

# Microsurgical Treatment of Posterior Cerebral Artery Aneurysm (P2P Segment): Case Report and Review of the Literature

## *Tratamento microcirúrgico de aneurisma da artéria cerebral posterior (Segmento P2P): Relato de caso e revisão da literatura*

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### Abstract

**Introduction** Aneurysms of the posterior cerebral artery (PCA) represent ~ 1% of all intracranial aneurysms and usually present with subarachnoid hemorrhage.

**Objective** The aim of the present study is to describe the case of an adult man presenting a saccular aneurysm of the right PCA at the posterior half of the postcommunicating (P2P) segment, and to discuss the technical nuances of the approach and of the clipping process.

**Case Report** An investigation of a chronic headache in a 55-year-old man found a saccular aneurysm located just posterior to the most lateral portion of the right cerebral peduncle. A digital subtraction arteriography revealed a 7.8 mm × 5.6 mm × 4.8 mm posterior-medial projecting aneurysm of the right PCA at the P2P segment. A subtemporal approach was performed with partial aspiration of the right parahippocampal gyrus for a better exposure of the vascular structures. A proximal temporary occlusion of the PCA was performed at the anterior half of the postcommunicating P2A segment. The aneurysm was clipped with two semi-curved clips. The patient presented an uneventful recovery and was discharged from the hospital on the third postoperative day without any additional neurological deficits.

**Conclusion** Aneurysms of the PCA are an uncommon vascular disease that challenges the ability of the neurosurgeons due to their many anatomical nuances, to their vast number of perforators, and to the risk of bleeding. However, the operative management of aneurysms of the PCA is technically feasible, safe and effective when performed respecting microsurgical principles.

### Keywords

- ▶ posterior cerebral artery (PCA)
- ▶ aneurysm

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## Resumo

**Introdução** Aneurismas da artéria cerebral posterior (PCA) representam aproximadamente 1% de todos os aneurismas intracranianos e usualmente apresentam hemorragia subaracnoidea.

**Objetivo** O objetivo do presente estudo é descrever o caso de um homem adulto portador de aneurisma sacular da PCA direita, segmento P2P, e discutir as nuances técnicas da abordagem e do processo de clipagem.

**Relato de caso** Um homem de 55 anos investigando cefaléia crônica descobriu a presença de um aneurisma sacular localizado logo após a porção mais lateral do pedúnculo cerebral direito. A arteriografia de subtração digital revelou um aneurisma de projeção póstero-medial de 7,8 mm x 5,6 mm x 4,8 mm da PCA direita, segmento P2P. Uma abordagem subtemporal foi realizada com aspiração parcial do giro parahipocampal direito para melhor exposição das estruturas vasculares. A oclusão temporária proximal do PCA foi realizada no segmento P2A. O aneurisma foi clipado com dois cliques semi-curvos. A paciente apresentou uma recuperação sem complicações e recebeu alta hospitalar no terceiro dia pós-operatório sem apresentar nenhum déficit neurológico adicional.

**Conclusão** O aneurisma da PCA é uma doença vascular incomum que desafia a capacidade do neurocirurgião devido às inúmeras nuances anatômicas, grande número de perfurantes e risco de sangramento. Entretanto, o manejo cirúrgico do aneurisma da PCA é tecnicamente viável, seguro e eficaz quando realizado respeitando-se os princípios microcirúrgicos.

## Palavras Chave

- artéria cerebral posterior
- aneurisma

## Introduction

Aneurysms of the posterior cerebral artery (PCA) represent ~1% of all intracranial aneurysms.<sup>1-4</sup> The surgical approach and dissection of the PCA is technically challenging due to the complexity of its perforating branches and their intimate relationship with the cranial nerves and with the upper brain stem.<sup>5,6</sup> A precise knowledge of the segmental anatomy of the PCA and its branches is essential when the surgical or endovascular approach to an aneurysm is planned, particularly if parent vessel occlusion is contemplated as a temporary control.<sup>7-9</sup>

The aim of the present study is to describe the case of an adult man presenting with a saccular aneurysm of the right PCA at the posterior half of the postcommunicating (P2P) segment, and to discuss the technical nuances of the approach and of the clipping process.

