Full Endoscopic Infratentorial Supracerebellar Approach to Lesion of Pineal Region - Case Report

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Abstract

Introduction: The supracerebellar infratentorial approach was originally described by Sir Victor Horsley, and was later adapted by Stein who applied the microsurgical technique improving the results of surgeries of the pineal region.

Objectives: To highlight and systematize the indications, technical-anatomical details in the supracerebellar infratentorial approach based on our surgical experience and the review of the microsurgical anatomy of the Pineal region.

Material and Methods: A retrospective descriptive study was carried out analyzing the clinical histories of six patients surgically intervened by the author in the aforementioned hospitals, through a full endoscopic supracerebellar infratentorial approach, between January 2013 and June 2019.

Results: During the 2013-2019 periods, 6 patients underwent surgery. All of them underwent a full endoscopic supracerebellar infratentorial approach. 3 tumors of the pineal region, 1 Pilocytic Astrocytoma and 2 Arachnoid Cyst were treated.

The following steps were standardized for the completion of endoscopic Stein’s supracerebellar infratentorial approach: presurgical preparation, sitting position, head position, cutaneous marking and antisepsis, sterile field placement, skin and subcutaneous tissue incision, muscular plane dissection, craniotomy, dural opening, preparation of the supracerebellar corridor, intradural dissection and microsurgical anatomy of the pineal region and considerations on closure.

Conclusion: The supracerebellar infratentorial approach with which we could access pineal tumors was systematized. In all cases, the anatomical exposure was enough to adequately treat the aforementioned pathologies, with minimal retraction of the CNS structures.

Keywords: Supracerebellar infratentorial approach; Suboccipital craniotomy; Pineal region

Introduction

The incidence of tumors of the pineal region is between 0.5% to 2% of all tumors of the Central Nervous System (CNS), being the tumors of origin of the germinal cells and those of the parenchyma the most common, these tumors were described for the first time in 1717 and the first attempts at surgery were not made until 1910 by Sir Victor Horsley [1,2]. In 1913 Oppenheim and Krause successfully report the removal of a tumor from the pineal region using as a corridor, the supracerebellar infratentorial approach, later in 1971 Bennet Stein with the advent of the microsurgical technique refined this approach and described the steps of it [3-5]. With the advent of endoscopy, in 1997 Ellenbogen and Moores performed the first third endoscopic ventriculostomy and biopsy of a lesion of pineal region [6]. This procedure opened the doors to a new surgical perspective for the pineal region, which led the neurosurgeons to support the micro approach surgical by endoscopy.

Objective

To describe the supracerebellar infratentorial endoscopic approach for tumors of the Pineal region.

Method

Six patients diagnosed with Tumor of the pineal region, surgically treated by totally endoscopic approach, in the period from January 2015 to February 2017 at the "Hermanos Ameijeiras" Surgical
Clinical Hospital and Antonio Lenin Fonseca School Hospital Nicaragua and Institute of Neurology and Neurosurgery of Cuba.

Surgical Technique

Sitting position After orotracheal intubation, ocular protection with ophthalmic ointment ensuring the palpebral occlusion, later the lower limbs and the trunk are gradually elevated, in such a way that the gluteal region is at an angle of 90° with the stretcher, pad is placed in the region popliteal of both legs, as well as elastic bandages as prophylaxis of deep vein thrombosis. Mayfield head is placed, head in neutral position, with flexion of the cervical spine avoiding the chin contact the sternal handle, adjust the head to the attachment for the sitting position (Figure 1).

Incision of skin in the mid cervical posterior line, Nafziger type from 1 cm above the inion to the spinous process of C3, descends by planes until it deepens to the muscular plane. As the muscle dissection is advanced, the auto clavable retractors are placed of adson, deepening each time it is necessary, the exposure of the posterior arch of the atlas, should be done from medial to lateral, first by the inferior margin, and not exceeding 1cm lateral, to avoid lesions of the vertebral artery.

The patient’s sitting position is risky for the air embolism, so all bleeding should be immediately restrained, paying special attention to lesions of emissary veins that must be plugged with bone wax. It may happen that they do not bleed due to negative pressure, but they must be identified and immediately closed. (Control of bleeding with respect to the dural venous sinuses will be discussed in the dural opening section).

With high-speed Drill, two holes are made on both sides of the midline of the occipital bone 1 cm below the inion, so as not to work on the transverse sinus, using a cutting bur to expose the dura, then the craniectomy is completed with an extension of 3 cm lateral, it descends obliquely towards the foramen magnum with 1 cm and a half of each side It if has not been possible to expose the inferior border of the transverse sinus it wears with drill the superior part of the craniotomy.

