Clinical Neurology and Neurosurgery 115 (2013) 2062–2068

Contents lists available at ScienceDirect

Clinical Neurology and Neurosurgery

journal homepage: www.elsevier.com/locate/clineuro

Outcomes of multidisciplinary treatment for posterior cerebral artery aneurysms

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ARTICLE INFO

Article history:
Received 6 March 2013
Received in revised form 19 June 2013
Accepted 6 July 2013
Available online 30 July 2013

Keywords:
Cerebral aneurysm
Posterior cerebral artery
Microsurgery
Coil embolisation
Parent artery occlusion

ABSTRACT

Objective: Posterior cerebral artery (PCA) aneurysms are rare and often challenging to manage. Since Drake's historical report regarding PCA aneurysms, there has been limited additional information on recent advancements in either microsurgical or endovascular tools. We report a series of 25 consecutive cases and attempt to extrapolate useful information for managing PCA aneurysms.
Methods: A total of 25 cases of PCA aneurysm that were treated either by microsurgical or endovascular methods were selected and retrospectively reviewed. The clinical data, radiographic findings, and outcomes associated with the treatment modality were analysed.
Results: The case series included 13 women and 12 men with a mean age of 52 years, ranging from 11 to 75 years. Fourteen aneurysms were ruptured, 7 aneurysms caused a direct mass effect, and the remaining 4 aneurysms were found incidentally. Most aneurysms were located in the P1 through P2A segment of the PCA (19 aneurysms, 76%). Seven aneurysms (28%) were large-giant in size (>20 mm), 4 of which had a thrombosed sac. Microsurgical treatment was the primary treatment in 15 aneurysms, including 9 successful direct clip ligations, 3 aneurysms that were surgically trapped without a bypass, and 2 wrapped aneurysms. One giant thrombosed aneurysm was incompletely clipped; subsequently, the large remnant was coil-embolised. Endovascular coil embolisation was performed for 6 aneurysms, stent-assisted coil embolisation was performed for 2 aneurysms, and 2 aneurysms were treated by endovascular occlusion of the parent artery. Permanent deficits acquired after treatment included limb weakness, palsy of the third cranial nerve, and hemianopsia in 5 cases (20%). There was no mortality. Overall, 22 patients (88%) showed favourable clinical outcomes according to the modified Rankin Scale Score (≤2) at the mean clinical follow-up period of 43.2 months (range: 2–130 months).
Conclusions: The present case series suggests that treating PCA aneurysms with microsurgical or endovascular options can achieve a comparable outcome when a judicious decision is made. Endovascular treatment had excellent anatomical and clinical outcomes for non-mass compressing, non-giant, saccular aneurysms. Given the propensity for the large-giant, dysplastic nature of PCA aneurysms to develop in younger patients, microsurgical competence should be maintained. Along with careful evaluation of the anatomic collaterals over the PCA territory, therapeutic parent artery sacrifice may be an appropriate option without adding bypass.

1. Introduction

With the advent of endovascular options to manage cerebral aneurysms, physicians are often required to judiciously select the best scenario for their patients with cerebral aneurysms. For aneurysms at the posterior circulation, the endovascular option is overwhelmingly used and appears generally plausible [1]. However, aneurysms grouped at the posterior cerebral artery (PCA) may differ somewhat from those at bifurcations or the major branching sites of the basilar trunk. At this point, no single methodology provides a 'flawless solution'. Although studies regarding the strengths and weaknesses of surgical and endovascular modalities for the general population of aneurysms are extensive, there is little documentation specifically for PCA aneurysms. Therefore, in the present case series, we retrospectively reviewed our multidisciplinary experience in treating 25 PCA aneurysms to add information reflecting the contemporary aspects of the clinical rationale to the literature.

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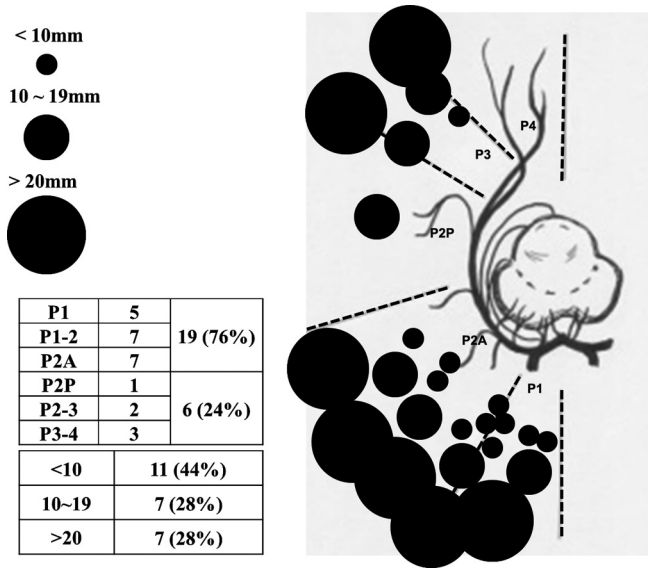
http://dx.doi.org/10.1016/j.clineuro.2013.07.004



P1	5	19 (76%)
P1-2	7	
P2A	7	
P2P	1	6 (24%)
P2-3	2	
P3-4	3	

<10	11 (44%)
10~19	7 (28%)
>20	7 (28%)

Fig. 1. A schematic illustration of 25 PCA aneurysms according to size and location.

