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TELOVELAR APPROACH FOR FOURTH VENTRICLE TUMORS: SAFETY, EFFICACY, AND ENDOSCOPIC ADJUNCTS IN A PROSPECTIVE SERIES OF 30 PATIENTS

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ABSTRACT

Introduction :The surgical approach to fourth ventricle (V4) tumors is a challenge for neurosurgeons, as devastating morbidity can occur at any moment. Traditionally, a transvermian approach has been employed. However, vermian incision is associated with a higher incidence of cerebellar mutism and posterior fossa syndrome, as well as chronic neurocognitive sequelae. This has led some authors to opt for the telovelar approach to fourth ventricle tumors, which represents a more natural and safer corridor.

Objective: The main objective of our work is to evaluate the benefits and safety of the telovelar approach in surgery for fourth ventricle tumors and its role in reducing postoperative neurological dysfunctions, namely cerebellar mutism, cerebellar cognitive affective syndrome, and ataxia, with particular emphasis on vermis preservation and the added value of endoscopic assistance.

Materials and Methods: We conducted a prospective study of 30 patients operated on between 2022 and 2025 at the "Mustapha Pacha" University Hospital Center in Algiers. The telovelar approach was systematically used for all patients, with endoscopic assistance employed in nearly half of the cases. Clinical, radiological, and operative data were analyzed to assess the quality of resection as well as short- and long-term postoperative prognosis.

Results:Total macroscopic resection was achieved in 66.7% of patients. The opening of the cerebellomedullary fissure (CMF) was extensive in the majority of cases (90%). The combination of microscope and endoscope facilitated complete resection of extensions toward the cerebral aqueduct in 100% of cases. Notably, no cases of cerebellar mutism were observed. At 2 years, neurological recovery was complete for all followed patients.

Conclusion: The telovelar approach provides a safe and versatile surgical corridor that offers a panoramic view of the entire fourth ventricle and excellent, secure exposure of fourth ventricle tumors without the need for vermian incision. Endoscopic assistance proves to be an indispensable adjunct for ensuring safe resection in areas with limited microscopic visibility.

Keyword: Telovelar approach, Cerebellomedullary fissure, Fourth ventricle tumors

1. INTRODUCTION

Surgery of fourth ventricle (V4) tumors is one of the most complex challenges in contemporary neurosurgery. Located at the crossroads of vital functional structures, the V4 demands extreme precision from the surgeon to balance the imperative for maximal tumor resection with the preservation of the neurological integrity of the brainstem and cerebellum.

Historically, the transvermian approach was long used to access fourth ventricle tumors, but the occurrence of cerebellar mutism, cerebellar cognitive affective syndrome, and the risk of damaging the dentate nucleus (17,180) with this technique prompted some authors to choose a natural corridor via the CMF for these tumors.

Matsushima was the first to describe the microsurgical anatomy of the cerebellomedullary fissure and to use it. Subsequently, Kellogg and

Piatt (28), and later Ziyal et al. (9), reported satisfactory outcomes for fourth ventricle tumors. Since then, other studies have documented the successful use of this approach for various fourth ventricle tumors (1,9,24). The aim of our study is to evaluate the contribution and safety of the telovelar approach for fourth ventricle tumor surgery, while identifying and preserving important neurovascular structures particularly the floor of the V4, the PICA, and the deep nuclei to reduce postoperative complications.

2. MATERIALS AND METHODS:

We conducted a descriptive prospective study over a 3-year period (2022-2025) involving 30 patients operated on for a fourth ventricle (V4) tumor at the university hospital center (MUSTAPHA–Algiers). The telovelar approach was systematically performed for all patients. Inclusion criteria comprised all tumors arising from the floor of the V4 or the inferior vermis (VMI), regardless of age or histopathological profile. Clinical, radiological, and operative data (microsurgery and endoscopy videos) were analyzed using SPSS software.

3. OPERATIVE TECHNIQUE: THE TELOVELAR APPROACH

All surgeries were performed under general anesthesia, with patients positioned in the prone position (97%), the head fixed in a Mayfield clamp in flexion. The approach was made via a midline occipito-cervical incision extending from the inion to C3. A suboccipital median craniectomy (50% of cases) or craniotomy (remaining 50%) was performed, sometimes in combination with a C1 laminectomy in % of cases. After opening the dura in a “Y” shape and the arachnoid of the cisterna magna, gentle aspiration of cerebrospinal fluid was performed to achieve cerebellar decompression, and the cerebellomedullary fissure (CMF) was dissected. Exposure of the fourth ventricle was obtained by incising the choroid plexus and the inferior medullary velum (telovelar approach). According to tumor extension, a bilateral (extensive-type) opening was favored in most cases, which enabled complete access from the obex to the cerebral aqueduct while preserving vermis integrity.