## Case Report

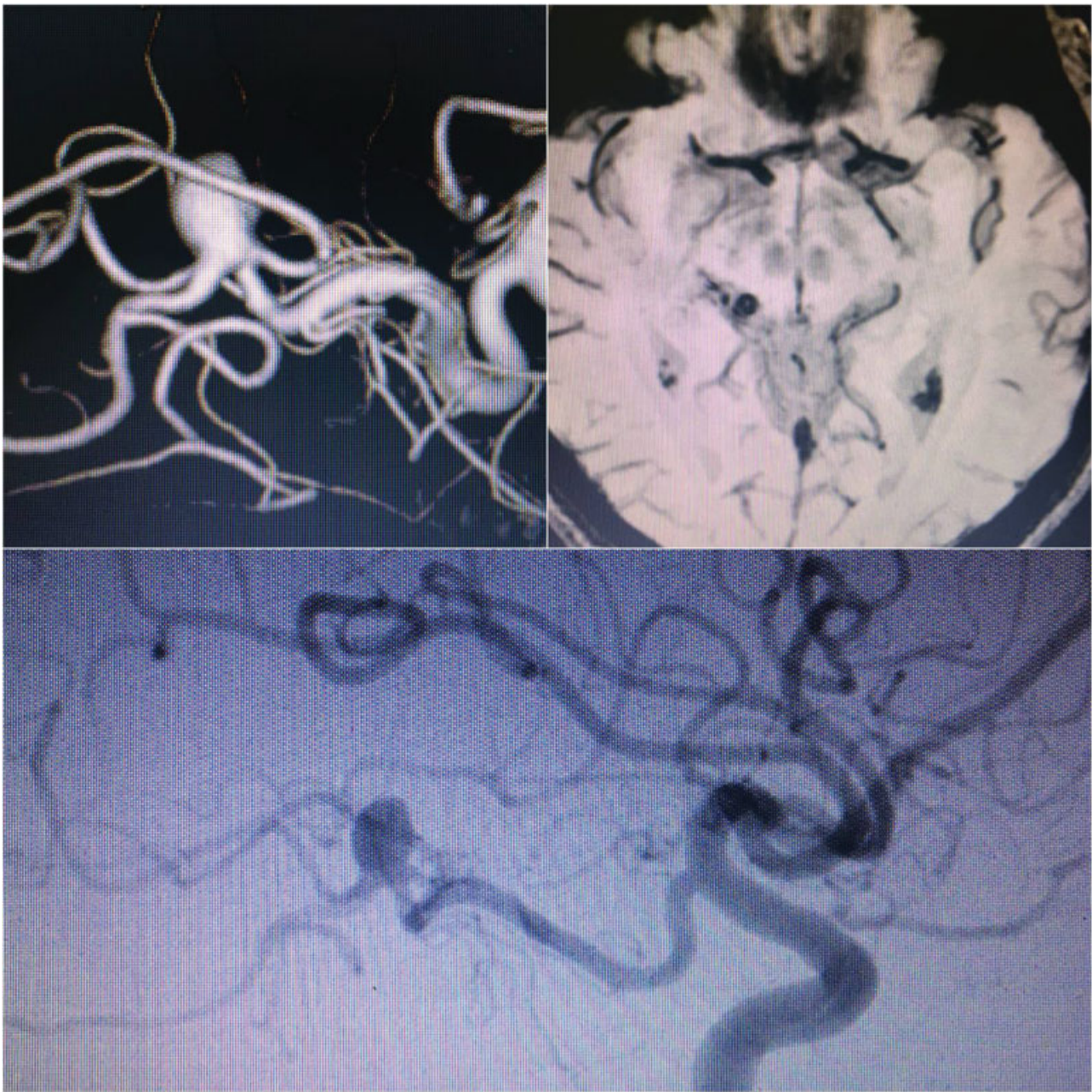
A 55-year-old man was referred for neurological investigation due to a persistent headache with significant worsening on the previous 4 weeks. The patient was treating arterial hypertension with good clinical control. A magnetic resonance imaging (MRI) exam revealed a saccular formation located just posterior to the most lateral portion of the right cerebral peduncle (►Fig. 1). A digital subtraction arteriography revealed a 7.8 mm × 5.6 mm × 4.8 mm posterior-medial projecting aneurysm of the right PCA at the P2P segment (►Figs. 1 and 2). A subtemporal approach was performed with partial aspiration of the right para-