The dura opens in a V shape, based on the transverse sinuses, traction points of the dura with Polyester 4.0, the cerebellum is exposed, the rigid endoscope is inserted slowly, 0°, 4mm in diameter, 18 cm in length. (Karl Storz GmBH & Co, Tuttlingen, Germany) in the supracerebellar infratentorial corridor, cotenoids are placed and advanced without the use of spatulas (Figure 2), because due to the action of gravity, as well as drainage of Cerebrospinal Fluid (CSF) by the continuous spinal drainage, favors the exhibition, as it advances in the supracerebellar infratentorial space, the arcanoid bands and small bridging veins are cut between the tentorium and superior face of the cerebellum, it is important to coagulate the least amount of veins possible with the greatest visualization and exposure, exposing in this way the posterior tentorial incisura, during this phase the superior vermian bridges veins that drain to the third or middle of the transverse sinus and the tentorial sinus, trying to respect it until the last moment, only to coagulate it if there is a need before reaching the lesion, which allows to expand the supracerebellar corridor. The arachnoid is dissected and the posterior wall of the quadrigeminal cistern is exposed. From the anatomical point of view already at this stage of the surgery and depending on the size of the lesion, the superior quadrigeminal tubers can be visualized, the view of the inferior quadrigeminal plate will always be hindered by the culmination, and superior to them the pineal gland and the vein of Galen. Anterior to the pineal gland we find the posterior wall of the third ventricle and on the sides the pulvinar of the thalamus, although in some cases the posterior part of the parahippocampal gyrus may appear above the posterior portion of the free edge of the tentorium. The vein complex of Galen with its internal cerebral tributaries coming from the velum
The use of endoscopic supracerebellar infratentorial approach is not without difficulty. Experience with this and similar procedures leads to several refinements in the preoperative and transoperative methodology. It is necessary a family anesthesiologist with the sitting position and with the management of its potential complications. Navigation without intra operative framework is essential to perform the same. It needs a pre and transoperative reconstruction.

FEISA: Full Endoscopic Infratentorial Supracerebellar Approach

The sitting position in both the supracerebellar endoscopic infratentorial approach and in the conventional approach is favorable for the surgeon, although it is associated with a significant risk of venous embolism [1,19,25-27]. This complication in the endoscopic supracerebellar infratentorial approach is less likely because the dural sinuses are not exposed; it is also easier to flood the operative field with irrigation fluid and to occlude the air inlet with a simple trephine orifice. When performing this surgical procedure, in a semi-sitting position with the use of a microscope, it is fatiguing for the surgeon, whose arms should remain extended and the shoulders abducted. The endoscope can be held at the level of the surgeon’s chest and can be easily manipulated without tension. In addition, the wound associated with a supracerebellar endoscopic infratentorial approach is relatively small, thus decreasing pain and postoperative morbidity compared to the open approach. The opening and closing is faster with the endoscopic supracerebellar infratentorial approach [19].

The totally endoscopic use for the supracerebellar infratentorial approach to a cyst of the pineal region was performed for the first time as recently as 2008 Gore et al. [19]; it is an approach that is not free of risk, to perform the same. It needs a pre and transoperative radiation therapy and chemotherapy, it favors a lower predisposition to cerebrospinal fluid fistulas, muscle reconstruction.

Results

Patients operated by totally endoscopic approach, with tumors of the pineal region, the characteristics are shown in Table 1.

Discussion

Ruge et al. [7] was the first to report the totally endoscopic approach to the fenestration of an arachnoid cyst that enveloped the quadrigeminal plates, the internal walls of the III ventricle and the orifice of the third ventricle. Aqueduct of Silvio, during this step you can unclog the same if there was the presence of a clot, once concluded the revision of the neural and vascular structures with the 30° endoscope, remove and place again the 0°, to be able to complete the hemostasis.

The hermetic closure is of the utmost importance, with a correct and meticulous haemostasis to avoid postsurgical bleeding, placement of the bone flap or plasty with methyl methacrylate, which favors a lower predisposition to cerebrospinal fluid fistulas, muscle reconstruction.

Table 1: Patients operated by totally endoscopic approach, with tumors of the pineal region, the characteristics.

<table>
<thead>
<tr>
<th>Age/sex</th>
<th>Surgical Approach</th>
<th>Histopathology</th>
<th>Preoperative Karnosfsky</th>
<th>Adjuvant Therapy</th>
<th>Glasgow Scale for Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>56/m</td>
<td>FEISA</td>
<td>Pineoblastoma</td>
<td>50</td>
<td>-</td>
<td>1</td>
</tr>
<tr>
<td>31/m</td>
<td>FEISA</td>
<td>Pitocytic Astrocytoma</td>
<td>100</td>
<td>-</td>
<td>5</td>
</tr>
<tr>
<td>23/m</td>
<td>FEISA</td>
<td>Pineocitoma</td>
<td>100</td>
<td>Radiation therapy and chemotherapy</td>
<td>4</td>
</tr>
<tr>
<td>33/m</td>
<td>FEISA</td>
<td>Arachnoid Cyst</td>
<td>100</td>
<td>-</td>
<td>5</td>
</tr>
<tr>
<td>46/f</td>
<td>FEISA</td>
<td>Arachnoid Cyst</td>
<td>100</td>
<td>-</td>
<td>5</td>
</tr>
<tr>
<td>27/m</td>
<td>FEISA</td>
<td>Pineocitoma</td>
<td>100</td>
<td>-</td>
<td>5</td>
</tr>
</tbody>
</table>

FEISA: Full Endoscopic Infratentorial Supracerebellar Approach

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fixed on the occipital region before performing the Preoperative MRI [19,24-27].

**Conclusion**

The supracerebellar endoscopic infratentorial approach was systematized to access pineal tumors. In all cases, the anatomical exposure was sufficient to adequately treat the aforementioned pathology, with minimal retraction of the CNS structures.

**References**