Subtemporal Approach to Posterior Cerebral Artery Aneurysms

Felix Goehre[1,2], Martin Lehecka[1], Behnam Rezai Jahromi[1], Hanna Lehto[1], Riku Kivisaari[1], Ferzat Hijazy[1], Lamia Nayeb[1], Tetsuaki Sugimoto[1], Masaki Morishige[1], Ahmed Elsharkawy[1], Mikael von und zu Fraunberg[3], Juha E. Jääskeläinen[3], Juha A. Hernesniemi[1]

Key words
- Aneurysm
- Microsurgical technique
- Posterior cerebral artery
- Subtemporal approach

Abbreviations and Acronyms
CSF: Cerebrospinal fluid
ELANA: Excimer laser-assisted nonocclusive anastomosis
mRS: modified Rankin scale
PCA: Posterior cerebral artery
SAH: Subarachnoid hemorrhage

From the [1]Department of Neurosurgery, Helsinki University Hospital, Helsinki University, Helsinki, Finland; [2]Department of Neurosurgery, Bergmannstrost Hospital Halle, Halle, Germany; [3] Department of Neurosurgery, Kuopio University Hospital, Kuopio, Finland

To whom correspondence should be addressed: Felix Goehre, M.D. [E-mail: felix.goehre@bergmannstrost.de]

Citation: World Neurosurg. (2015) 83, 5:842-851. http://dx.doi.org/10.1016/j.wneu.2015.01.042

Supplementary digital content available online.

Journal homepage: www.WORLDNEUROSURGERY.org

Available online: www.sciencedirect.com

OBJECTIVE: **Aneurysms of the posterior cerebral artery (PCA) are rare, and therefore the individual and institutional experience of their microsurgical management is usually limited. In the present article, we describe our experience with the subtemporal approach to aneurysms arising from the PCA.**

METHODS: **We reviewed 34 patients diagnosed with 37 PCA aneurysms, all microsurgically managed using the subtemporal approach between 1980 and 2012 at 2 Finnish neurosurgical centers (Helsinki and Kuopio). The following procedures were applied using the subtemporal approach: neck clipping (n = 24); proximal occlusion (n = 7); trapping (n = 2); wrapping (n = 1); aneurysmoraphy (n = 1); bypass bridging/trapping (n = 1); and a complex excimer laser-assisted nonocclusive anastomosis procedure (n = 1).**

RESULTS: **Of these 34 patients, 16 presented with acute subarachnoid hemorrhage as a result of PCA aneurysm rupture, and 11 of the 16 had good outcome (modified Rankin scale 0–2) at 3 months The remaining 18 patients were treated microsurgically for incidentally diagnosed unruptured aneurysms, and 14 of the 18 had a good outcome. The most common serious complication in this series was an ipsilateral PCA infarction (12/34; 35%), mostly after proximal occlusion (n = 7) and/or trapping (n = 2).**

CONCLUSIONS: **The subtemporal approach is a suitable approach to aneurysms of the segments P1, P1–P2 junction, and P2, as well as the anterior P3 segment of the PCA. Using the subtemporal approach, the cerebrospinal fluid is released before retraction is necessary to prevent temporal lobe injury. The subtemporal approach can provide enough space for revascularization procedures. The most encountered complications were not related to the subtemporal approach but to the specific nature of PCA aneurysms.**

INTRODUCTION

Aneurysms of the posterior cerebral artery (PCA) are rare, with an overall incidence of <1% and only 7% of all posterior circulation aneurysms (4, 10, 17). The typical characteristics of the PCA aneurysms are high proportion of fusiform aneurysms, the affection of midbrain perforating branches, and association with other cerebrovascular lesions such as arteriovenous malformations (6). PCA aneurysms can be found along the whole course of the artery (Figure 1), but the most frequent locations are the P1 segment, the P1–P2 junction, and the P2 segment.

Endovascular surgery is evolving rapidly and PCA aneurysms are increasingly treated with endovascular techniques (2, 8, 15, 31). However, the particular characteristics of PCA aneurysms, such as the fusiform shape and the involvement with the brainstem perforating branches may favor open microneurosurgical management in selected situations (6, 7).

Various microsurgical approaches to PCA aneurysms have been described, including the subtemporal approach, the pretemporal/pterional approach, the orbitozygomatic approach, and the supracerebellar transtentorial approach (4, 5, 24, 27, 32, 33). Each of these approaches have their advantages and limitations. Because PCA aneurysms are rare, their individual and institutional experience is often limited and most of the published series are small.

The purpose of this article is to summarize our experience with the subtemporal approach in the management of 34 patients with PCA aneurysms, reflecting potentials and pitfalls of the approach.

METHODS

PCA Aneurysms at Helsinki and Kuopio Neurosurgery Databases

Helsinki and Kuopio Neurosurgeries solely serve a combined catchment population of 2.8 million, and both maintain a large database of their intracranial aneurysm patients, >10.000 in Helsinki and >4.500 in Kuopio. Altogether, 120 patients with 136 PCA aneurysms have been treated during a period of 33 years from 1980 to 2012.