hippocampal gyrus for a better exposure of the vascular structures. A proximal temporary occlusion of the PCA was performed at the anterior half of the postcommunicating (P2A) segment. The aneurysm was clipped with two semi-curved clips (►Figs. 2 and 3). The patient presented an uneventful recovery and was discharged from the hospital on the third postoperative day without any additional neurological deficits. A postoperative digital subtraction arteriography showed no residual aneurysm filling (►Fig. 4).

## Discussion

Aneurysms of the PCA account for between ~0.7 and 2.3% of all intracranial aneurysms<sup>4,10,11</sup> and may be associated with innumerable vascular anomalies, such as Moyamoya disease, arteriovenous malformation, and arterial occlusion, as well as with systemic diseases, such as bacterial sepsis, tumor emboli, Marfan syndrome, Ehlers-Danlos syndrome, systemic lupus erythematosus, and head injury.<sup>11-13</sup> Aneurysms of the PCA are usually associated with vertebrobasilar and/or posterior circulation fusiform or saccular additional aneurysms affecting the midbrain perforating branches.<sup>4,10,11</sup> However, distal aneurysms of the PCA located at the P2P segment or at the P2P-P3 junction are an extremely rare disease.

The surgical treatment of aneurysms located at the P2P-P3 junction is challenging, and most of the cases are currently treated via endovascular route.<sup>7,14-17</sup> Coil embolization, stent-assisted or balloon-assisted coiling, and flow diverters are the main techniques used to occlude posterior circulation



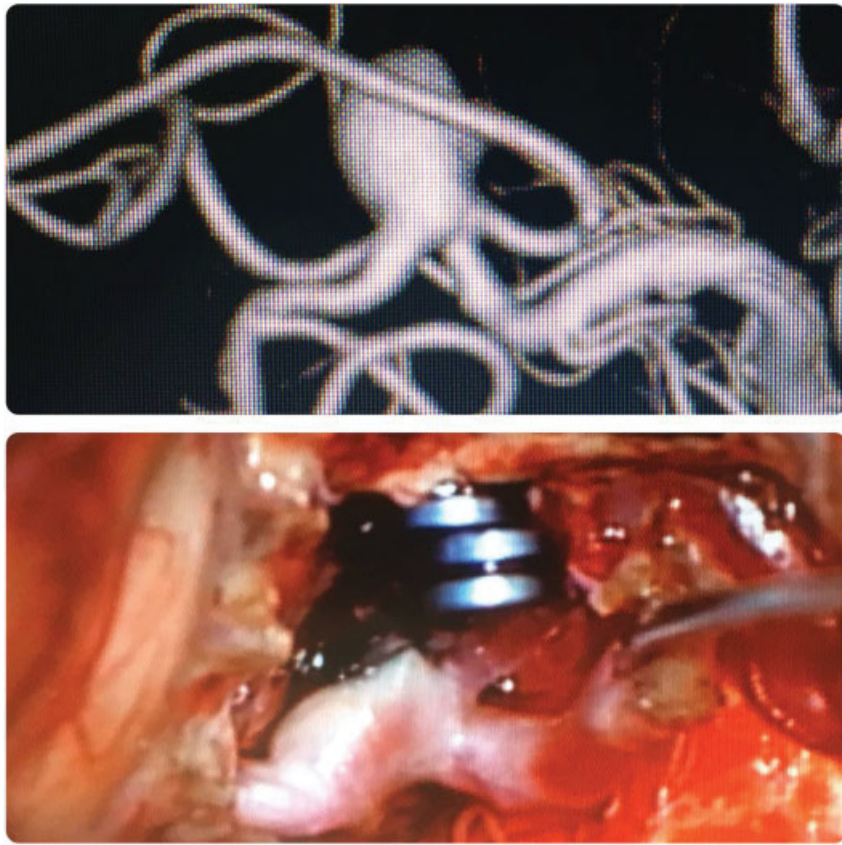
**Fig. 1** Digital subtraction arteriography (2D and 3D) and magnetic resonance imaging revealing a saccular formation located just posterior to the most lateral portion of the right cerebral peduncle.

