in poor nations do not have health insurance; instead, they pay for their care with their own resources.

As a result, there is frequently a major delay in therapeutic and diagnostic care because of the populations' financial constraints as well as the prevalence of traditional medical practices, which may cause diagnostic inaccuracy. It should be emphasized, nonetheless, that in the case of craniocervical junction tumors, the principal reason for the delay in diagnosis could be attributed to the clinical signs gradually developing over a rather extended period of time and the diagnosis frequently occurring only after deficiency signs manifest.

An important consideration is the tumor's location. It provides the surgeon the opportunity to select the most efficient approach for accessing the lesion with a minimum of compromise to the vascular and nervous structures. We got a majority of the posterolateral tumors based on the implantation in the anteroposterior plane, as reported by Bruneau et al. [13].

Moreover, the angiographic investigation offers a comprehensive examination of the arterial circulation, specifically focusing on the tumor's primary interactions with the vertebral artery. This enables the surgeon to evaluate the risks and challenges associated with the surgical treatment. Additionally, it makes it possible to evaluate the degree of vascularization present in specific tumors in order to potentially do a preoperative embolization [10]. Please take note that cerebral arteriography, both therapeutic and diagnostic, is still not available in our practice.

The patient's position during surgery depends on the tumor location and the approach used by the surgeon to enable easier access to the tumor. In our study, all patients were operated on in the ventral decubitus position, as in that of Hajhouji [10] and Sahraoui et al [14]. This posture has the benefit of offering straightforward and direct access to the posterior and lateral contents of the craniocervical junction. Its main disadvantage is musculoaponeurotic detachment, which may be

a source of weakening of the posterior cervical muscles.

It also presents a limitation in access to anterior tumors. Unlike our study, in the series of Doleagbenou et al [15], most patients were operated on in a sitting position.

The sitting position has the advantage of offering a clean view of the surgical field by promoting satisfactory venous drainage. The Park Bench position has the advantage of minimizing the danger of venous gas embolism, however it increases the risk of brachial plexus injury and predisposes to muscular injuries [16, 17]. The transoral approach is likewise not practiced in our hospitals. We don't employ these very specialized operating facilities in our practice because we don't have adequate technical support. Note that intraoperative neurophysiological monitoring is not present. Consequently, the location, size, and habits of the surgeon all have a role in the surgical strategy that is selected. The best approach should allow for direct access to the mass while preserving the biomechanical stability of this extremely dynamic site in addition to maintaining neurological function [11].

Cases of craniocervical instability following C1 (Axis) and C2 laminectomy have been reported in the literature [18]. Therefore, hemi-laminectomy is a less-invasive technique that permits the C1 and C2 bone structures to be preserved. Hemi-semi-laminectomy, however, is superior to hemi-laminectomy. It permits the mechanically important bone structures to be preserved as much as feasible [19-21].

Two patients with anterolateral intradural extramedullary tumors developed a surgical complication which resulted in a deterioration of their motor deficit and in one case, death after becoming dependent on mechanical ventilation.

A patient's intraoperative cardiac arrest was described by Hajhouji [10].

In addition to spinal cord manipulations or ischemia, hyperflexion contusion during surgical installation may potentially be a factor of postoperative neurological complications.

The financial and technical limitations previously discussed make it difficult to perform immediate postoperative control imaging, especially magnetic resonance imaging (MRI), to highlight these complications. In our public hospitals, immunohistochemical is still practically absent in this the same context. Some tumors in our series have not histological confirmation, which affects our study's overall histological distribution.

5. Conclusion

For the treatment of tumors of the craniocervical junction, excision remains the treatment of choice. It offers recovery from symptoms, particularly from compression-related neurological issues. The lesion's location and the surgeon's preferences influence the surgical strategy that is chosen. The posterior approach is the most frequent and appears to have

good results in our practice context, where improving access to care and enhancing the technological platform continue to be challenges.

Abbreviations

C0	Occiput
C1	Axis
C2	Atlas
MRI	Magnetic Resonance Imaging
VHL	Von Hippel Lindau
MPNST	Malignant Peripheral Nerve Sheath Tumors

Author Contributions

Sagar Diop: Conceptualization, Writing – original draft, Writing – review & editing

Ababacar Sall Basse: Data curation, Visualization

Souleymane Diallo: Data curation, Visualization

Ibrahima Tine: Validation, Visualization

Mbaye Thioub: Visualization

Abdou Azize Diop: Validation, Visualization

Conflicts of Interest

The authors declare no conflicts of interest.

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