Posterior circulation aneurysms: A 10-year institutional analysis

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ABSTRACT

Background: Aneurysms are uncommon and challenging to manage. **Materials and Methods:** A retrospective study was designed to report 53 patients who are treated from June 2002 to June 2011. **Results:** The mean age at presentation was 46.34 ± 13.67 years (males, 26). Clinical features included subarachnoid hemorrhage (median Hunt and Hess Grade II, *n* = 42), cranial nerve palsies (9), hydrocephalus (5), and incidentally diagnosed (5). Locations included superior cerebellar artery (3), posterior cerebral artery (2), basilar trunk (4), vertebral (8), anterior inferior cerebellar artery (AICA) (5), posterior inferior cerebellar artery (PICA) (13), vertebrobasilar junction (6), and basilar top (13). Management included both endovascular intervention (26) and surgery (19), and both (2). Five patients presented as poor grade and underwent only extraventricular drain placement while one patient had thrombosed aneurysm and was managed conservatively. Mortality was 26.4% (*n* = 14) and morbidity included vasospasm (10), meningitis (2), pseudomeningocele (2), pneumonitis (2), and myocardial infarction (1). **Conclusion:** Posterior circulation aneurysms are highly challenging. They require the multimodality approach, and decision regarding surgery or embolization has to be individualized.

Key words: Aneurysm, complications, management, posterior circulation

INTRODUCTION

Subarachnoid hemorrhage (SAH) is a critical medical emergency with an incidence of 9 per 100,000 person-years.[1] In 85% cases of spontaneous SAH, the cause is ruptured cerebral aneurysm.[2] The morbidity and mortality rates of posterior circulation aneurysms (10-15% for all aneurysms) are higher compared to anterior circulation and presents a technical challenge to manage.[3,4]

Endovascular techniques have evolved significantly in the last decade, and the incidence of surgery has reduced especially so after the International Study of Unruptured Intracranial Aneurysms (ISUIA), (which demonstrated higher than expected morbidity with microsurgical clipping), and the International Subarachnoid Aneurysm Trial (ISAT) (demonstrated better neurological outcomes with endovascular coiling).[5,6] The effect of these studies have been varied. For example in London, all posterior circulation aneurysms were coiled if feasible (the rate of aneurysm clipping reduced from 51% to 31%).[7]

However, the perception that endovascular therapy is superior to microsurgical clipping for posterior circulation aneurysms is not based on clear evidence. Neurosurgeons who operate in the posterior circulation appreciate the technical difficulties and associated morbidity. These neurosurgeons also recognize the appeal of minimally invasive options and the exciting advancements in endovascular technique. At the same time, a failed coiling could be equally disastrous and make then a surgical option extremely challenging and difficult.

The series presented here demonstrates the current practice of posterior circulation aneurysm management at our institution. This study does not attempt either to promote a technique or to compare or both. It is a retrospective analysis of the entire spectrum of management.

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MATERIALS AND METHODS

This is a retrospective analysis of 53 patients who treated from June 2002 to June 2011. The case records, operative notes, imaging data and follow-up data were analyzed. All patients with proven posterior circulation aneurysms were included. The Hunt and Hess Scale and Glasgow

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Outcome Scale (GOS) were used for grading a patient's neurological condition.

Imaging included a plain CT scan of the head, intra-arterial digital subtraction angiography (IADSA) and if the latter contraindicated, a CT or MR angiography. Postprocedure imaging included a plain CT head and a follow-up IADSA, which is possible after 6-12 weeks.

Decision about optimal management was made at a combined surgeon–radiologist meeting. The selection of treatment was based on the aneurysm location, circulation status, morphological features, general medical condition, and the financial status of the patient.

Surgical approaches included standard (subtemporal, midline suboccipital, and retromastoid suboccipital approaches) and skull base approaches (frontotemporal orbitozygomatic (FTOZ), far-lateral (FLA), transpetrosal and extreme lateral approaches (ELA)).

RESULTS

Patient Population

There were 53 patients (26 men) with a mean age at presentation of 46.2 + 13.67 years.

Clinical Presentation

Forty-two (79.2%) patients presented with SAH, symptoms related to mass effect (cranial nerve palsies) were seen in six patients (11.3%), and aneurysm was found incidentally (found on MRI investigated for some other etiologies) in five (9.4%) patients.