aneurysms.<sup>7,14-17</sup> However, endovascular techniques may not completely exclude saccular dilation, with persistent neck flow, generally do not resolve mass effect in giant lesions, and present a risk of occlusion of the small perforating arteries. The operative management allows a direct approach of the aneurysm, as well as arterial reconstruction with direct clipping or by-pass techniques, and the removal of mass effect over the nearby structures.<sup>18,19</sup>

Great advances have been achieved in the surgical treatment of posterior circulation aneurysms as the result of a refined anatomical knowledge of the basal cisterns and of their vascular contents, and of appropriate skull base approaches and clinical experience.<sup>20,21</sup> Several surgical approaches with modifications and combinations have

been described to access the posterior portion of the PCA. However, choosing wisely the appropriate operative route remains an important step for perfect clipping and requires a precise understanding of the drawbacks of each approach, as well as of the anatomical variations of the region. Figueiredo et al<sup>22</sup> showed the appropriateness of four different surgical approaches of the ambient cistern, as well as the advantages of performing a resection of the parahippocampal gyrus before clipping distal PCA aneurysms according to their location in the cistern. Goehre et al<sup>19</sup> affirmed that the subtemporal approach is a suitable route to aneurysms at the P1, P1-P2 junction, and P2 segments, as well to those located at the anterior portion of the P3 segment. Through this approach, the cerebrospinal



