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Treatment of intracranial aneurysms using detachable coils; Initial results at a University Hospital in Pakistan

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Abstract

Objective: To evaluate the technical success, safety and outcome of endovascular coiling procedure in intracranial aneurysms.

Methods: From April 2003 to April 2009, 43 patients (23 males and 20 females), age range 11 to 70 years, mean age 46.67 ± 11.57 years were treated for intracranial aneurysms by detachable coil deployment at Radiology Department of Aga Khan University Hospital. Aneurysm rupture with subarachnoid haemorrhage was the cause of presentation in 39 patients while 4 patients were diagnosed with un-ruptured aneurysms. At time of presentation, grading of subarachnoid haemorrhage was done according to Hunt and Hess grading system. Eleven patients presented with Grade I haemorrhage, other 11 presented with grade II haemorrhage, 8 patients had grade III haemorrhage and 9 patients had grade IV haemorrhage. Preliminary diagnostic workup was performed by cross sectional imaging, CT angiography or digital subtraction angiography. Coiling procedures were performed under general anaesthesia through femoral artery approach. Detachable platinum coils were densely packed in all aneurysms by endovascular technique. Patient files and radiology reports were retrospectively reviewed. Technical success and safety of the procedure were analyzed. Modified Rankin Score was used to determine clinical outcome. Score 0-2 represented good outcome, score 3-5: dependency (Can not attend own bodily needs and carry out daily activities without assistance) and score 6: death.

Results: Aneurysm size ranged from 3mm - 22mm (mean size $8 \text{ mm} \pm 4$). 74.4% aneurysms had narrow necks while 25.6% aneurysms were wide necked. Most common aneurysm site was anterior communicating artery. Technical success rate for endovascular intracranial aneurysm coiling was 95.3 % (n = 41). Major complication rate was 11.6 % (n = 5). Mortality rate was 2.3% (n = 1). 78 % patients showed good clinical outcome after coiling including 4 patients with un ruptured aneurysms (n = 32).

Conclusion: Results of endovascular aneurysm coiling at our center showed high technical success rate (95.3%) and good short term clinical outcome in 78% patients (JPMA 60:638; 2010).

Introduction

Intracranial aneurysm is not an uncommon entity, with a prevalence of 0.5% to 6% in adults in general population.¹ They are multiple in 10 -30% of cases. Although most aneurysms are small but they can lead to substantial morbidity and mortality. Most common presentation is rupture leading to subarachnoid haemorrhage.² Approximately 27,000 new cases of subarachnoid haemorrhage due to aneurysm rupture present each year in United States.³ In Pakistani population frequency of subarachnoid haemorrhage as a cause of stroke is estimated to be 8-10%.^{4,5}

Patients with ruptured aneurysms present with severe headache, coma or with severe neurologic compromise. More than 10% patients die before reaching hospital.³ Over all 50% patients die within first month from progressive deterioration. Approximately 30 percent of survivors have moderate-to-severe disability.⁶ Ruptured aneurysms may bleed again within 24 hours of initial episode and risk remains high in initial 2 weeks.² Patients with un-ruptured aneurysms can present with symptoms due to mass effect, resulting in cranial-nerve palsies or brain-stem compression. Prompt diagnosis with timely treatment of aneurysm is associated with improved prognosis.

Intracranial aneurysms are now increasingly treated by endovascular coiling. A microcatheter is positioned into the aneurysm, and detachable coils are deployed to decrease the amount of blood or to stop blood from filling the aneurysm.⁷ This technique is rapidly becoming primary option for the treatment of aneurysms.⁸

In Pakistan, the outcome of surgical clipping of aneurysms has been studied locally in the past⁹ but to the best of our knowledge no local data is available regarding outcome of endovascular coiling as treatment modality.

We evaluated the technical success, safety and outcome of endovascular coiling procedure in intracranial aneurysms.

Patients and Methods

This retrospective study was carried out at radiology department of Aga Khan University Hospital. Data of patients was collected from April 2003 to April 2009. We included all patients who underwent coiling procedure for intracranial aneurysm. Patients in whom coiling was technically not possible due to difficult anatomy or severe vascular spasm were excluded from the study.

Sample comprised of total 43 patients (23 males and 20 females) age range was from 11 to 70 years, mean age 46.67 ± 11.57 years. Thirty-nine (90.69%) patients presented with subarachnoid haemorrhage due to ruptured aneurysms while 4 (9.3%) patients had symptoms due to unruptured intracranial aneurysms. At time of presentation subarachnoid haemorrhage in 39 patients was graded according to Hunt and Hess grading system.¹⁰ Eleven patients presented with Grade I haemorrhage, other 11 presented with grade II haemorrhage, 8 out of 39 patients had grade III haemorrhage and 9 patients had grade IV haemorrhage. Standard four vessels cerebral angiogram was performed supplemented by rotational and 3D angiography prior to the coiling procedure. Location, size, orientation, neck diameter, and shape of intracranial aneurysm. were analyzed. Narrow neck of aneurysm was defined as less than 50% neck to body ratio and wide necked aneurysms were defined as those with more than 50% neck to body ratio.