In all patients who presented with SAH, the neurological status was Hunt and Hess Grade I or II in 26 (61.9%) and Grade III or above in the rest (17; 38.1%).

Management

Totally, 47 cases underwent definitive treatment. Five patients had very poor clinical status at admission and underwent only extraventricular drain (EVD) placement. One patient had thrombosed basilar top aneurysm and was managed conservatively [Figure 1].

Direct clipping was performed in 19 cases, while embolization only was performed in 26 patients. Two underwent combined treatment. One patient had a posterior inferior cerebellar artery (PICA) aneurysm which was operated through a midline suboccipital craniotomy and also a superior cerebellar artery (SCA) aneurysm which was embolized. One more patient had a basilar top aneurysm, which was coiled initially. The patient presented 1 year later with features of mass effect due to reoccurrence of the sac. Endovascular therapy entailed a complex process of stent-assisted coiling and after detailed counseling they underwent surgery and clipping. Both patients had a good outcome [Figure 2].

Surgical approaches included FTOZ (Eight cases: six BA, one posterior cerebral artery (PCA), and one PICA aneurysm); FLA (five cases: two PICA aneurysm, two vertebrobasilar junction, and one vertebral artery aneurysm); anterior inferior cerebellar artery (AICA) (3), and PICA aneurysms (3). Other surgical approaches included subtemporal combined with anterior transpetrosal (one BA), extreme lateral with C1 laminectomy (PICA) [Table 1].

Mortality

Six patients (21.4%) who underwent embolization and three patients (14.2%) who underwent craniotomy died as a direct effect of perioperative complications. The comparative figures were not statistically significant. Five patients presented with poor-grade SAH (H and H IV and V) and were managed with EVD placement only and expired as a result of their primary condition.

Of the three patients who died (all basilar top aneurysm) following surgery, one died because of cardiac event (myocardial infarction). Other two cases developed features of raised intracranial tension due to large PCA infarct and had to undergo decompressive craniectomy.

Table 1: Summary of all patients

Characteristics	No. of patients (%)							
	SCA	PCA	BA (trunk)	VA	AICA	PICA	VBJ	Basilar top
No. of patients	3	2	4	8	5	13	6	13
Mean age in years (range)	60	36	44.5	49.6	44.2	13	44.2	44.4
Median aneurysm size in mm (range)	12	10	11.3	17.4	11.2	13.0	13	15.4
H and H grade								
0	0	0	1	2	0	5	0	2
1–2	1	0	2	4	5	7	2	5
3–5	2	2	1	2	0	1	4	6
Treatment modality								
Clipping	0	1	1	1	3	6	2	5
Embolization	2	1	2	6	2	7	3	5
Both	0	0	0	0	0	0	0	1
Evd/conservative	1	0	1	1	0	0	1	2
GOS score								
1	1	1	1	2	0	0	3	6
2–3	1	0	0	1	0	0	1	1
4–5	1	1	3	5	5	13	2	6

SCA - Superior cerebellar artery aneurysm; PCA - Posterior cerebral artery aneurysm; BA - Basilar artery aneurysm; VA - Vertebral artery aneurysm; AICA - Anterior inferior cerebellar artery aneurysms; PICA - Posterior inferior cerebellar artery aneurysm; VBJ - Vertebral basilar junction aneurysm

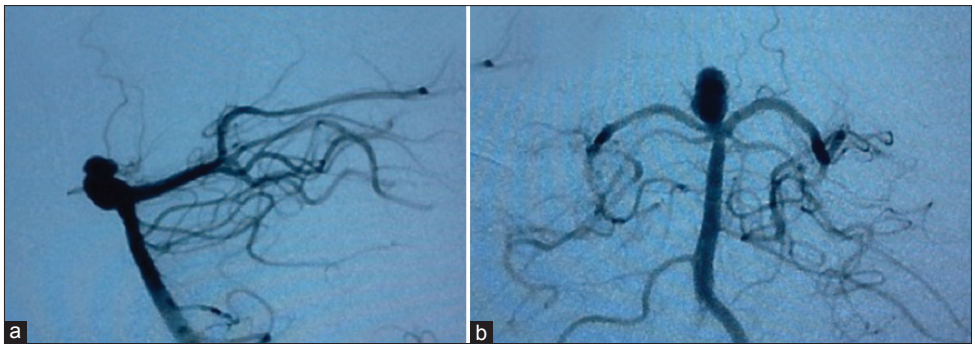

Figure 1: Basilar top aneurysm lateral (a) and AP view (b)

