Microsurgical Management, Endoscopic Review and Intraoperative Video Angiography with Fluorescein in Posterior Circulation Aneurysm

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Abstract

Introduction: Posterior cerebral artery (ACP) aneurysms account for less than 2% of all aneurysms. The fronto-temporo-zygomatic approach allows access to the cranial base with less parenchymal damage. Endoscopy allows you to visualize deep structures. Fluorescein allows to verify the permeability after clipping.

Clinical case: A 44-year-old woman with subarachnoid hemorrhage (SAH), CT angiography shows an aneurysm of the right posterior cerebral artery segment P1/P2. A fronto-temporo-zygomatic craniotomy was performed for the clipping of the aneurysm. Permeability was confirmed with fluorescein and verified with endoscopic review. It was presented with alteration of the III pair that progressively.

Conclusion: P1/P2 segment aneurysm surgery, associated with video angiography and endoscopy, ensured correct clipping and permeability of the posterior brain and collaterals. We corroborated with the literature, regarding a lower rate of complications through a fronto-temporo-zygomatic approach, endoscopic assistance and intraoperative video angiography.

Keywords
Intracranial aneurysm, Posterior cerebral artery, Fluorescein angiography, Endoscopy

Introduction

Posterior cerebral artery (PCA) aneurysms are rare lesions [1-4], accounting for between 0.7 and 2.2% of all intracranial aneurysms [2,3,5], between 7-15% of posterior circulation aneurysms occur at junction P1/P2 [2-4]. The ACP is divided into segments P1, P2, P3 and P4. Different types of sacular, fusiform, dissecting, and serpentine aneurysms can develop from the basilar artery to the cortical branches [6].

The fronto-temporo-zygomatic approach is used to treat tumors and vascular lesions located deep in the middle fossa, the cavernous sinus, and the upper part of the clivus [6]. It allows a wider surgical vision, safe manipulation of the optic nerve [7], better exposure with less brain retraction through the resection of the edge of the orbital roof, orbital lateral wall, and zygomatic arch [6]. It is the gold standard in skull base surgeries with simple execution, versatility, and low morbidity [8].

Videoangiography (AV) with sodium fluorescein (NaF) is used in cerebrovascular surgery for a better visualization of patency after microsurgical clipping [9-11]; endoscopic help corroborates the correct clipping...
Clinical evolution

In the postoperative period in the intensive care unit we observed paresis of the right cranial nerve III, remains 3 days and with good evolution passes to hospitalization. After 7 days she was discharged, with favorable neurological evolution, Glasgow: 15; paresis of the right pair III, wound without complications with modified Rankin scale (SRm: 1). In the control at 2 weeks there was evidence of improvement of the nerve III pair and in the control at 3 months a clear improvement in the function of the III cranial nerve and with SRm: 0 (Figure 4).

Discussion

Between 2018 and 2021, at the Hospital Nacional Dos de Mayo we operated on 3 cases of aneurysms in the posterior circulation, out of 236 patients operated on for aneurysms [13]. Corroborated by the literature indicating a prevalence of less than 2.2% of aneurysms in the posterior cerebral artery of all intracranial aneurysms [2-4] (Table 1).

The evolution of posterior cerebral artery aneurysms may present variable hemodynamic characteristics, one of the main factors for their growth being the energy transferred from the bloodstream to the arterial wall [14]. Prevocating its growth even to sizes greater than 30 mm with a 6% risk of rupture in the first year [14,15].

The clinical picture varies according to the affected
Figure 2: 3D tomography. a) Frontotemporal skin incision (red line); b) Right lateral view of right frontotemporal craniotomy; c) Surgical position and craniotomy with zygomatic frontotemporal enlargement; d) Surgical position and access corridors to the aneurysm (green line).

Figure 3: Microsurgical vision. a) Exposure of the sphenoid wing and posterior drilling; b) Mini-peeling of the middle fossa; c) Anterior extradural clinoectomy; d) Wide opening of the Silviano valley; e) ACI-III bifurcation nc; f) Temporary clipping in basilar artery; g) Clipping and exclusion of P1 aneurysm; h) Fluorescein videoangiography corroborates P1-P2 exclusion and patency; i) Endoscopic visualization confirms patent branches adjacent to the neck.
segment and the neighboring structures involved; The most common symptoms are: headache, decreased visual acuity, ptosis, dizziness, diplopia and hemiparesis [16,17].