Tumor resection was conducted via operative microscope by central debulking followed by capsular dissection. Special attention was paid to the interface between the tumor and the floor of the V4. In 46.7% of cases, endoscopic assistance was used at the end of surgery. The use of a rigid endoscope introduced through the foramen of Magendie allowed for inspection of blind spots (lateral recesses and upper part of the aqueduct) to confirm an empty ventricle and restore CSF dynamics.

4. RESULTS:

4.1. Clinical Profile and Circumstances of Discovery:

Our series includes 30 patients with an average age of 25 years (range: 3–68 years) and a slight female predominance (60%). The mean diagnostic delay was 4.4 months. The main presenting signs were intracranial hypertension syndrome in 22 patients, followed by ataxia in 13 patients. We also noted that in 2 patients, the condition was discovered incidentally during the investigation of a moderate head injury. Abnormal neck posture was observed in 6 patients, and cranial nerve involvement in 7 patients.

4.2. Surgical Strategies and Exposure of the Fourth Ventricle:

The telovelar approach was used for the entire series, either exclusively under microscopy (53.3%) or with complementary endoscopic assistance (46.7%). Removal of the posterior arch of C1 was deemed necessary in 20 patients (66.7%) in cases of tonsillar herniation, as well as to widen the vertical working angle, particularly in cases of extension toward the aqueduct.

Opening of the cerebellomedullary fissure (CMF) was mostly extensive (90%), with the lateral type being used in only 10% of cases. Bilateral retraction of the tonsils was performed in 90% of procedures, allowing panoramic exposure of the choroid tela and the inferior medullary velum (IMV).

4.3. Analysis of Tumor Extension and Infiltration:

Intraoperative exploration revealed infiltration of the obex in 20% of patients (anaplastic medulloblastomas, glioblastomas, and ependymomas). The bulbar triangle of the floor of the fourth ventricle was infiltrated in 30% of cases. Extension towards the mesencephalic aqueduct was observed in 36.7% of patients, and towards the lateral recesses in 63.3% of cases.

4.4. Quality of Surgical Resection:

Gross total resection was achieved in 66.7% of patients. Subtotal resection (residual tumor nodule) was performed in 26.6% of cases, and partial resection in 6.7%. At the aqueduct level, resection was total in 100% of patients with infiltration in this area, thanks to endoscopic control and adjustment of working angles. For the lateral recesses, resection was total in 73.7% of the patients where the tumor had extended to this area. Limitations of resection were not due to the exposure provided by the telovelar approach, but rather to infiltration of the floor of the fourth ventricle and the obex, which required a conservative strategy to preserve vital neurological functions.

4.5. From a histopathological point of view:

Medulloblastomas were predominant (23.3%), followed by pilocytic astrocytomas (20%) and ependymomas (16.7%). Benign lesions (epidermoid cysts, hemangioblastomas) accounted for 26.8% of the series. Adjuvant therapy (chemoradiotherapy) was necessary for 36.7% of the cohort.

4.6. Management of Preoperative Hydrocephalus:

Urgent management of hydrocephalus secondary to the tumor process was indicated in 19 patients (63.3% of cases). A ventriculoperitoneal shunt (VPS) was placed in 11 patients (36.7% of cases). Endoscopic treatment of hydrocephalus (third ventriculostomy) was performed in 6 patients (20% of cases). The ventriculostomy was combined with a transaqueductal biopsy in 2 patients (6.7% of cases).

4.7. Postoperative Course and Complications:

The immediate postoperative evolution was marked by a remarkable absence of mortality and cerebellar mutism. The most frequent complications were transient worsening of ataxia (16.7%) and cerebrospinal fluid leaks (10%). In the long term, clinical improvement was significant.

4.8. Discussion:

Surgical management of fourth ventricle tumors is a challenge for neurosurgeons, as devastating morbidity can occur at any time. The traditional approach has involved a transvermian approach. However, vermian incision is correlated with a higher incidence of cerebellar mutism or posterior fossa syndrome as well as chronic neurocognitive sequelae (23, 57, 1913193). The discovery of the CMF was monumental for fourth ventricle surgery (33, 194, 195). The telovelar approach offers a relatively minimally invasive corridor for fourth ventricle tumor surgery; moreover, it also provides an adequate angle of exposure and working space. Authors have differing perspectives on the method of exposing the fourth ventricle. They have described the various parts of the roof of the fourth ventricle that should ideally be incised.

Matsushima described three methods for opening the CMF via the trans-CMF approach: the [illegible]ensive (aqueductal) type, which should be most commonly used since it provides the largest opening of the fissure (10, 13). Analysis of the methods for opening the cerebellomedullary fissure in our series shows a predominance of the extensive type (90%), consistent with Tomasello's practices (100%). The safety of incising the choroid tela and the inferior medullary velum (IMV) is now widely accepted (Matsushima, El Bahy, Gök), with postoperative morbidity being correlated with manipulation of adjacent critical structures rather than the surgical approach itself.

