

## Case Report

## Acute formation of a pseudoaneurysm adjacent to a previously clipped anterior communicating artery aneurysm

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**Abstract****Background:** Cerebral pseudoaneurysms, especially of the anterior communicating artery (ACoA), are rare.**Case Description:** Herein, the authors report a 66-year-old patient who underwent successful clip ligation of a small ruptured ACoA aneurysm. Eighteen days after surgery, he suffered from another episode of subarachnoid hemorrhage due to the rupture of a newly formed pseudoaneurysm adjacent to the previously clipped aneurysm. This pseudoaneurysm was treated through clip ligation as well.**Conclusion:** A pseudoaneurysm may rarely form adjacent to a previously clipped cerebral aneurysm and should be included in the differential diagnosis of recurrent subarachnoid hemorrhage. Potential mechanisms of formation and management strategies for this challenging problem will be discussed.**Key Words:** False aneurysm, clip ligation, intracranial aneurysm, subarachnoid hemorrhage**Access this article online****Website:**[www.surgicalneurologyint.com](http://www.surgicalneurologyint.com)**DOI:**

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**Quick Response Code:****INTRODUCTION**

Intracranial pseudoaneurysms encompass less than 1% of all intracranial arterial dilations.<sup>[16]</sup> Pseudoaneurysms may develop as a result of direct (surgical or penetrating wound) arterial injury, infections,<sup>[12,29]</sup> or more frequently, as a result of indirect (blunt) head trauma. Idiopathic cases may very rarely occur in children.<sup>[10]</sup> Pseudoaneurysms of the internal carotid artery (most common),<sup>[5,15,28,31]</sup> middle cerebral artery or its branches,<sup>[3,20,21,23]</sup> anterior cerebral artery or its branches,<sup>[1,11,15,16,24,28,31]</sup> anterior communicating artery (ACoA),<sup>[22,26,31]</sup> posterior cerebral artery,<sup>[2,5]</sup> posterior inferior cerebellar artery,<sup>[4,14]</sup> superior cerebellar artery,<sup>[9,19]</sup> middle meningeal artery,<sup>[8,18,26,27,30]</sup> basilar artery,<sup>[6]</sup> and vertebral artery<sup>[13,17]</sup> have been described.

Pseudoaneurysm formation has been reported as a cause of early rebleeding following cerebral aneurysm coiling.<sup>[25]</sup> Most of the previously reported cases of surgery-related intracranial pseudoaneurysms are secondary to iatrogenic arterial injuries during tumor resection.<sup>[5]</sup> To the best of our knowledge, there has been only one other report of an intracranial pseudoaneurysm as a complication of successful clipping of an original nearby aneurysm.<sup>[7]</sup> From a neurosurgical point of view, this potential complication may be challenging to resolve because of the difficulty with occluding the secondary fragile pseudoaneurysm while accommodating for the clip-aneurysm complex formed by the initial aneurysm. Herein, we report a patient with a ruptured ACoA aneurysm who, at postoperative day 18, suffered from another subarachnoid hemorrhage. Angiography revealed a relatively large

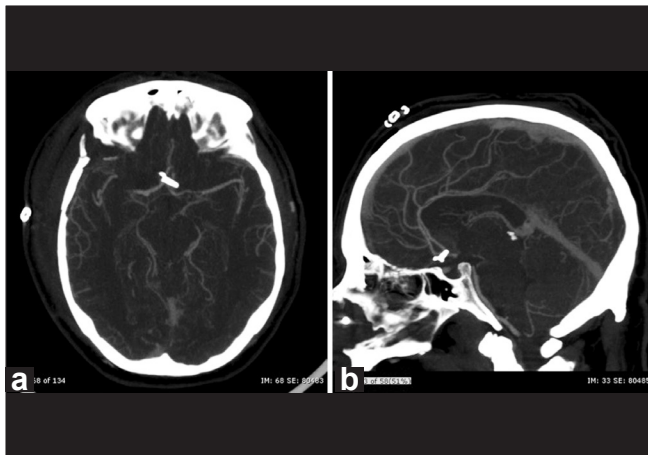
pseudoaneurysm adjacent to the first clipped aneurysm. The management aspects and potential mechanisms of this pseudoaneurysm formation will be discussed.

