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Mustafa Ismail,
Ali K.Alshalchi,
Muslim M.Badr,
Aanab O. Abdulameer,
Hagar A. Algburi,
Rania H. Al-Taie,
Saleh Al-Lami,
Aktham O. Al-Khafaj,
Samer S. Hoz

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Impact of dome projection on operative steps during clipping of a ruptured pure posteriorly directed posterior communicating artery aneurysms

Mustafa Ismail[1], Ali K. Alshalchi[2], Muslim M. Badr[3], Aanab O. Abdulameer[1], Hagar A. Algburi[1], Rania H. Al-Taie[1], Saleh Al-Lami[1], Aktham O. Al-Khafaj[1], Samer S. Hoz[4]

[1] Department of Neurosurgery, College of Medicine, University of Baghdad, Baghdad, IRAQ
[2] Department of Neurosurgery, College of Medicine, University of Baghdad, Baghdad, IRAQ
[3] Department of Radiology, Neurosurgical Teaching Hospital, Baghdad, IRAQ
[4] Department of Neurosurgery, University of Cincinnati, Cincinnati, OH, USA

ABSTRACT

Background: Ruptured posterior communicating artery (PCoA) aneurysms are common; they usually present with subarachnoid haemorrhage (SAH) and oculomotor nerve palsy. The aneurysmal dome projection may influence the safety access and aneurysmal neck clipping. Here, we discuss additional intraoperative steps that may be required to widen the surgical field to ensure safe surgical clipping of a rupture pure posteriorly directed PCoA aneurysm.

Case description: A previously healthy 38-year-old male reported sudden severe headache and disturbed level of consciousness with a Glasgow coma scale (GCS) of 13. His initial computed tomography (CT) scan of the head showed SAH in the basal cistern. 3D-constructed CT angiography (CTA) revealed a left pure posteriorly directed PCoA aneurysm.

In the surgery, through the left pterional approach, all intraoperative steps were carried out. Additional steps were performed as well. Three additional intraoperative steps were contemplated because a pure posteriorly directed PCoA aneurysm is not well appreciated and is often hidden behind the supra cliniold internal carotid artery (ICA). First, the extension of Sylvian fissure dissection to include the distal part and the proximal. Second, temporal pole mobilization is performed by cutting small anterior temporal veins. Third, a brain retractor is placed on the temporal lobe to gently tract the superficial part of the lobe. All these steps widened the surgical corridor to ensure the aneurysm's safe clipping.

Conclusion: Surgical clipping is influenced by the aneurysmal dome projection. In a ruptured pure posteriorly directed PCoA aneurysm, further intraoperative steps may facilitate complete access and safe clipping of the aneurysm.

Keywords
intracranial aneurysms,
posterior communicating artery,
microsurgical clipping

Corresponding author:
Mustafa Ismail

Department of Neurosurgery,
University of Baghdad / College of Medicine.
Baghdad, Iraq

mostafa.ismail1700d@comed.uobaghdad.edu.iq

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Introduction

Posterior communicating artery (PCoA) aneurysms represent 25% of all aneurysms and 50% of the entire internal carotid artery (ICA) aneurysms [3]. Ruptured PCoA aneurysms frequently present with subarachnoid hemorrhage (SAH) and oculomotor nerve palsy [4]. Surgical clipping and endovascular coiling are two therapeutic options for ruptured PCoA aneurysms, and the outcome of the endovascular has a slight advantage compared to surgical clipping [8]. In the surgery, intraoperative clipping of PCoA aneurysms is influenced by the dome projection, which includes lateral and posterior directions [9]. PCoA aneurysm's surgical clipping carries surgery-related nuances [12]. In pure posteriorly direct PCoA aneurysm may render peculiar intraoperative steps [10,12]. Here, we discuss the procedure-related surgical steps in a ruptured pure posteriorly directed PCoA aneurysm.

Case description

An otherwise healthy 38-year-old male presented with a sudden onset of severe headache, disturbed level of consciousness (Glasgow coma scale (GCS) 13, E3, M6, V4), right-sided weakness grade 2 (Medical Research Council (MRC) scale), left partial oculomotor nerve palsy, and neck stiffness. A non-contrast cranial computed tomography (CT) scan revealed SAH in the basal cistern. 3D-reconstructed CT angiogram (CTA) revealed a left pure posteriorly directed aneurysm with a wide neck arising from the Supracliniod ICA in the junction with PCoA (Figure 1).

