# Posterior Cerebral Artery Aneurysms: Treatment and Outcome Analysis in 121 Patients

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■ OBJECTIVE: **Aneurysms of the posterior cerebral artery (PCA) are uncommon. Because of their low incidence, only 5 series with more than 30 patient cases have been reported. The treatment of PCA aneurysms is challenging because of the high frequency of fusiform aneurysms and closeness to important neuroanatomic structures.**

■ METHODS: **A total of 121 patients with 135 PCA aneurysms were reviewed. The clinical and radiologic data, treatment strategies, and 1-year outcomes were analyzed. Patients with giant aneurysms, associated aneurysms, and aneurysms on arteriovenous malformation-feeding PCAs were considered as complex cases. Outcomes were categorized into 3 groups: good (modified Rankin Scale [mRS], score 0–1), moderate (mRS score, 2–4), and poor (mRS score, 5–6).**

■ RESULTS: **There were 52 ruptured (39%) and 83 unruptured (61%) PCA aneurysms in 121 patients, with the following distribution: P1 ($n = 53$), P1/2 ($n = 39$), P2 ($n = 28$), and P3 ($n = 15$). The incidence of fusiform PCA aneurysms was high (24%). Microsurgical treatment was applied to 63 aneurysms and endovascular treatment to 19 aneurysms; 55 aneurysms were treated conservatively. The following treatment results were achieved: for patients with unruptured PCA aneurysms, $n = 19$; 12 good outcomes, 63%; 6 moderate, 31%; 1 poor, 1%; for patients with ruptured PCA aneurysms, $n = 27$; 10 good, 37%; 9 moderate, 33%; 8 poor, 30%; and for patients with complex neurovascular diseases and PCA aneurysms, $n = 96$; 42 good, 43%; 40 moderate, 42%; 14 poor, 15%.**

■ CONCLUSIONS: **Aneurysms of the PCA are infrequent and often associated with other vascular diseases. Microsurgery and endovascular treatment are effective for the occlusion of PCA aneurysms. The preservation or reconstruction of the parent vessel is crucial for favorable treatment outcomes.**

## INTRODUCTION

Aneurysms of the posterior cerebral artery (PCA) are uncommon, representing less than 2% of all aneurysms.[1-3] Because of this low incidence, most of the institutional series on PCA aneurysms are small[2,4-17]; only 7 reports with more than 25 patients have previously been published (Table 1).[1,18-23] The largest series was reported by Drake et al.[7] in a study of 125 cases.

PCA aneurysms are classified into 5 groups according to their segment origin (Figure 1): the P1 segment (P1 aneurysms) or precommunicating segment; the P1/P2 junction (P1/P2 aneurysms); the P2 segment (P2 aneurysms); the P3 segment (P3 aneurysms); and the P4 segment (P4 aneurysms).[24]

In general, treatment of PCA aneurysms is challenging because of their deep anatomic location, closeness to sensitive

**Key words**
- Aneurysm
- Outcome
- Posterior Cerebral Artery
- Treatment

**Abbreviations and Acronyms**
AVM: Arteriovenous malformation
DSA: Digital subtraction angiography
H&H: Hunt and Hess grade
ICH: Intracerebral hemorrhage
IVH: Intraventricular hemorrhage
mRS: modified Rankin Scale
P1: P1 segment of posterior cerebral artery
P1/2: P1/P2 junction of posterior cerebral artery
P2: P2 segment of posterior cerebral artery
P3: P3 segment of posterior cerebral artery
P4: P4 segment of posterior cerebral artery
PCA: Posterior cerebral artery
SAH: Subarachnoid hemorrhage

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**Table 1.** Previous Reports on Posterior Cerebral Artery Aneurysms with More Than 25 Patients

| Reference | Cases | Treatment |
|---|---|---|
| Drake et al. 1996[1] | 125 | Surgical |
| Zhitao et al. 2010[18] | 42 | Surgical |
| Chang et al. 2010[19] | 33 | Surgical and endovascular |
| Wang et al. 2015[20] | 30 | Surgical |
| Taylor et al. 2003[21] | 30 | Surgical and endovascular |
| Sanai et al. 2008[22] | 27 | Surgical and endovascular |
| Kim et al. 2013[23] | 25 | Surgical and endovascular |

neuroanatomic structures, and the long intravasal route to the terminal segments of the posterior circulation.[25,26] Furthermore, the specific morphologic features of PCA aneurysms complicate their treatment, especially the high frequency of fusiform shape and closeness to important midbrain perforators.[27]