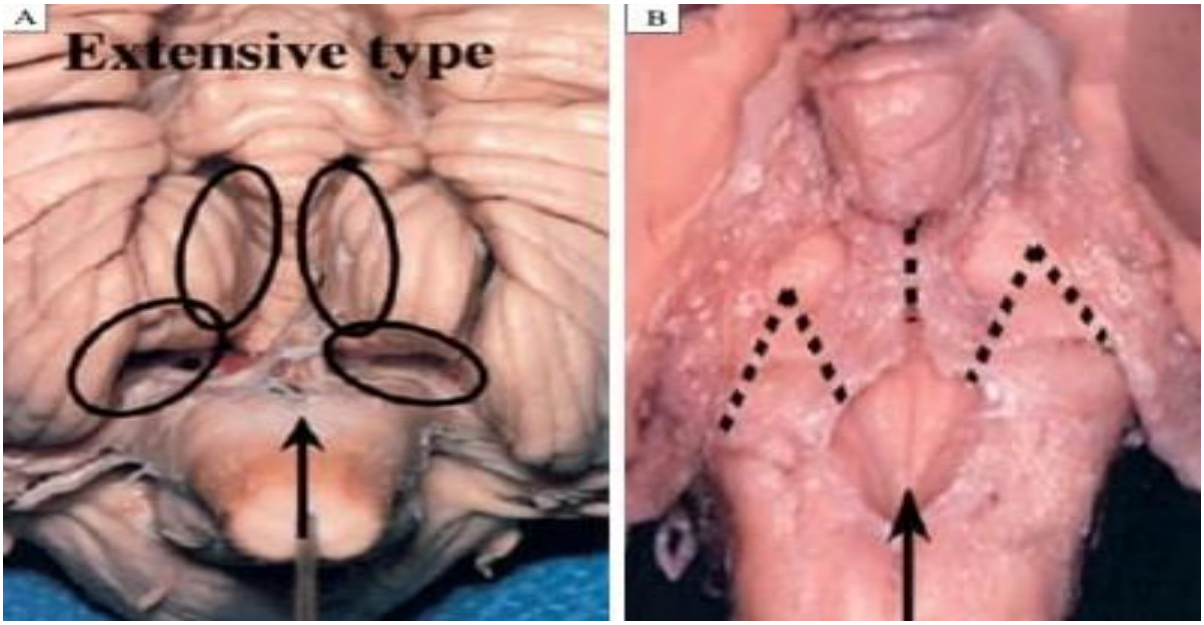

Figure1. The Extensive Opening Method of the CMF : (A) The recesses of the **V4** (fourth ventricle) to be exposed by the extensive opening mode of the **CMF** (cerebellomedullary fissure) , (B) The extensive opening mode of the **CMF**

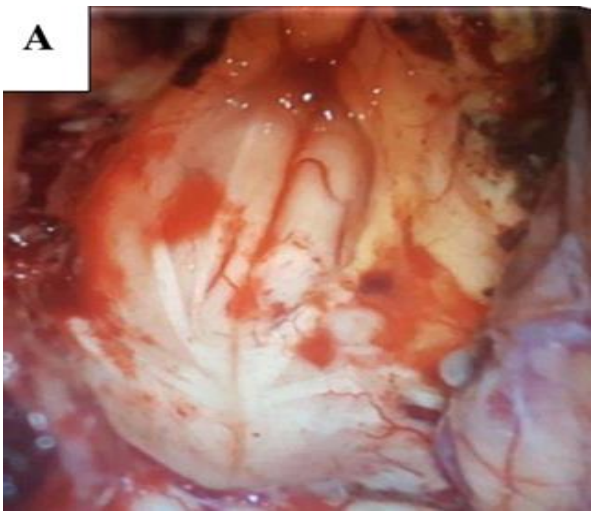

Figure 2. (A) intraoperative image showing the exposure of an **exophytic lesion** at the level of the **pontine triangle** via an extensive opening mode (Mustapha University Hospital Center)