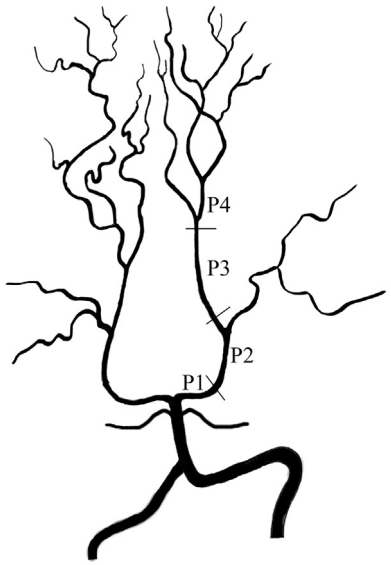

Figure 1. Schematic drawing of the P1, P2, P3, and P4 segments of the posterior cerebral artery.

Selection of Subtemporal Approach in 34 Patients with 37 PCA Aneurysms

The subtemporal approach was selected in 34 patients mainly due to the localization of the PCA aneurysm below the posterior clinoid process and in proximity to the tentorium (Figure 2). High-lying PCA aneurysm (Figure 3) and far distal PCA aneurysms (Figure 4) require different approaches and strategies. Direct visual control of the midbrain perforating branches was the most decisive factor to choose the subtemporal approach. Taken in account were also the rupture status, brain edema, and the presence of associated aneurysms. The remaining 86 patients were treated either with a different surgical approach, by endovascular means, or altogether conservatively due to very old age or poor clinical condition.

Patients and Aneurysms

The characteristics of the study group are presented in Table 1. Of the 34 patients, 7 were men and 27 were women. In 14 patients, the PCA aneurysm had ruptured causing acute subarachnoid hemorrhage (SAH), at a median age of 41 years (range, 11–74 years). Of the 14 patients with SAH, 8 presented with Hunt and Hess grade 1–2 and 6 with Hunt and Hess grade 3–5 on admission. Six patients had acute hydrocephalus, 3 had intracerebral hematoma in the temporal lobe (n = 2) or the occipital lobe (n = 1), and 5 had intraventricular hemorrhage.

In two patients (38 and 66 years), other than a PCA aneurysm had caused SAH, and both patients presented with Hunt and Hess Grade 2 on admission.

Altogether 18 patients with a median age of 48 years (range, 21–72 years) had no SAH. In 6 of them the PCA aneurysms were symptomatic with a median diameter of 19 mm (range, 8–40 mm): hemiparesis (n = 2), headache (n = 2), diplopia (n = 1), embolic syndrome (n = 1). In the remaining 12 patients the PCA aneurysms were incidental. Multiple aneurysms were found in 15 (44 %) of the 34 patients.

The locations of the 37 PCA aneurysms in the 34 patients were as follows: P1 segment, n = 6; P1–P2 junction, n = 10; P2 segment, n = 16; and P3 segment, n = 5. Of the 23 unruptured aneurysms, 12 were saccular (median size, 5 mm; range, 2–33 mm) and 11 fusiform (median length, 8 mm; range, 5–40 mm). Of the 14 ruptured aneurysms 9 were saccular (median size, 8 mm; range, 5–25 mm) and 5 were fusiform (median length, 11 mm; range, 9–37 mm). An irregular wall structure was seen in 14 aneurysms (38%; saccular n = 10; fusiform n = 4). Three of 34 patients had 2 PCA aneurysms. Two aneurysms were found on a PCA feeding an arteriovenous malformation.

Clinical Variables and Follow-up Data

The clinical and radiologic data were collected from the hospital records and by analyzing the actual imaging studies. The following clinical data were collected: age, gender, aneurysm rupture state, Hunt and Hess grade, date of surgery, intraoperative procedures, and complications. The early surgical outcome and the complications were divided into those related to the approach and those related to the actual aneurysm management. The modified Rankin scale (mRS) was used to record early outcome at 3 months postoperatively. Good outcome was considered as mRS 0–2, moderate outcome as mRS 3 and 4, and poor outcome as mRS 5 and 6. The preoperative and postoperative computed tomography, computed tomography angiography, and digital subtraction angiography images were analyzed for the aneurysm location, the aneurysm size and shape, Fisher grade, intracerebral hematoma, intraventricular hemorrhage, postoperative parent artery occlusion, and postoperative hematomas and infarcts.

Statistical Methods

For data analyses, a commercially available software was used (SPSS for Mac, version 21.0 [2012]; SPSS, Inc, Chicago, Illinois).

Ethical Committee Approvals

The data were collected under the approval of a local university hospital ethic committee (469/Eo/04 HUCH).

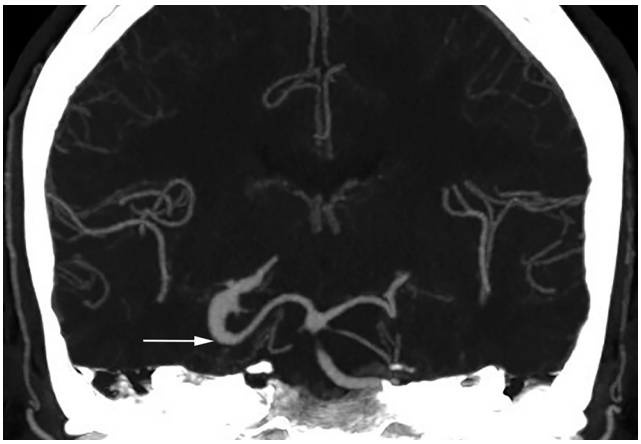

Figure 2. The subtemporal approach allows the surgeon to get to posterior cerebral artery aneurysms in proximity to the tentorium (coronal computed tomography angiography, fusiform P2 segment aneurysm of the posterior cerebral artery).