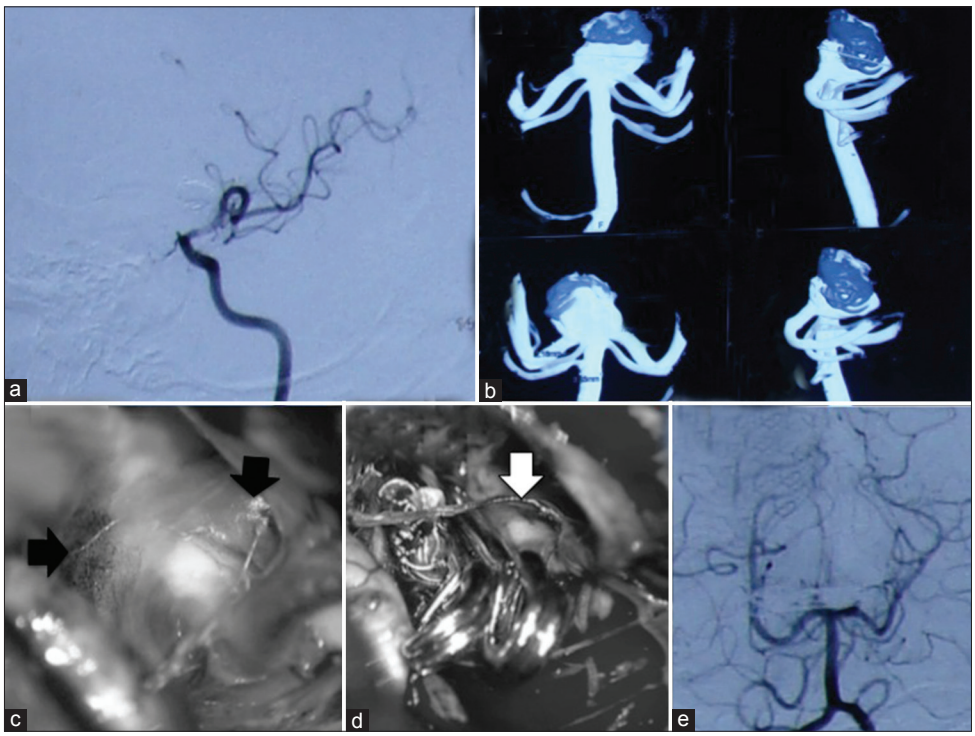

Figure 2: The same patient underwent coiling successfully (a). The patient presented 1 year later with features of lower cranial palsy. A repeat DSA showed evidence of regrowth of sac of aneurysm in the lower part. (b) In view of complexity of aneurysm sac regrowth, two possibilities were considered: (1) stent-assisted coiling and (2) surgery. After discussion at a joint meeting, a decision on surgery was reached. A fronto-orbitozygomatic subtemporal approach was performed (Dr PSC). View at surgery (c), the basilar trunk (vertical arrow), and the coils which could be seen bulging from the top (horizontal arrow). A temporary clip was applied on the basilar trunk under mild hypothermia. The fundus of the aneurysm was opened, the coils were crushed using a forceps, and two clips were applied (d). (e) he postclipping angiogram

All the three patients had Fischer grade III SAH with dense blood in cisterns. Of the three patients, one was grade II, and two were grade III Hunt and Hess. Six patients died following embolization, five of them re-bleed and one due to vasospasm.

Morbidity and Complications

Ten patients developed neurological worsening due to vasospasm. Five of these 10 improved on follow-up at 6 months. Neurological complications were more prevalent in the basilar top aneurysms (6).

Other complications included third nerve palsy (three cases: two PICA and one PCA), lower cranial nerve palsy (6), pseudomeningocele with meningitis and pneumonitis (2). The latter improved with appropriate antibiotics. Three cases had hydrocephalus at casualty and underwent an EVD placement, while two cases developed it following admission and underwent ventriculo-peritoneal shunt placement.

Follow-up

The mean follow-up in our series was 1.7 years. After a follow-up of 6 months, outcome in 35 (66.0%) patients was reflected by a GOS score of 4 or 5, in 4 (7.5%) by a score of 2 or 3.