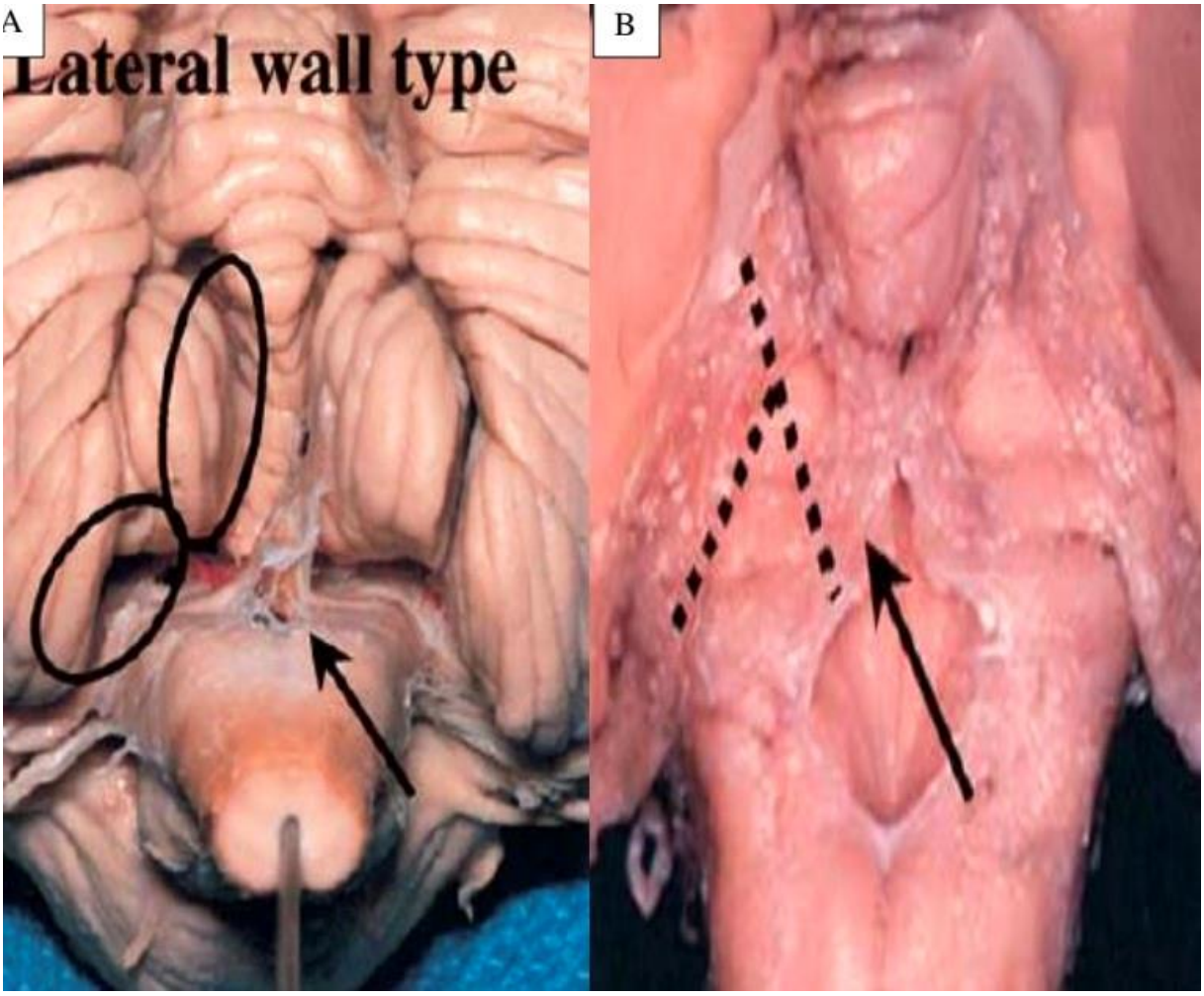

Figure3. The Lateral Wall Opening Method (A) The recesses of the V4 (fourth ventricle) to be exposed by the lateral wall opening mode,(B) The lateral opening mode of the lateral wall.

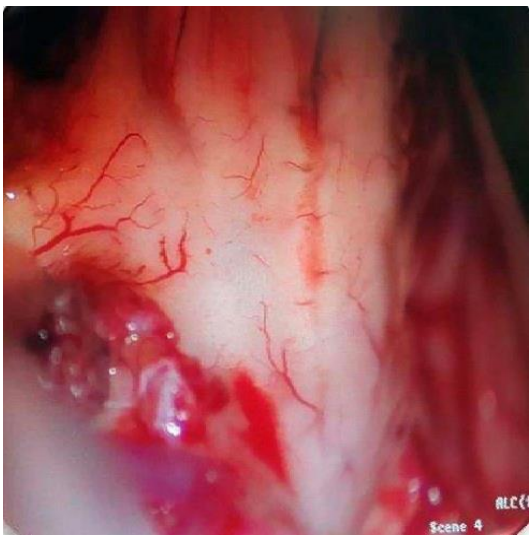

Figure4.Intraoperative image showing the exposure of a lesion at the level of the lateral wall via a lateral opening mode of the lateral wall (Mustapha University Hospital Center).

