

## Factors Influencing Outcome of Treatment of Posterior Communicating Arteries Aneurysm

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### ABSTRACT

**Background:** The study of posterior communicating artery (PCoA) aneurysms, and the different modalities as well as the factors influencing the treatment represent a great challenge.

**Aim of the work:** To explore out whether factors are associated to a better or worse prognosis in aneurysms of the posterior communicating artery. We also sought to see how different treatment techniques for posterior communicating arteries aneurysm performed, as well as the problems and side effects of each.

**Patients and methods:** This study was conducted on 39 (20 males and 19 female) patients who were diagnosed with posterior communicating artery aneurysm at Neurosurgery department, Al-Azhar University Hospitals and Damanhur Medical National Institute.

**Results:** The surgical technique (clipping) for the treatment of aneurysms represented 20.5%, while the endovascular techniques accounted for 79.5% (coiling represented 56.4%, stent-assisted coiling represented 12.8% stenting was provided only 10.3%), and 83.9% of the endovascular techniques had a good outcome with a significant difference (P = 0.016), and 16.1% results were bad, while the results of surgical clipping were 37.5% good and 62.5% bad.

**Conclusion:** During the current study and according to our selection criteria, all the factors that we analyzed were not statistically significant. But the endovascular techniques have a better advantage in the treatment of (PCoA) artery aneurysms.

**Keywords:** Internal Carotid Artery Aneurysm ; Posterior Communicating Arteries Aneurysm ; Endovascular ; Clipping.

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### INTRODUCTION

The posterior communicating artery (P Com A) is one of the most intracerebral important arteries. Aneurysmal lesions of the posterior communicating artery (PCoA) account for nearly half of all ICA aneurysms and a quarter of all intracranial aneurysms. Aneurysms of the posterior communicating arteries aneurysm (PCoA) are one of the most notably and commonly seen by neurosurgeons.<sup>1</sup>

Recently, with the development of investigation devices and techniques, the term (true PCoA aneurysms) appeared to refer to aneurysms that exit from the artery (PCoA) itself, the author's estimate that these aneurysms account for 0.1% to 2.8 % of all intracranial aneurysms and 4.6 to 10.9 % of all (PCoA) aneurysms.<sup>2</sup>

A three-dimensional CTA and whole brain digital subtraction angiogram are the most confirmatory radiographic images in diagnosis of (PCoA) aneurysms.<sup>3</sup>

Endovascular Coiling (EVC) is a minimally invasive procedure with apparently higher procedural cost. EVC is now being widely used as an alternative treatment modality for the treatment of (PCoA) aneurysms

where coils are passed through the femoral artery route, with less morbidity and hospital stay. There are concerns regarding the coiling that could contribute to the mass effect and compromise nerve recovery.<sup>4</sup>

We aimed to study the factors that are associated with better or worse outcome in cases with posterior communicating artery aneurysms. We also aimed to evaluate the outcome of the different treatment modalities of posterior communicating arteries aneurysm including the success and adverse effects of the all the modalities.

### PATIENTS AND METHODS

**Subjects:** The study was conducted over two years on all cases that have been diagnosed with posterior communicating artery aneurysms at Neurosurgery department, Al-Azhar hospitals, and Damanhur Medical National Institute.

**Inclusion criteria:** Posterior communicating artery aneurysms treated by surgical or endovascular technique at Al-Azhar University Hospitals and Damanhur Medical National Institute.

**Exclusion criteria:** Vitaly unstable patient, Cases with GCS < 6, and Patient refusing intervention.

**Methods:** The study was conducted over 2 years on all cases of posterior communicating arteries aneurysms that have been treated by surgical or endovascular techniques.

**The cases were subjected to the following:**

**Demographic and basic data collection:** age, sex, and medical history.

**Clinical assessment:** Full detailed history of present illness of patient, full neurological examination of patient

**Radiological assessment:** Cross sectional (CT and MRI), and Angiography (CTA, MRA and CCA)

**Decision making of the operative intervention including** Counseling with the patients and relatives, surgeon preference Aneurysm characteristics as for unruptured aneurysm, endovascular is better, while for giant aneurysms with mass effect surgical clipping is considered, and Hospital policies:

**Endovascular approach is the treatment of choice in our centers.**

**Cases where surgery is preferred are;** A patient who may need long time to be prepared for EVC, aneurysms requiring stent (long term antiplatelet) with concomitant ventriculomegaly that may progress after endovascular intervention, and cases which need concomitant surgeries like massive hematoma.

**Informed consent signed:** Explanation of management strategy, Explanation of Operative procedure, Explanation of outcome expected and Explanation of outcome if refusing intervention.