Coiling Procedure: Procedures were performed by senior interventional radiologist in angiography suite on a monoplane flat panel DSA unit (Axiom Artis angiography machine Siemen's corporation). All procedures were carried out under general anaesthesia via femoral artery approach. Following diagnostic angiography by 5 Fr HI catheter (Cordis corporation), a 6 Fr guiding catheter (MPD, Cordis corporation) was placed in internal carotid artery as distally as possible and after selective catheterization of aneurysm with micro-catheter (Prowler, Cordis corporation), multiple detachable coils (GDC, Boston Scientific or TRUFIL, Cordis corporation) were deployed for embolization. Dense packing

of aneurysm was the end point for procedure (Figure-1). Technical failure was defined as an attempted embolisation procedure during which coils could not be successfully deployed. Any procedural or other subsequent complication was recorded. Patients were followed after procedure and Modified Rankin Score¹¹ was used to determine clinical outcome.

- ◆ Scores 0-2: Good out come
- ◆ Scores 3-5: Dependency (Can not attend own bodily needs and carry out daily activities without assistance)
- ◆ Score 6: Death

Data from patient's files and radiology reports was collected on performa and analyzed on SPSS version 16.

Results

Aneurysm size ranged from 3mm-22mm (mean size 8 ± 4 mm). 32 aneurysms had narrow necks while 11 aneurysms had wide necks. Most common aneurysm site was anterior communicating artery (30.2%). Frequency for distribution of location of aneurysm is outlined in Table.

Technical success rate for endovascular intracranial aneurysm coiling was 95.3 % (41 out of 43 patients). In 2 patients the procedure was unsuccessful due to anatomically difficult catheterization of aneurysm or supplying artery. Major complication rate was 11.6 %. Aneurysm rupture



Figure: Digital subtraction angiogram showing large aneurysm at basilar tip (a) successfully treated by coil deployment (b & c).

Table: Distribution of location of aneurysms.

Total patients n = 43		
Aneurysm Location	Number	Percentage
Anterior Communicating Artery	13	30.2
Anterior Cerebral Artery	06	13.9
Posterior Communicating Artery	05	11.6
Basilar Tip	05	11.6
Basilar Trunk	02	4.6
Internal Carotid Artery Bifurcation	04	9.3
Ophthalmic Artery	02	4.6
Posterior Inferior Cerebellar Artery	01	2.3
Internal Carotid Artery	03	6.9
Vertebral Artery	01	2.3
Posterior Cerebral Artery	01	2.3

occurred in 3 patients, 2 of them underwent subsequent surgical clipping. In 1 patient the ruptured aneurysm was immediately sealed by deployment of coil. In 3 patients thromboembolism occurred during attempts of cannulation of the native artery. Two of these patients developed established infarctions. In 3rd patient tiny thrombus was discovered in parent artery and was immediately treated with Nimodipine, Abciximab and Heparin infusion. No neurological deficit was observed in this patient.

One patient died after 2 days of coiling procedure due to infarct induced by intense vascular spasm. Out of 41 patients who underwent successful coiling of aneurysms, 32 (78%) showed good clinical outcome, this group includes all 4 patients with un-ruptured aneurysms. Six patients developed dependency (14.63%). Two patients were lost to follow-up after discharge from hospital.

Discussion

In the past, surgical clipping had been the mainstay of treatment of both ruptured and unruptured cerebral aneurysms. With development of newer interventional techniques and increasing experience of interventional radiologists, traditional concepts of aneurysm treatment have changed.^{12,13} Since the advent of Guglielmi detachable coils in 1991¹⁴ the technique is being widely used as alternative treatment modality of intracranial aneurysms. It allows placement of platinum coils into lumen of the aneurysm blocking blood flow into the aneurysm and preventing rerupture. The technique is a safe and effective alternative treatment option with fewer complications, shorter hospital stay and faster recovery.^{15,16} Reported technical complications of coiling include parent artery occlusion, aneurysm perforation and coil migration.¹⁷

Major procedural complications in our series were 11.6%, similar to those reported by Renowden i.e. 12.4%.¹⁸ Two patients with ruptured aneurysms underwent successful surgical clipping. Surgical intervention can be a helpful second line treatment in cases of unsuccessful or complicated coiling procedure.¹⁹ One patient in our series had a tiny thrombus in native artery which was managed successfully by Abciximab, nimodipine and heparin infusion. Mortality rate related to procedural complications or technical failure is variable, ranging from 0.6-29%.²⁰⁻²² In our series mortality rate was 2.3% which is comparable to published literature.

Regarding eventual patient outcome, a large multi center prospective study of 2143 patients with ruptured intracranial aneurysms, by Molyneux⁸ showed favourable results for endovascular therapy as compared to surgery. The relative risk of significant disability at one year for patients treated with coils was 22.6 percent lower than in surgically-treated patients. Yu²³ have also demonstrated lower risk of death and significant disability in patients treated with coiling

procedures as compared to surgically treated group. In our series 78% patients showed good clinical outcome after endovascular management, our results in this regard are better than Jahromi²⁴ and quite similar to Sluzewski²⁵ (63% and 84% respectively).

The procedural success rates, safety and eventually patient outcome is expected to improve further with increasing experience of interventional radiologists and availability of multidimensional coils allowing safer initial deployment.

Conclusion

Results of endovascular aneurysm coiling at our center showed high technical success rate and good short term clinical outcome.

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