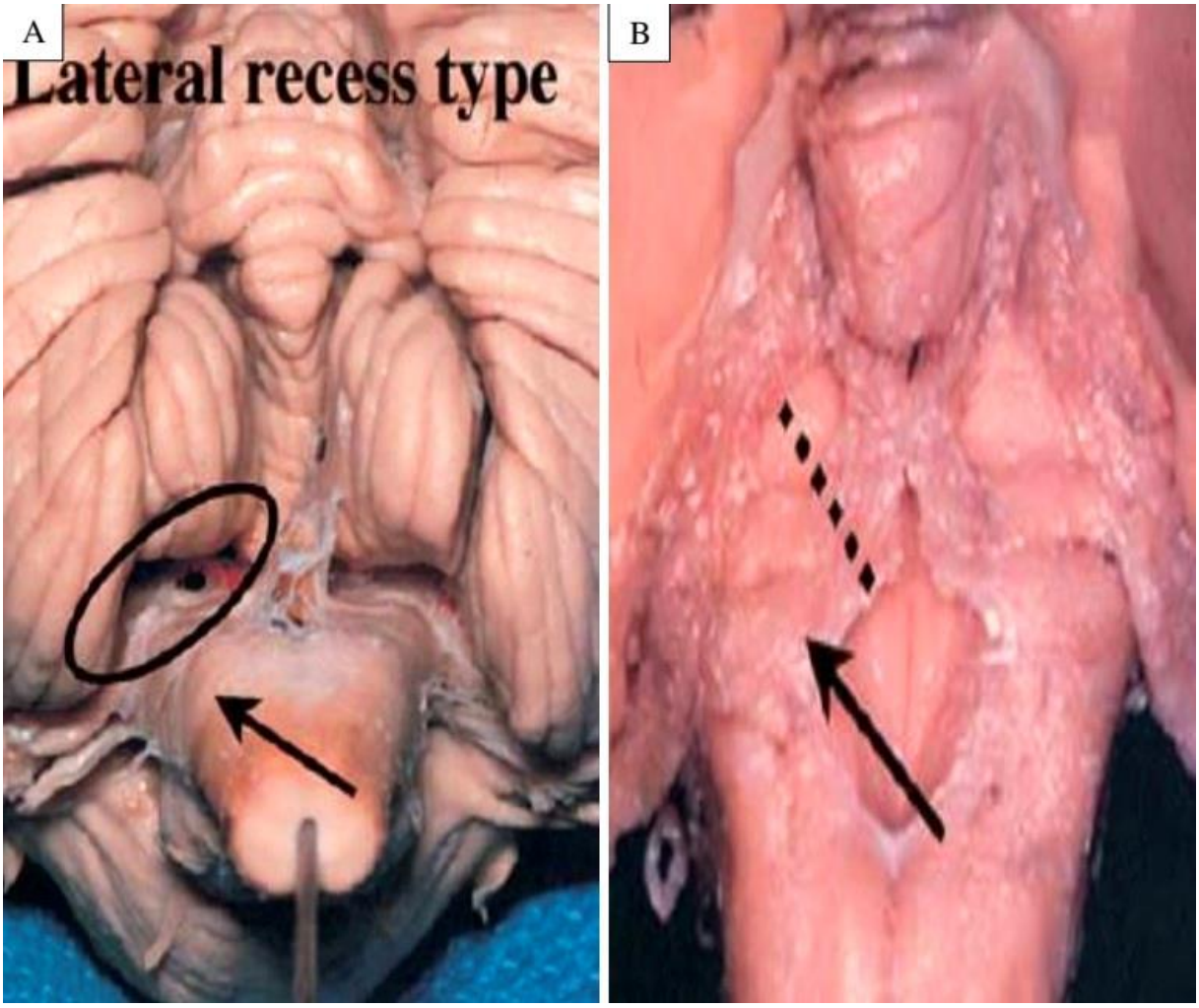

Figure5.The lateral opening method of the CMF (21, 77) (A) The recesses of the V4 (fourth ventricle) to be exposed by the lateral opening mode,(B) The lateral mode of opening the lateral recess.

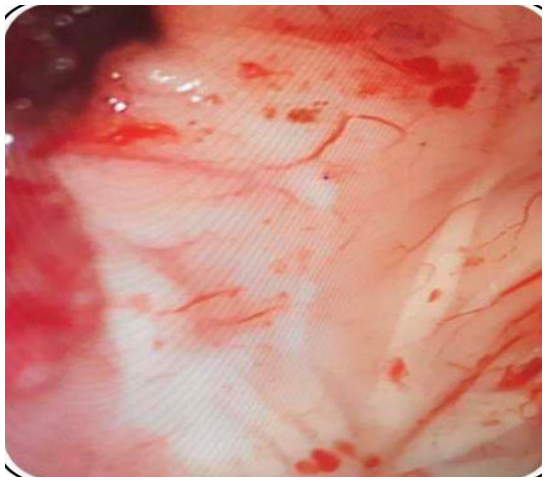

Figure6. Intraoperative image showing the exposure of a lesion at the level of the lateral recess via a lateral opening mode (Mustapha University Hospital Center).