The surgery was advised to the patient because of the unavailability of the endovascular choice in Iraq and the high cost to the patients. Through the left pterional approach with all the steps contemplated to reach the aneurysm, including using a retractor on the frontal lobe and deep part dissection of the Sylvian fissure. Because the PCoA aneurysm is not well appreciated due to its projection as a pure posteriorly directed and its neck is hidden behind supra cliniod ICA. Here, additive steps were performed, including first, lengthening the Sylvian fissure dissection to encompass the distal part (wide Sylvian dissection). Second, temporal pole mobilization was carried out by releasing the anterior part of the temporal pole from small bridging veins connecting it to the sphenoparietal and cavernous sinuses. Third, using the temporal lobe retractor mainly on the superficial part of the temporal lobe to minimize the risk of early rupture Here, the operative field widened, and the surgeon had full access to the aneurysmal neck. The aneurysm was exposed, dissected then clipped safely without incident (Figure 2). PCoA patency was checked. The postoperative course was uneventful. On the follow-up, the patient was conscious (GCS 15), with no neurological deficit aside from improving his right-side weakness (MRC grade 4).

Figure 1. Left anterolateral CT angiogram showing left pure posteriorly directed PCoA aneurysm.

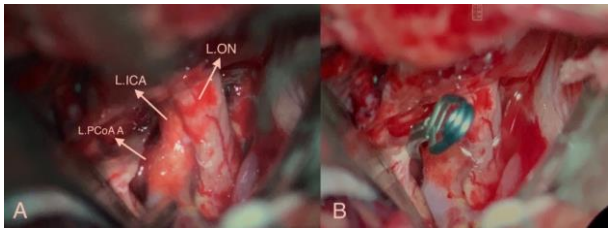

Figure 2. Intraoperative images through the left pterional approach show (A) before clipping. (B) after clipping insertion. L.PCoA A: Left posterior communicating artery aneurysm. L.ICA: Left internal carotid artery (Supracliniod) L.ON: Left optic nerve.

Discussion

Ruptured PCoA aneurysms represent 13-25% of all intracranial aneurysms, and the unruptured aneurysms are proportionally lower [2]. In a meta-analysis study, Clark et al, estimated the risk of rupture of PCoA aneurysm (0.46%) yearly, and it regularly presents with SAH [1,4,13]. However, the oculomotor nerve palsy may present with ruptured or unruptured aneurysms in 19-38% of PCoA aneurysm patients, and it may be partial or complete [4,5,7]. In the treatment of PCoA aneurysm, Molyneux et al, 2005 trial found endovascular coiling increased the survival rate independently by one year compared to surgical clipping; and the survival benefit extended for seven years with the former

option [8]. With limited resources, hospitals such as the status in Iraq and the high cost to the patients made endovascular options off the choice in most of the cases as well as in our example here.

The Intraoperative surgical steps of PCoA aneurysm clipping may be affected by the dome projection [4,5]. The lateral or the posterolateral projection, which is the most common projection of the PCoA aneurysm, is particularly operated with regular steps of 1) pterional craniotomy and dura opening, 2) positioning of the brain retractor on the frontal lobe; however, some surgeons prefer retractor less surgery [6]. Obviously, this is not always possible in ruptured aneurysm cases with an expected tense brain, 3) proximal Sylvian fissure dissection, 4) identification and dissection of supracliniod ICA and its bifurcation, optic nerve, PCoA (proximal to the aneurysmal neck), and anterior choroidal artery (distal to the aneurysmal neck), 5) dissection of the neck of the aneurysm then placement of the aneurysmal clip to exclude the aneurysm from the circulation, 6) oculomotor nerve decompression by opening and shrinking the aneurysmal dome [4,6]. On the other hand, with a pure posteriorly directed PCoA aneurysm, there are further steps required to reach the neck of the aneurysm due to technical difficulties. Because first, the major segment of the aneurysm is positioned posterior to the supra clinoid ICA, thus it will be hidden from the surgeon's view during the typical pterional approach [4,5]. Second, PCoA is commonly arising proximal to the aneurysm and course posteromedial in addition to the possible presence of perforator branches in the area close to the neck [4]. These reasons may render further steps mandatory for the neurosurgeon to ensure adequate surgical view, thus ensuring complete safe clipping of the aneurysm.

In our case, three additional steps were contemplated, which include a) extended dissection of the Sylvian fissure to include the distal part in addition to the proximal one to widen the operative corridor. b) The mobilization of the temporal pole is performed carefully by cutting the small anterior temporal veins, thus releasing the temporal lobe and gaining extra space for the operating surgeon. c) placing a retractor on the temporal lobe to enlarge the surgical view in these cases of the tight brain due to ruptured aneurysm and the consequences of SAH. Although Nadar et al, advised not to use a retractor on the temporal lobe, we only retracted the superficial part of the temporal lobe gently to gain a better surgical view and at the same time to prevent early rupture of the aneurysm [9].

In summary, the modification of the pterional approach by these three additional steps intraoperatively allowed better access and safe clipping of pure posteriorly directed PCoA Aneurysm's neck.

Conclusions

Ruptured PCoA aneurysm clipping is affected by the dome projection. A ruptured pure posteriorly directed PCoA aneurysm may require additional intraoperative steps to improve the operative view and widen the surgical field, thus ensuring complete and safe clipping.

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