2. Patients and methods

During a 12-year period (1998–2010), a total of 2522 patients with cerebral aneurysms were treated at our institution. Among them, we identified 25 (1%) patients who had PCA aneurysms by searching the Yonsei Aneurysm Database with a query of 'location'. Aneurysms at the tip of the basilar artery were excluded from this series. This series included 13 women and 12 men with a mean age of 52 years, ranging from 11 to 75 years. Fourteen patients presented with subarachnoid haemorrhage due to rupture of the PCA aneurysm, and 2 patients with giant-thrombosed aneurysm had mural haemorrhage that caused acute symptoms. Five patients presented with hemiparesis, 3rd cranial nerve palsy, or both due to a direct mass effect. The remaining 4 patients had aneurysms that were found incidentally during investigation for other diseases. Eleven aneurysms (44%) were less than 10 mm in their longest diameter; 7 aneurysms (28%) were between 10 and 19 mm, and 7 aneurysms (28%) were larger than 20 mm.

The PCA segments were defined according to Zeal and Rhoton's classification [2]. Briefly, the P1 segment extends from the tip of the basilar artery to the origin of the posterior communicating artery, the P2 segment lies within peduncular and ambient cisterns and terminates at the posterior aspect of the midbrain. The P2 segment is further divided into the anterior (P2A) and posterior (P2P) halves. The P3 segment extends along the lateral aspect of quadrigeminal cistern and ends at the calcarine fissure, the P4 segment is the terminal cortical branches of the PCA. Overall, 19 aneurysms (76%) in this series were located in P1 through P2A, and 6 aneurysms (24%) were beyond P2P. The details regarding the size and location of all 25 PCA aneurysms are presented in Fig. 1.

The choice of treatment strategy was made following a multidisciplinary team conference in every case. The main considerations usually included surgical accessibility versus the simplicity of the endovascular procedure, the patient's general condition, the existence of acute haemorrhage, the possibility of sacrificing the parent artery, the aneurysm traits (saccular versus non-saccular), and the existence of a mass effect. The team members came to a general consensus regarding several aspects of the decision. First, 'the simpler the treatment, the better'. If a treatment modality was deemed complex, the team opted for a simpler substitute when possible. For example, a straightforward surgical approach was favourable to a complex coil embolisation, and a straightforward coil embolisation was a favourable to a complex surgery. Similarly, the team tended to reserve revascularisation bypass of the distal PCA for patients who exhibited poor collaterals. Second, aneurysms with dysplastic pathologies, such as dissection, fusiform, and bleb-like lesions, were considered to be potential candidates for parent artery occlusion. Therefore, a surgical approach was used first not only to confirm the aneurysm pathology but also to determine intraoperatively whether the parent artery could be saved with reconstructive clipping or reinforcing the lesion. Third, the microsurgical strategy was the primary treatment for large-giant sized aneurysms or aneurysms causing a mass effect. Fourth, non-invasiveness was the main concern for the asymptomatic lesions, making the endovascular option favourable, though it was compared to conservative observation to balance the risk-benefit.

An angiographic follow-up was performed for the coiled aneurysms with either magnetic resonance angiography (MRA) or catheter angiography at regular intervals based on each case's complexity. Generally, the first MRA follow-up was scheduled 6 months after the procedure, and the catheter angiography was performed at 1 year. Thereafter, additional surveillance was maintained annually. The clinical outcome was measured according to a modified Rankin Scale Score at the final outpatient visit. The mean follow-up period was 43.2 months, ranging from 2 to 130 months.

3. Results

Microsurgery was the primary treatment for 15 aneurysms, including 9 direct clip ligations, 3 surgically trapped aneurysms without additional bypass, a fusiform aneurysm that was wrap-clipped, and a small blister-like aneurysm that was wrapped. One giant thrombosed aneurysm in the P1 segment had a planned trapping and debulking via a combined pretemporal and subtemporal approach; however, unexpected copious bleeding from the aneurysm occurred before controlling the proximal and distal parent artery. A salvageable tentative clipping was performed to reduce the bleeding, and the patient was immediately transferred to the angiography suit for coil embolisation of the large remnant of the aneurysm (Fig. 2).

Although the surgical approach was individually designed based on the angiographic characteristics, a pretemporal approach was generally favoured for lesions located in the anterior half of the PCA (P1 and P2A, 6 cases), and a subtemporal approach was selected for lesions beyond P2P (7 cases). Both approaches were used simultaneously for 2 large-giant aneurysms. In the microsurgical group, there were 4 permanent deficits acquired after treatment, including limb weakness, visual field cut, and 3rd cranial nerve palsy. Three patients who underwent parent artery sacrificing showed no additional neurological deficit compared to their preoperative state.

Endovascular coil embolisation was performed for 6 aneurysms, stent assisted coil embolisation was performed for 2 aneurysms, and endovascular occlusion of the parent artery was performed for 2 aneurysms. There were no procedure-related complications. One of 2 patients who underwent endovascular parent artery occlusion had hemiplegia and hemianopsia due to an infarct on the large PCA territory. No patients showed major recurrence or recanalisation of the treated aneurysm at their final follow-up angiography. The immediate and follow up angiographic outcomes are detailed in Table 2.

Overall, 5 patients acquired a permanent deficit after treatment (20%), and there was no mortality. Twenty-two patients (88%) showed favourable clinical outcomes according to a modified Rankin Scale Score ($\leq$2) at their final follow-up. All of the cases are summarised in Table 1.