In our series, the appearance of the choroid tela was normal in 4 cases, stretched and translucent in 17 cases, and fused with the tumor capsule in 9 cases. Regarding the appearance of the inferior medullary velum, our study analysis showed that it was fused with the tumor capsule in 13.3% of cases, thinned and taut in 13.3% of cases, and infiltrated by the tumor in 73.4% of cases. According to Francesco Tomasello, S.N. Zaheer, and El Bahy, the pathological changes of the choroid tela and the inferior medullary velum are correlated with the histopathological types of fourth ventricle tumors as well as their sites of attachment or tumor origination. The presentation of the choroid tela can be thinned, translucent, and spread over the tumor capsule (choroid plexus papillomas and meningiomas). Sometimes it is fused with the tumor capsule (dermoid and epidermoid cysts). This scenario

suggests a simultaneous opening of the choroid tela and the tumor capsule. In cases of vermian tumors extending into the fourth ventricle (such as medulloblastomas and vermian astrocytomas), the inferior medullary velum is infiltrated by the tumor and is not identifiable. In cases of purely intraventricular tumors (ependymomas, meningiomas, epidermoid and dermoid cysts, choroid plexus papillomas), the inferior medullary velum is thinned and stretched, appearing as a sheet over the tumor capsule. Large intraventricular tumors stretch and thin both the inferior medullary velum and the choroid tela, thus facilitating easier and wider access to both the tela and the tumor (1,10,24,179).

In our series, the telovelotonsillar segment of the PICA was free in 86.7% of cases and infiltrated in 13.3%. This infiltration was found in four cases of medulloblastomas. After dissection of the uvulotonsillar and medullotonsillar sulci, identification and inspection of the telovelotonsillar segment of the PICA are mandatory before tumor dissection or opening of the CFM (187). When the tumor shows cisternal development, frequently enlarging the CFM, the PICA and its branches may be engulfed or displaced by the tumor. This situation must be considered during the dissection and resection of the tumor in the CFM. Involvement of PICA branches downstream from the medullary branches at the level of the roof of the fourth ventricle can lead to ataxia and postoperative nystagmus (1,66).

In our series, 17 patients (or 56.7% of cases) presented with tonsillar herniation. This was present in 33.3% of cases in Francesco Tomasello's series. Exposing the lower edges of the cerebellar tonsils allows for the dissection of the medullotonsillar and uvulotonsillar spaces, facilitating manipulation and gentle retraction of the tonsils (1,13,23). Tonsillar herniation below the foramen magnum on preoperative imaging indicates removal of the posterior arch of C1 (1,10,197).

Removal of the posterior arch of C1 (performed in 66.7% of our cases compared to 33.3% for Tomasello and 100% for Eissa) appears to be a crucial adjunct maneuver. According to the cadaveric studies by Deshmukh et al., this procedure significantly increases both the vertical and horizontal working angles of the obex, offering better exposure than the telovelar approach or the classic transvermian approach alone.

We concur with Francesco Tomasello, S. Noman Zaheer, Abdulvahap Gok, and Sheng Han, who reported that the posterior arch of C1 is removed in cases of cerebellar tonsil herniation on preoperative imaging (1,10,23,198), and with F. Tomasello who mentioned that C1 laminectomy is a possible maneuver to achieve a favorable working angle toward the aqueductal region of the fourth ventricle (10).

Regarding tonsillar retraction, in our series, bilateral retraction predominated (90% of cases), aligning with the practices of Tomasello, Gok, and El Bahy (100%), while Sheng Han favors a contralateral unilateral approach (86%) to widen the visual field. Technically, bilateral dissection of the uvulotonsillar and medullotonsillar spaces allows inferior-lateral or medio-lateral mobilization of the tonsils, which is essential for exposing the choroid tela, the inferior medullary velum, and accessing the different recesses of the fourth ventricle.

Although Di Leva highlights the risk of compression of the dentate nuclei and cerebellar peduncles during excessive maneuvers, we agree with Matsushima in noting that sufficient opening of the CFM guarantees the neurological safety of the retraction. Thus, contrary to some authors who suggest tonsillectomy for large tumors or those attached to the superolateral angle, we found this parenchymal sacrifice unnecessary in our series. Our explanation is that in actual surgery, unlike cadaveric dissection, after the release of CSF, flexible tonsil retraction and progressive tumor resection provide sufficient exposure.