Surgical approaches, such as the subtemporal, pterional, orbitozygomatic, supracerebellar transtentorial, and posterior interhemispheric approaches, have been described for microsurgical management of aneurysms on various PCA segments.[1,6,17,21,28,29] However, during the last 3 decades, endovascular techniques have evolved rapidly and PCA aneurysms close to the brainstem are also treated using endovascular techniques.[4,7,16,30]

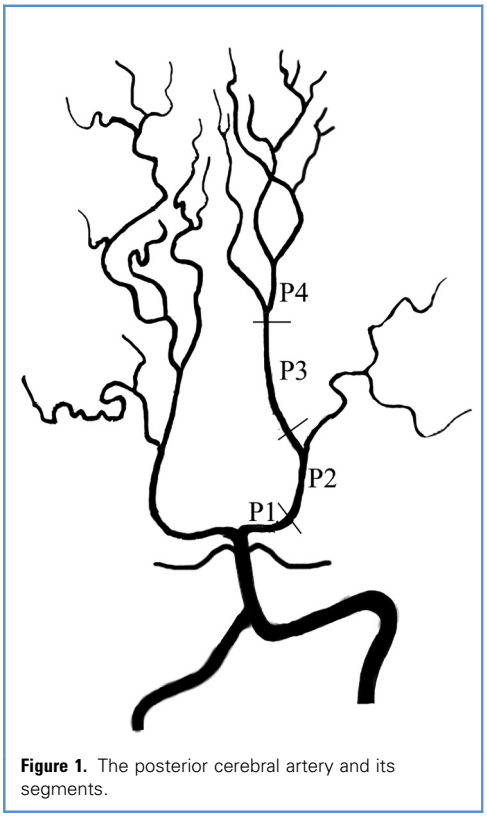


**Figure 1.** The posterior cerebral artery and its segments.

We present a consecutive series of 121 patients with 135 PCA aneurysms treated between 1980 and 2014 at the 2 given neurosurgical centers, which are responsible for a population of approximately 2.8 million people. The aim of this analysis is to establish a foundation for the further development of treatment strategies for PCA aneurysms.

## METHODS

From 1980 to 2014, 121 patients with 135 PCA aneurysms were evaluated and treated at 2 neurosurgical centers (Helsinki and Kuopio), responsible for the entire population of southern and eastern Finland of 2.8 million people. Overall, slightly more than 14,500 patients with intracranial aneurysms were treated.

The hospital records and images were evaluated for all patients with PCA aneurysms. The following clinical data were collected: patient age, sex, Hunt and Hess (H&H) grade on admission, treatment modality, time to treatment, occlusion grade, complications, neurologic deficits, and cause of death. The modified Rankin Scale (mRS) was used to measure outcomes, evaluated at 12-month follow-up. For further analysis, outcomes were categorized into 3 groups: 1) good (mRS score, 0–1), 2) moderate (mRS score, 2–4), and 3) poor (mRS score, 5–6).

We performed a PubMed search for articles published from 1980 to 2015 on the treatment of PCA aneurysms with the following keyword(s): PCA, posterior cerebral artery, aneurysms. We identified 7 series with over 25 patients, presented in Table 1.

All patients underwent computed tomography angiography, digital subtraction angiography (DSA), or magnetic resonance angiography for diagnosis. The radiologic images were stored in the hospital's digital archiving system (PACS; AGFA, IMPAX, version 4.5, launched in 1998) or in the central radiographic image archive, from which the relevant images were recalled. The image analyses were conducted by 2 experienced neurosurgeons, 1 (R.K.) with double specialization in neurosurgery and neuroradiology. The following radiologic data were collected: aneurysm height, neck diameter, dome width, previous treatment (coiling or clipping), and the presence of remnant aneurysm parts after the treatment.

Using these methods, 121 consecutive patients (36 male, 85 female) with 135 PCA aneurysms were identified. Ruptured PCA aneurysms were found in 52 patients. For further analyses, the patients were divided into 9 groups: 1) unruptured saccular aneurysms ($n = 9$); 2) unruptured fusiform aneurysms ($n = 10$); 3) unruptured giant aneurysms ($n = 7$); 4) unruptured PCA aneurysms with associated aneurysms ($n = 21$); 5) ruptured saccular aneurysms ($n = 20$); 6) ruptured fusiform aneurysms ($n = 7$); 7) ruptured PCA aneurysms with associated aneurysms ($n = 18$); 8) subarachnoid hemorrhages (SAHs) from an associated aneurysm rupture ($n = 17$); and 9) SAHs from an associated arteriovenous malformation (AVM) ($n = 12$).

Microsurgical treatment was applied to 63 aneurysms and endovascular treatment to 19 aneurysms; 55 aneurysms were treated conservatively.