## CASE REPORT

A 66-year-old man with an acute onset of headache and a brief period of loss of consciousness was diagnosed with acute subarachnoid hemorrhage and his cerebral angiogram revealed a small ACoA aneurysm [Figure 1]. His past medical history was remarkable for myocardial infarction, hypertension, and chronic obstructive pulmonary disease. On admission, his Glasgow coma scale score was 14. Subsequent attempts to occlude this ACoA aneurysm through endovascular routes were unsuccessful because of coil herniation into the ipsilateral A2 branch, which was retrieved successfully without any obvious ill



**Figure 1: 3D reconstruction of the initial cerebral angiogram discloses a small anterior communicating artery aneurysm with two small lobules and a common neck**

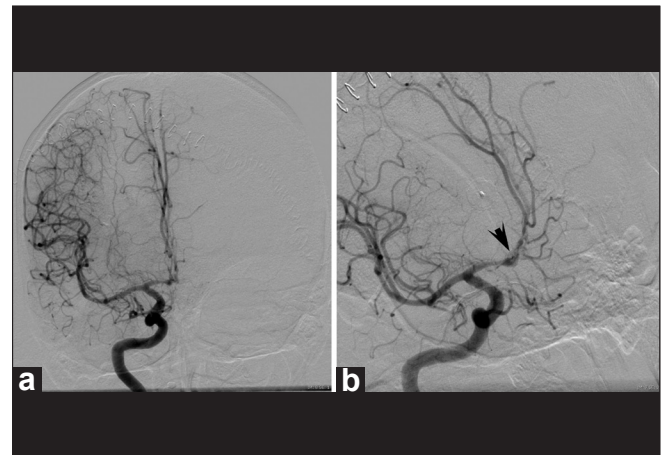


**Figure 2: A CT angiogram [axial (a) and sagittal images (b)] 3 days after surgery, as part of the work-up to assess for worsening confusion, revealed mild anterior circulation vasospasm without any evidence of residual or recurrent aneurysm**

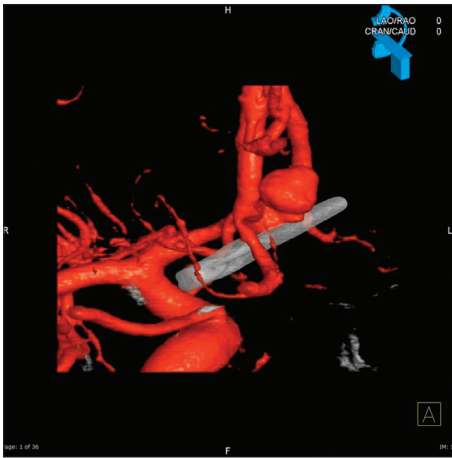
effect. Surgical clipping of the aneurysm was subsequently performed through a standard right frontotemporal craniotomy on the first day of admission. Intraoperatively, following temporary occlusion of the A1 segment, a 7-mm Yasargil clip (Aesculap, Tuttlingen, Germany) was placed across the neck of the aneurysm and both aneurysm lobes were clipped across their common neck. There was no identified intraoperative injury to the aneurysm neck or ACoA during microdissection, including clip application. The wall of the ACoA complex was not obviously dysplastic. The aneurysm did not rupture intraoperatively. Intraoperative angiogram revealed no evidence of residual aneurysm.

The patient's neurological status remained stable postoperatively. A CT angiogram done 3 days later, as part of the work-up to assess for worsening confusion, revealed mild anterior circulation vasospasm without any evidence of residual or recurrent aneurysm [Figure 2]. A repeat four-vessel cerebral angiogram without 3D reconstructions 9 days later revealed mild right A1 and A2 vasospasm without any evidence of residual or recurrent aneurysm [Figure 3]. Eighteen days after his first surgery, the patient developed a sudden onset of altered mental status. A head CT demonstrated a small amount of increased basal subarachnoid hemorrhage. A subsequent cerebral angiogram revealed a relatively large pseudoaneurysm originating from the ACoA adjacent to the neck of the previously clipped aneurysm and projecting superiorly [Figure 4]. In retrospective review, this pseudoaneurysm may have been present on the angiogram completed on day 9 [Figure 3]. The pseudoaneurysm projected superiorly between the two A2 segments.

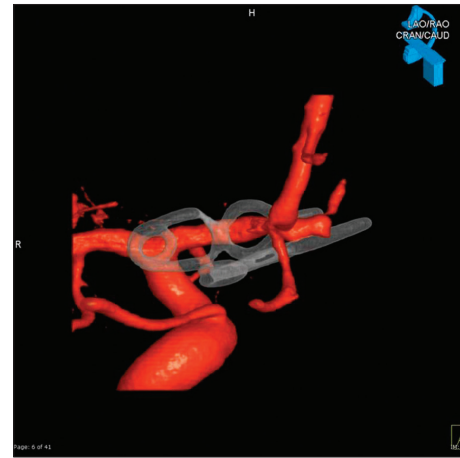
Endovascular attempts at aneurysm occlusion were again



**Figure 3: A repeat four-vessel cerebral angiogram [anteroposterior (a) and oblique (b) views] without 3D reconstructions 9 days after the initial surgery revealed mild right A1 and A2 vasospasm without any evidence of residual or recurrent aneurysm. A potential aneurysmal abnormality was retrospectively detected (arrow)**