The surgery options require a wide field of work for deep access to the posterior circulation, being relevant the variants of the pterional technique [18]. Subtemporal and transylvic approaches are widely used in aneurysms from P1 to P3, as Drake reports on the advantages of securing the blood vessels surrounding the aneurysm during the subtemporal approach [19]. However, from P2 it is already difficult to reach the most distal parts of the posterior brain and requires an excessive retraction of the temporal [20,21]. These techniques are associated with involvement of the III and/or IV cranial nerve and thalamic infarction [19-22]. Uygur already highlighted the importance of the frontotemporozygomatic approach, basic in skull base surgery to improve the exposure of deep structures to minimize brain retraction. However, there were insufficient data on functional and aesthetic outcomes [23]. Boari in 2018 reported 169 patients who underwent this type of approach, evaluating precisely the functional and aesthetic results, including subjective satisfaction in 90% of patients without affecting their quality of life [8].

Remarks

We measure our result compared with the results of other reviews conducted on the surgical treatment of posterior cerebral artery aneurysms, where cases of cranial nerve III palsy, quadrantanopsia and other alterations of the visual field, hemiplegia, hemiparesis and diplopia are presented[19,24-26].

The use of fluorescein video angiography showed a direct relationship with a decrease in postoperative complications and higher success rates in surgeries [9,11]. In our case we allowed to verify the definitive clip je of the aneurysm, avoiding the adjacent vascular damage. Endoscopy allowed us to observe structures that are not accessible through the field of view offered by the surgical microscope [12].

In this case, we seek to enhance the benefits of these techniques towards a better visualization of the anatomical structures around the aneurysm, for a better dissection and clipping, minimizing the retraction of the structures and reducing morbidity; Therefore, endoscope-assisted microsurgery is complemented in deep lesions, especially those in which the microscope does not allow adequate visualization of structures, such as aneurysms of the posterior circulation [27].

Fischer, et al. found that, without endoscopy, the rates of incomplete clipping and perforator occlusion were 18.9% and 8.3%, respectively, in a series of 180 cases [28]. However, disadvantages in its use are also described: constant introduction and removal of the endoscope from the surgical field (by change of modality between the endoscope and the microscope).

<table>
<thead>
<tr>
<th>Aneurysms in the PCA</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sacular</td>
<td>12</td>
</tr>
<tr>
<td>Fusiform</td>
<td>4</td>
</tr>
<tr>
<td>Thromosed</td>
<td>3</td>
</tr>
<tr>
<td>Gigant</td>
<td>2</td>
</tr>
<tr>
<td>Multilocular</td>
<td>1</td>
</tr>
<tr>
<td>Dissecting</td>
<td>1</td>
</tr>
</tbody>
</table>

Figure 4: Scheme on the distribution of aneurysms in the posterior cerebral artery according to the review of the literature, classified into segments and types of aneurysms. Adapted from: Ros J, Cuartero B. Completely thrombosed aneurysms of the posterior cerebral artery: A comprehensive review.
Table 1: Literature review of case reports and case series on posterior cerebral artery aneurysms.