Outcome

Comparing outcome at 6 months with that documented at 1 month, there was no change in the mortality rate (GOS score 1), whereas the number of patients in the group with severe disability (GOS score 3) decreased from 13.5% to 7.7%. There was a significant increase in number of patients in the GOS score 5 group (good outcome) from 25% to 44%.

The mean GOS score in patients less than 46 years of age was 4.0 at admission and 3.9 at follow-up and in patients more than 45 years the GOS values were 3.6 and 3.0, respectively.

In patients less than age 46 years, the mortality rate was 20.6% (7/34), whereas in patients greater than 46 years of age the mortality rate was 36.8% (7/19). However, the correlation between the age and outcome was not significant ($P>0.5$).

An important predictor of the outcome was admission GOS. Admission GOS scores were best for PICA aneurysms and worst for basilar top, and was associated with poorer outcome in these patients ($P>0.5$).

The mean aneurysm size was 13.7 mm (range, 6-26 mm). Only one patient had giant aneurysm while 12 (22.6%) of the aneurysms were smaller than 10 mm.

Patients with aneurysms more than the mean size (13.7 mm) did not fare worse than those with smaller ($P = 0.39$). Nineteen (70.4%) of the 27 endovascularly treated patients presented with SAH as did 17 (85%) of the 20 surgically treated patients.

In 77.4% of the patients in our study, the diameter of the aneurysm was 10 mm or larger (mean 13.7 mm), which suggests greater risk of future rupture.

The statistical analysis showed that overall patients with Hunt and Hess Grade I and II neurological status did better than those with Hunt and Hess Grade III and IV status ($P >0.05$). Of the 16 patients with pretreatment Hunt and Hess Grade III to IV status, three (18.8%) had a good outcome (GOS score 4-5), whereas of the 26 patients with Hunt and Hess I to II status, 22 (84.6%) had a good outcome (GOS score 4-5).

DISCUSSION

Generally, the natural history of posterior circulation aneurysms is thought to be unfavorable[8,9] although more benign courses have been described.[10,11] Of the total 1700 aneurysms treated at our institution over 10 years, only 53 (3.1%) were posterior circulation and among these 17 (38.1%) were poor grade. This may explain high mortality (26.4%, $n = 14$) in our series thus proving that "H and H grade" is an important prognostic criterion.

Many authors have demonstrated that aneurysms of 10 mm in diameter or greater enlarged over time and that this feature was predictive of future rupture.[10,12] In our study, the 42 (76.3%) aneurysms were ≥10 mm (mean 13.7 mm) but the size did not prove to be a statistically significant prognostic factor.

Late rehemorrhage has been described up to 11 years after initial presentation.[13] In our study, post-treatment rebleed (SAH) occurred in five patients postembolization and all five expired, there was only one case of thrombosed aneurysm who was managed conservatively and did well on regular follow-up.

Vasospasm has been well documented to be an important cause of deterioration in patients with aneurysmal SAH.[14] Vasospasm can be treated in various ways—medically using intravenous nimodipine/triple-H therapy, intrathecal papaverine, intra-arterial nimodipine/papaverine, and balloon angioplasty. Balloon angioplasty is the gold standard and is better than all other modalities available.[14] In our series, 10 patients developed clinical deterioration because of vasospasm and were treated medically using intravenous nimodipine, triple-H therapy with or without a stellate ganglion block.

In our study, rebleed was an important cause of mortality while (recurrent) posterior circulation ischemia secondary to vasospasm was the most important cause of morbidity.

This study was not meant to determine or compare best practices for posterior circulation aneurysms; it was meant to demonstrate the integration of both surgical and endovascular modalities in the management of posterior circulation aneurysms, where a decision for treatment was taken after a full discussion with the entire team depending on various factors such as morphology of aneurysm, density of SAH, clinical grade, and financial capability of the patient.[15-17]

All patients should be explained in detail, the existing data and facts about each treatment modality before making their decision.

On the basis of our experience, we conclude that both the techniques have their limitations and none of these can or should be labeled as "better" than the other. Posterior circulation aneurysms are highly challenging. They require multimodality approach, and decision

regarding surgery or embolization has to be individualized on case-to-case basis.

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