**Post operative evaluation:**

**Clinical:** Including mRS scores. Good ( $\leq 2$ ) and bad ( $> 2$ )

**Radiological:** Raymond's classification which designed as early (immediate post operative) and late (3-18 months post operative), cross sectional (CT and MRI) and angiography (CTA, MRA and CCA), **complication reported and cranial nerve outcome.**

**Statistical Analysis:** On an IBM-compatible PC, all data were revised and validated before being described and analyzed using the SPSS (Statistical Package for the Social Science) application version 22.0.0, Microsoft Office Excel 2007, and Graph Pad Prism 6. For all researched parameters in the studied data, descriptive statistics were calculated and provided in the form of mean, median, standard deviation (SD), minimum, maximum, range, and percentages. When comparing parametric data that was normally distributed, the student t test was used to provide an analytical comparison across groups. Fisher's exact test was employed instead of chi-square test for comparing nonparametric data because Fisher's test creates an exact P value, whereas chi-square merely calculates an estimate.

## RESULTS

This prospective study was conducted on 39 (20males and 19 female) patients who were diagnosed with posterior communicating artery aneurysm at Neurosurgery department, Al-Azhar University Hospitals and Damanhur Medical National Institute.

Technique	No.	%
<b>Technique</b>		
Surgical (Clipping)	8	20.5
Endovascular	31	79.5
Stent	4	10.3
Coiling	22	56.4
Coiling ass with stent	5	12.8

**Table 1:** Distribution of the studied cases according to technique (n=39)

This table shows that, 31 patients underwent endovascular intervention of their (PCoMA) aneurysms (79.5% of all cases) including coiling in 22 patients (56.4%), stent assessed coiling in 5 patients (12.8%) and stenting in 4 patients (10.3%), while 8 patients had surgical clipping (20.5% of all cases).

modified Rankin scale score	No.	%
Good ( $\leq 2$ )	29	74.4
Bad ( $> 2$ )	10	25.6

**Table 2:** Distribution of the studied cases according to clinical outcome mRS (n=39)

In our study we used modified Rankin scale as a clinical outcome assessment, patients were divided to 2 groups (good  $\leq 2$  and bad  $> 2$ ). 29 patients were with good outcome (74.4%) and 10 patients were in bad clinical outcome (25.6%).

Raymond's classification	No.	%
<b>Early</b>		
Complete occlusion	21	53.8
Aneurysm remnants	10	25.6
Neck remnants	8	20.5
<b>Late</b>		
Complete occlusion	28	71.8

Aneurysm remnants	3	7.7
Neck remnants	8	20.5

**Table 3:** Distribution of the studied cases according to radiological outcome (Raymond's classification) (n=39)

Regarding to Raymond's classification all 39 patients among the recent study were evaluated radiologically early and late. Early evaluation (immediately post operative), 21 patients (35.8%) had complete occlusion, 10 patients (25.6%) had aneurysm remnant and 8 patients (20.5%) had neck remnant. While in late evaluation (3-18 months post operative) there were 28 patients (71.8%) with complete occlusion, 3 patients (7.7%) with aneurysm remnant and 8 patients (20.5%) still with neck remnant.

Aneurysm characters	N	Modified Rankin scale score				$\chi^2$	P
		Good ( $\leq 2$ ) (n= 29)		Bad ( $>2$ ) (n= 10)			
		No.	%	No.	%		
<b>Technique</b>							
Surgical	8	3	37.5	5	62.5	$\chi^2 = 7.172^*$	FE P= 0.016*
Endovascular	31	26	83.9	5	16.1		

**Table (4):** Descriptive analysis of the studied cases between intervention technique and clinical outcome (n=39)

This table shows the relation between techniques and clinical outcome (Modified Rankin scale), out of 39 case 31 cases underwent endovascular intervention (coiling, stent assisted coiling ang stenting) 26 patients 83.9% come with good outcome ( $\leq 2$ ) with a significant difference (P = 0.016).

Technique	N	Op complications				$\chi^2$	P
		Without (n= 29)		With (n= 10)			
		No.	%	No.	%		
<b>Technique</b>							
Surgical	8	5	62.5	3	37.5	0.742	FE P= 0.399
Endovascular	31	24	77.4	7	22.6		

**Table 5:** Descriptive analysis of the studied cases between technique and operative complications (n=39)

Technique	N	Post op complications				$\chi^2$	p
		Without (n= 30)		With (n= 9)			
		No.	%	No.	%		
<b>Technique</b>							
Surgical	8	5	62.5	3	37.5	1.179	FE P= 0.355
Endovascular	31	25	80.6	6	19.4		

**Table 6:** Descriptive analysis of the studied cases between technique and post operative complications (n=39)

The relation between operative complication and post-operative complication on one side and the techniques (surgical and endovascular) from another side we find no significant difference.

## DISCUSSION

The posterior communicating artery (PComA) is one of the most intracerebral significant arteries as it attaches the internal carotid artery (ICA) with the posterior cerebral artery (PCA). The term true posterior communicating artery aneurysm (PComA) is used to refer to an aneurysm arising from (PComA) and not to any other site (either the internal carotid or the posterior cerebral artery).<sup>5</sup>

This study was conducted on 39 patients for two years who had a posterior communicating artery aneurysm that was treated surgically or endovascularly at Neurosurgery department, Al-Azhar hospitals, and Damanhur medical national institute.