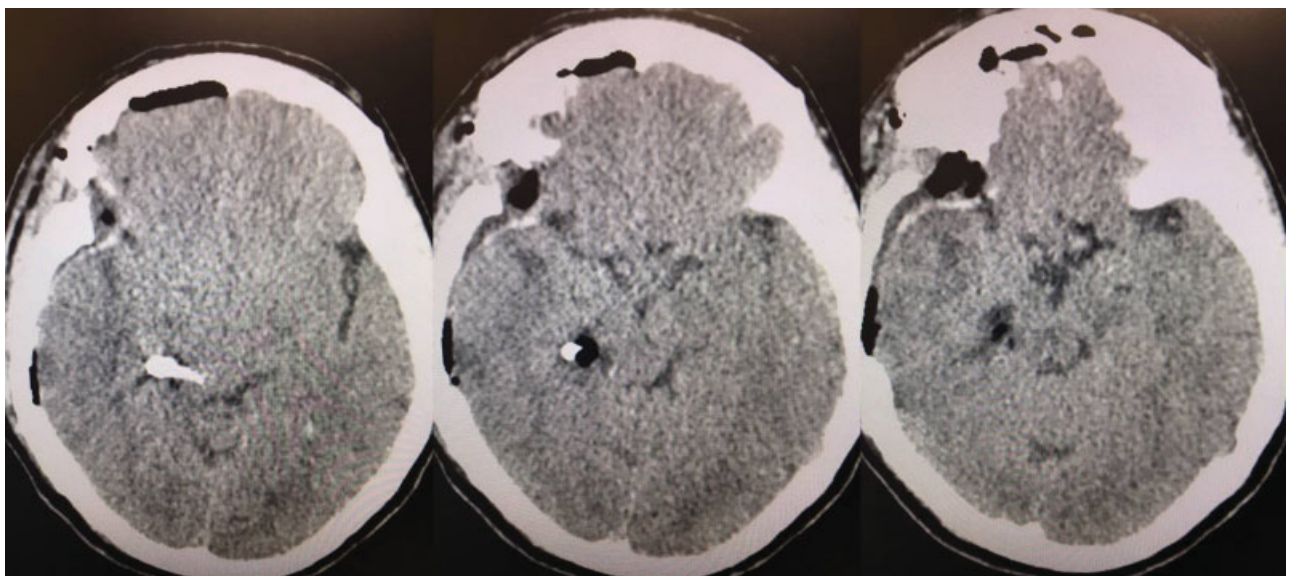


**Fig. 2** Intraoperative imaging showing the aneurysm clipped with two semi-curved clips.

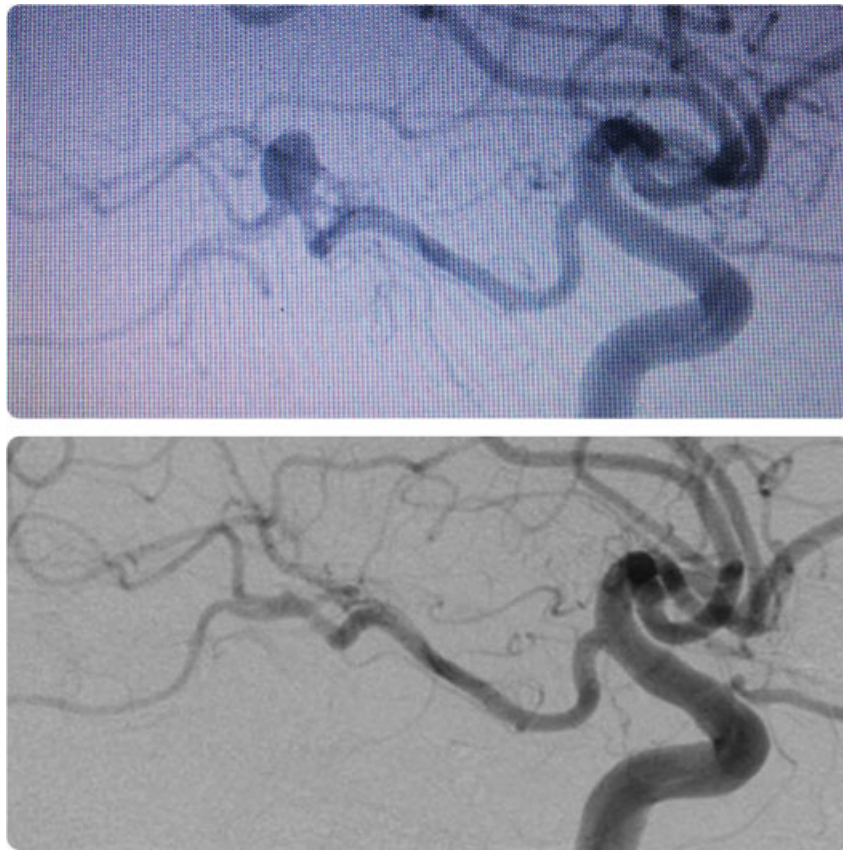
fluid can be released before retraction is necessary to prevent temporal lobe injury.<sup>19</sup>

In 1997, Seoane et al<sup>23</sup> didactically divided the anatomical segments of the PCA aneurysms in three different regions/segments. The anterior segment, or S1, is located inside the interpeduncular, crural and ambient cisterns, and in intimate relationship with the lateral aspect of the cerebral peduncle,

and should be approached via a pterional, a pretemporal, or a subtemporal route. The middle segment, or S2, is located inside the ambient and quadrigeminal cisterns, extends from the most lateral aspect of the PCA inside the quadrigeminal cistern, the so-called collicular point, and is best managed through the subtemporal approach (usually requiring some parahippocampal gyrus resection) or through the



**Fig. 3** Postoperative computed tomography showing the surgical site.



**Fig. 4** Postoperative digital subtraction arteriography showing no residual aneurysm filling.

subtemporal transventricular route. The posterior segment, or S3, is located inside the quadrigeminal cistern, which includes the collicular point and extends to the distal branches of the PCA inside the calcarine and parieto-occipital sulci and should be approached through an occipital interhemispheric route. In the present case, the aneurysm was located at the P2P-P3 junction and was managed with a subtemporal approach with limited parahippocampal gyrus resection without neurological complications.

In conclusion, the management of posterior circulation aneurysms remains challenging for neurosurgeons due to their deep location, to the difficult exposure, to the numerous surrounding cranial nerves and perforators, to the narrowness of surgical field, and to the limited space to operate. In the present case, we presented a distal PCA aneurysm located at the P2P-P3 junction and highlighted that the subtemporal approach is a safe and feasible route to appropriately clip this type of intracranial vascular disease.

#### Conflicts of Interest

The authors have no conflicts of interest to declare.

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