<table>
<thead>
<tr>
<th>No</th>
<th>Title</th>
<th>Author</th>
<th>Aneurysm characteristics</th>
<th>Patient’s clinical state</th>
<th>Type of surgery</th>
<th>Intraoperative</th>
<th>Postoperative complications</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Giant aneurysm of the posterior cerebral artery. Case report.</td>
<td>Obrador S (1966)</td>
<td>Saccular giant</td>
<td>50 mm, NR</td>
<td>Partial occipital lobectomy</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>2</td>
<td>Aneurysms of the posterior cerebral Artery.</td>
<td>Drake C [19]</td>
<td>Saccular: 5, Micotic: 1, Fusiform: 1, Multilocular: 1</td>
<td>NR, P1: 2, P2: 3, P3: 3</td>
<td>Subarachnoid hemorrhage</td>
<td>NR</td>
<td>No</td>
</tr>
<tr>
<td>3</td>
<td>Unusual MR features in a case of completely thrombosed giant aneurysm of the posterior cerebral Artery.</td>
<td>Rastogi H (1995)</td>
<td>Thrombosed giant</td>
<td>29 mm, P1/P2</td>
<td>Left temporal craniotomy</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>4</td>
<td>Transcortical transchoroidal fissure approach for ruptured distal posterior cerebral Artery.</td>
<td>Onoda K (2003)</td>
<td>Saccular</td>
<td>NR, P2/P3</td>
<td>Transcortical transchoroidal fissure</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>5</td>
<td>(p2-p3 junction) aneurysm associated with packed intraventricular hemorrhage - Two case reports.</td>
<td>Onoda K (2003)</td>
<td>NR</td>
<td>P2/P3</td>
<td>Transcortical transchoroidal fissure</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Case Number</td>
<td>Aneurysm Type</td>
<td>Location</td>
<td>Clinical Presentation</td>
<td>Approach</td>
<td>Resolution</td>
<td>Notes</td>
<td></td>
</tr>
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<td>-------------</td>
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<tr>
<td>6</td>
<td>Fusiform</td>
<td>P2</td>
<td>Right occipitoparietal headache</td>
<td>Subtemporal</td>
<td>Subtemporal microsurgery</td>
<td>None</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Fusiform</td>
<td>Sacular</td>
<td>Severe headache with sudden onset, vomiting, severe speech loss, altered consciousness</td>
<td>Subtemporal</td>
<td>None</td>
<td>None</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Complete loop of the posterior cerebral artery with ruptured aneurysm at the origin of the medial posterior choroidal artery</td>
<td>Subtemporal microsurgery</td>
<td>None</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Thrombosed fusiform</td>
<td>Sacular</td>
<td>Severe headache with sudden onset, vomiting, slurred speech, loss of consciousness, right subtemporal</td>
<td>Subtemporal</td>
<td>None</td>
<td>None</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Fusiform with atherosclerosis</td>
<td>Dissecting</td>
<td>Severe headache with sudden onset, vomiting, slurred speech, loss of consciousness, right subtemporal</td>
<td>Subtemporal</td>
<td>None</td>
<td>None</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Dissecting $18$ mm</td>
<td>P1/P2</td>
<td>Severe headache with sudden onset, vomiting, slurred speech, loss of consciousness, right subtemporal</td>
<td>Subtemporal</td>
<td>None</td>
<td>None</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Fusiform with atherosclerosis</td>
<td>Asymptomatic</td>
<td>Severe headache with sudden onset, vomiting, slurred speech, loss of consciousness, right subtemporal</td>
<td>Subtemporal</td>
<td>None</td>
<td>None</td>
<td></td>
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</table>
Therefore, to maintain endoscopic and microscopic vision simultaneously, it is necessary to incorporate imaging functions by intraoperative video angiography [29].

Our patient in the postoperative period presented as a complication paresis of the right cranial III nerve which shows a clear improvement at 3 months.

**Conclusion**

Posterior cerebral artery aneurysms are rare and challenge the abilities of neurosurgeons due to anatomical nuances, large number of perforants and risk of bleeding. However, surgery for these aneurysms is technically feasible, safe and effective when performed respecting microsurgical principles.

This aneurysm represented a challenge for us due to its deep location, difficult exposure, limited surgical field, adjacent cranial and perforating nerves. A safe clipping was achieved but we present a transient paresis of the III pair cran by manipulation, without long-term sequelae. Neuroendoscope (Kevo) and fluorescein video angiography were important during surgery for clipping safety.

The presentation of the case allows us to corroborate what was found in the literature review, mainly regarding the lower rate of complications in patients with aneurysm in the posterior cerebral artery who underwent clipping using a fronto-temporo-zygomatic approach complemented by the use of video angiography with sodium fluorescein and intraoperative endoscopy.

**References**