Microscopic exploration of the tumor-obex relationship is a crucial step before incising the choroid tela and/or the inferior medullary velum because certain tumors of astrocytic and ependymal origin, and even those originating from the inferior medullary velum, invade the obex, making total tumor resection impossible (1,24). In our series, tumor infiltration of the obex was found in 20% of cases (anaplastic medulloblastomas, ependymomas). A conservative approach (leaving behind a small tumor nodule) is recommended to preserve the

nuclei of the mixed nerves and the inferior cerebellar peduncles.

The floor (Bulbar Triangle) was infiltrated in 30% of our cases. Careful microscopic exploration of the tumor-floor interface is an essential condition to avoid damage to the vagal trigone. Tumor infiltration of the floor compels us to leave a small tumor remnant to avoid affecting the vagal trigone, especially since this is associated with a poor prognosis, and to minimize postoperative morbidity and mortality (23,24).

In our series, total tumor excision was achieved in 20 patients (66.7% of cases), subtotal excision leaving a small tumor remnant in 8 patients (26.6% of cases), and partial excision in 2 patients (6.7% of cases). These results are similar to those reported by Francesco Tomasello, who found that tumor excision was partial in 2 patients (4.4% of cases), subtotal in 3 patients (6.7% of cases), and total in 40 patients (88.9% of cases).

Subtotal resections are not related to inadequate exposure via this approach, but rather to the histological nature of the tumors and their degree of infiltration into the walls of the fourth ventricle, such that the conservative strategy described in many studies on these tumors was followed.

Tumor extension to the cerebral aqueduct was observed in 11 patients in our series (36.7% of cases). Tumor excision at this level was total in all our patients (100% of cases). Abdulvahap Gok, K. El Bahy, and Francesco Tomasello reported that aqueductal tumor excision was total in all their patients (100% of cases).

Although extensive opening of the cerebello-medullary fissure allows expanded access to the ventricular recesses, deep rostral extension remains a major surgical challenge. To address angular constraints in the aqueductal region, Tomasello and Deshmukh recommend resecting the posterior arch of C1 to optimize the working angle. El Bahy proposes a limited vermian incision (1 cm) to reduce retraction forces on adjacent tissue.

In our series, this step was replaced by changing the working angle, rotating the operating table, and using endoscopic control for tumor exploration and resection.

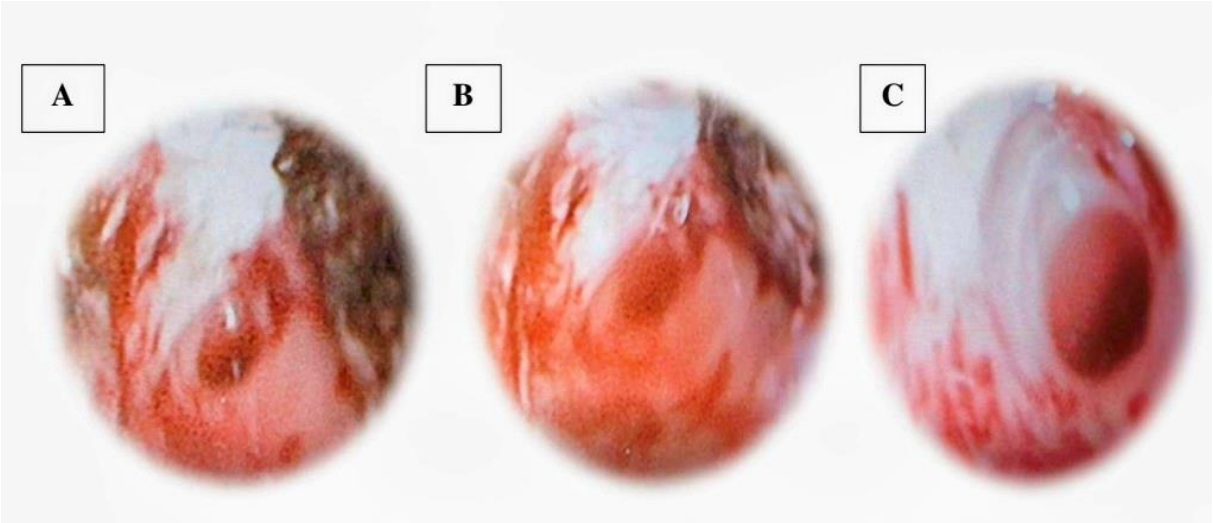

Figure7. Endoscopic exploration of (A) the roof of the fourth ventricle, (B) the lateral recess, and (C) the mesencephalic aqueduct

At the level of the lateral recess, tumor excision was partial in 5 of our patients (26.3% of cases) and total in 14 patients (73.7% of cases). We were able to achieve total tumor excision in the lateral recess in 14 patients (73.7% of cases), and partial in 5 patients (26.3% of cases). K. El Bahy reported lateral tumor excision was total in 5 patients (71.4% of cases) and partial in 2 patients (28.6% of cases). Francesco Tomasello reported that excision of tumor extension at the lateral recess was partial in 1 patient.