**Figure 4:** A subsequent cerebral angiogram revealed a relatively large pseudoaneurysm originating from the anterior communicating artery adjacent to the neck of the previously clipped aneurysm and projecting superiorly



**Figure 5:** A follow-up angiogram disclosed no further growth of the pseudoaneurysm

unsuccessful. A repeat right frontotemporal craniotomy was performed on the same day, and we clipped the newly diagnosed aneurysm by placing a 6-mm fenestrated clip across the ACoA and included the proximal A2 in the clip's fenestration. The aneurysm was found to barely contain a wall; its neck was located about 2 mm posterior to the neck of the original aneurysm and originated from the superior aspect of the ACoA. This aneurysm was not apparent during the first surgery despite a thorough inspection of the region. The clip from the first surgery was not manipulated and was noted to completely occlude the neck of the original aneurysm. Clip application during the second surgery was challenging due to the presence of the clip from the first surgery.

An intraoperative angiogram revealed reasonable occlusion of the aneurysm with its minimal faint filling and contrast stasis. A portion of the ACoA was noted to be significantly stenosed by the clip. Since other attempts at clip repositioning to keep the ACoA patent led to further filling of the aneurysm, we determined that sacrificing a portion of the ACoA, which did not harbor any hypothalamic perforator, was acceptable.

Two postoperative follow-up CT angiograms, performed 3 days apart, revealed no further growth of the pseudoaneurysm. Two weeks after the second surgery, a repeat cerebral angiogram revealed no significant residual aneurysm [Figure 5]. The patient made a good recovery and suffered from some memory difficulty, but was able to conduct his average daily activities independently. A repeat CT angiogram 3 months after the second surgery revealed no obvious further vascular abnormality.

## DISCUSSION

Previous reports of ACoA pseudoaneurysms have been

related to blunt head trauma<sup>[22,31]</sup> or iatrogenic arterial injury during resection of the tumors at the skull base.<sup>[26]</sup> Urgent management of ACoA pseudoaneurysms is indicated due to their high risk of rapid growth and rupture. In the present case, a rapidly growing pseudoaneurysm developed adjacent to a previously clipped ACoA aneurysm from the superior portion of the ACoA wall and this led to a repeat subarachnoid hemorrhage about 3 weeks after clip ligation of the initial aneurysm. There are several potential explanations for the formation of pseudoaneurysm. First, endovascular treatment with coil herniation through the ipsilateral A2 may have led to vessel wall injury and subsequent pseudoaneurysm formation. Intraoperative examination of the second aneurysm confirmed its pseudoaneurysmal character. Second, a small remnant of the initial aneurysm's neck (due to inadequate clipping) may have led to the resultant pseudoaneurysm formation. To our knowledge, this phenomenon has not been previously reported. Third, vasospasm might have resulted in a regional aneurysm neck ischemia due to clip traction or vasospasm-related compromise of the vaso vasorum. This ischemia, even subtle, might have caused regional aneurysm neck disruption with punctuate hemorrhage expanding into a large pseudoaneurysm. In previous reports, authors have suggested tearing of small perforating arteries, rapidly sealed and minor arterial perforation, adventitial stripping, and traction at the arterial branching points as potential causes of secondary aneurysm formation.<sup>[7,21]</sup> Rupture of the secondary aneurysm may occur 1–2 week(s) after the arterial injury.<sup>[7,21,32]</sup> Finally, a dysplastic ACoA may be prone to pseudoaneurysmal formation, although this phenomenon was not obvious during our initial exploratory surgery.

Cosgrove *et al.*<sup>[7]</sup> described a similar clinical scenario

in a 36-year-old woman who developed a 15 × 10-mm ACoA saccular pseudoaneurysm 3 weeks after clipping of an anteroinferiorly pointing ACoA aneurysm. Although they noted no obvious bleeding or any aneurysmal remnant during the first operation, clipping of the secondary pseudoaneurysm, which presented with rupture, was complicated by profuse intraoperative bleeding. Their patient made a good recovery. Rowed and Walters<sup>[21]</sup> reported a 35-year-old patient with transient intraoperative internal carotid artery bleeding during clipping of a superior cerebellar artery aneurysm. This patient developed a new narrow-based pseudoaneurysm of the internal carotid artery 8 days after surgery. The surgical repair of the aneurysm was unsuccessful, and finally the injured segment was isolated and trapped. Unfortunately, this patient suffered from a moderate-to-severe hemiparesis and hemisensory deficit.<sup>[21]</sup>

## CONCLUSIONS

The present report indicates that although rare, acute formation of a pseudoaneurysm adjacent to a previously clipped intracranial aneurysm should be considered in the differential diagnosis of early subarachnoid rebleeding following intracranial aneurysm clipping. The surgical management of secondary, fragile pseudoaneurysm may be challenging and sacrifice of the ACoA may be necessary.

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