Regarding the intervention technique for the treatment of aneurysms. Clipping represented 20.5%, coiling accounted for 56.4%, and stent-assisted coiling 12.8% only 10.3% were provided with stenting. The reason for these results is that Endovascular intervention is the first choice for us unless there is a conflict with that. Such as those patients who need a longer time to prepare for the

intervention, or who may need another surgical intervention such as subdural hemorrhage or craniectomy or the patient relative's decision. We found that endovascular intervention was significantly correlated with good clinical outcome (p: 0.016), were 26 out of 31 patients with (PComA) aneurysm underwent endovascular treatment come in good clinical outcome (mRS 0,1,2) according to modified Rankin scale (mRS).

This finding contradicts Tian & Fu,<sup>6</sup> who found that patients who got surgical clipping therapy had a considerably greater full recovery rate than those who received endovascular embolization treatment, but we found that during our study and the early or late follow up the endovascular is better than surgical clipping as outcome and adverse effect even during procedure or postoperative. A previous retrospective study in 2016 supports our results in agreement with us on the advantage of endovascular intervention on surgical techniques.<sup>7</sup>

In comparison to surgical clipping, endovascular approach is less dangerous and safer since it reduces the risks of general anesthesia and the time it takes to achieve the aneurysm and apply the clip in surgical

clipping. In addition, in endovascular clipping, we reduce the amount of manipulation and the negative effect on parenchymal cells and related structures, particularly aneurysms in the operating blind spot (aneurysms arise 2-3 mm distal to the origin of the PCom artery at the poster lateral aspect).<sup>8</sup>

Many studies have shown that endovascular therapy of (PCom) aneurysms has fewer risks than surgical treatment and that the results may be similar to or better than clipping. However, some studies have found that clipping is better in some cases, such as younger patients with a longer life expectancy or patients with large or wide neck aneurysms, but our recent study found that endovascular intervention was superior in the majority of cases enrolled in the study that had large or wide neck aneurysms or were young patients. This result is supported by a published data enrolled 8102 patients were 4051 underwent surgical clipping and 4051 underwent endovascular.<sup>9</sup>

In our study, as regards the operative complications, 74.4% showed no complications, 20.5% presented with Vasospasm, 2.6% presented with Stenosis, and 2.6% presented with Intraoperative bleeding. Moubark et al.,<sup>5</sup> reported that data talked about the complications related to the procedure that occurred in five patients (two ischemic, two TIA, and one ipsilateral distal hemorrhage).

As regard to the postoperative complications, 76.9% did not develop any complications, 5.1% presented with epilepsy, 10.3% developed hydrocephalus and 7.7% presented with subdural hematoma. The post-procedure complications after (PComA) treatment in Roy et al.,<sup>10</sup> study was only in one patient who suffered from seizure with no major neurological complications. While in another study there were no ischemic or hemorrhagic complications.<sup>11</sup> postoperative complications, including epilepsy, hydrocephalus, and rebleeding, were no different between the clipping and coiling groups that also as reported in a previous study.<sup>12</sup>

As regards Raymond's classification, 25.6% were with Aneurysm remnants with 100% good outcome and 53.8% were with complete occlusion and 61.9% good outcome while 20.1% were with neck remnants and 75.0% good outcome. other studies talked about complete aneurysm occlusion was achieved in 41/46 aneurysms 89.1% of treated aneurysms and that may be due to the limited number of cases in our study and the general condition of patients at the time of intervention and re-treatment was required in two aneurysms. While in our series, there were no cases that needed retreatment.<sup>5</sup> our study's relatively high percentage of total aneurysm occlusion corresponds with prior series' findings, particularly those concerning PCom aneurysm. In certain trials, 85.4 percent of patients had full or near-complete blockage.<sup>10</sup>

Complete occlusion increased from 53.8 percent at 6-12 months to 71.8 percent at 24 months in our research. From 6-month follow-up, Kühn et al.,<sup>11</sup> noted 86.7 percent complete or near-complete obliteration, with 91.5 percent full or near-total

occlusion seen at 3 to 9 months, while Brinjikji et al.,<sup>13</sup> reported 81.8 percent complete or near-complete occlusion at the final follow-up. . Some studies explained the exact mechanism of progressive occlusion by the progressive intrasaccular thrombus formation and shrinkage of the aneurysm with the inflammatory process reaction. Also, there were no recurrent cases in our study, some patients did not complete the follow-up with us, and so we cannot be certain that there were no recurrent cases. According to Raymond et al.,<sup>14</sup> significant recurrence rates for aneurysms that were originally totally occluded were 9%, 23percent for aneurysms with a residual neck, and 47percent for aneurysms with a residual aneurysm.

## CONCLUSION

In the current study and according to our selection criteria, all the factors that we analyzed were not statistically significant. But the endovascular techniques have a better advantage in the treatment of (PComA) artery aneurysms.

Conflict of interest : none

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