In our series, we performed a ventriculo-peritoneal shunt (VPS) for cerebrospinal fluid (CSF) in 11 patients and a ventriculo-cisternal shunt in 6 patients preoperatively. Meanwhile, 3

patients required a VPS after tumor resection surgery. F. Tomasello used a VPS postoperatively in 2 patients.

The protocol for active hydrocephalus is urgent preoperative diversion of CSF before tumor surgery (VPS, ventriculo-cisternal shunt, external ventricular drainage). Preoperative CSF diversion appears to be very useful in patients with large tumors because it facilitates intraoperative dissection and reduces retraction; furthermore, it protects against acute and delayed postoperative hydrocephalus (23,24,197).

Tomasello and Matsushima (10,13) suggested that the telovelar approach may offer an additional advantage in reducing the incidence of postoperative hydrocephalus; this satisfactory magento-ventricular communication is achieved by bilateral opening of the FCM and adequate exposure of the cerebral aqueduct, as well as verifying its patency.

5. CONCLUSION:

The telovelar approach stands out as an excellent alternative to the transvermian route for excision of fourth ventricle tumors. By preserving the integrity of the vermis, this approach offers secure, panoramic exposure, notably allowing early identification of the interface between the lesion and the ventricular floor. Its technical versatility, whether through unilateral or extensive bilateral variants, enables precise adaptation to the tumor topography, including extensions toward the cerebral aqueduct or the lateral recesses.

Our results underline that endoscopic assistance is an indispensable complement to microsurgery for the meticulous exploration of the lateral recess, the superolateral cavity, the cerebral aqueduct, and the upper part of the roof of the fourth ventricle (superior medullary velum), thus optimizing the quality of excision. Although histological infiltration of the ventricular floor remains the main limiting factor to resection, the wide bilateral telovelar approach promotes the restoration of cerebrospinal fluid dynamics, significantly reducing the incidence of postoperative hydrocephalus. The histological type and tumor infiltration of the ventricular floor are factors limiting the quality of excision of fourth ventricle tumors. The telovelar approach, with wide bilateral opening of the FCM, the patency of the cerebral aqueduct, and the enlargement of communication between the cisterna magna and the fourth ventricle, offers an added benefit of reducing the incidence of postoperative hydrocephalus.

BIBLIOGRAPHY

[1]. **Gok A, Alptekin M, Erkutlu I.** Surgical approach to the fourth ventricle cavity through the cerebellomedullary fissure. *Neurosurg Rev* 27(1), 2004: 50-54.

[2]. **Matsushima T, Fukui M, Inoue T, et al.** Microsurgical and magnetic resonance imaging anatomy of the cerebellomedullary fissure and its application during fourth ventricle surgery. *Neurosurgery* 30, 1992:325-330.

[3]. **Mussi AC, Rhoton AL Jr.** Telovelar approach to the fourth ventricle: Microsurgical anatomy. *J Neurosurg* 92(5), 2000:812-823.

[4]. **Tomasello F, Conti A, Cardali S, et al.** Telovelar Approach to Fourth Ventricle Tumors: Highlights and Limitations. *World Neurosurg*, 2015;83(6):1141-7.

[5]. **Deshmukh VR, Figueiredo EG, Deshmukh P, et al.** Quantification and comparison of telovelar and transvermian approaches to the fourth ventricle. *Neurosurgery*. 2006;58:ONS-202-206.

[6]. **Steinbok P, Cochrane DD, Perrin R, Price A.** Mutism after posterior fossa tumour resection in children: Incomplete recovery on long-term follow-up. *Pediatr Neurosurg* 39(4), 2003: 179-183.

[7]. **Di Ieva A, Komatsu M, Komatsu F, Tschabitscher M.** Endoscopic telovelar approach to the fourth ventricle: anatomic study. *Neurosurgical Review*, 2011; 35(3), 341–349.

[8]. **Ferguson SD, Levine NB, Suki D, et al.** The surgical treatment of tumors of the fourth ventricle: a single institution experience. *Journal of Neurosurgery*, 2018 128(2), 339–351.

[9]. **Han S, Wang Z, Wang Y, Wu A.** Transcerebellomedullary fissure approach to lesions of the fourth ventricle: less is

more? *Acta Neurochirurgica*, 155(6), 2013; 1011–1016.

[10]. **Tanriover N, Ulm AJ, Rhoton AL, Yasuda A.** Comparison of the transvermian and telovelar approaches to the fourth ventricle. *Journal of Neurosurgery*, 2004;101(3), 484–498.