

Role of Surgical Clipping and Endovascular Coiling in Management of Aneurysmal Subarachnoid Hemorrhage in Zagazig University Hospitals

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ABSTRACT

BACKGROUND: Microsurgical clipping has always been the standard treatment for ruptured intracranial aneurysms; however endovascular coiling is a frequently used treatment modality that replaced the traditional microsurgical techniques as standard treatment at some centers.

OBJECTIVES: Our purpose is to study safety and efficacy of endovascular coiling of ruptured aneurysms.

PATIENTS AND METHODS: 12 patients treated with microsurgical clipping and 12 patients treated with endovascular coiling at Zagazig University hospitals between March 2015 to February 2017. All were anterior circulation saccular aneurysms. Outcome was assessed using Modified Rankin Scale (MRS) with poor outcome defined with MRS>2 at discharge. Any rebleeding, retreatment was documented on each group.

RESULTS: Poor outcome was higher in surgery group 25% including one mortality versus 8.3% in Endovascular group. Rebleeding occurred in one patient in endovascular group that required retreatment with repacking coils to aneurysm.

CONCLUSION: Endovascular coiling is a safe and effective treatment option in treating ruptured intracranial aneurysms.

KEY WORDS: Aneurysm, clipping, coiling.

Introduction

Ruptured intracranial aneurysms account for approximately 85% of non-traumatic SAH and are associated with a 30-day mortality rate of 45% and a morbidity rate of 25% (van Gijn & Rinkel, 2001).

In 1991 Guglielmi et al reported on the experimental results and the clinical application of electrically detachable platinum coils (Guglielmi, 2009).

Guglielmi detachable coils (GDC) were approved by the Food and Drug Administration (FDA) and form the basis of endovascular treatment of intracranial aneurysms. Endovascular therapy for aneurysms is attractive because an effective and often an equivalent result can be achieved with a less invasive method compared to traditional microsurgical techniques. This may result in decreased hospitalization and faster recovery for the patient (Seibert et al., 2011).

The International Subarachnoid Aneurysm Trial (ISAT) was the only large, multicenter, randomized clinical trial that compared neurosurgical clipping with detachable platinum coils in patients with ruptured intracranial aneurysms. However, results of ISAT have continued to generate some criticism, mainly because of its selection bias. In recent years, coiling is being offered to patients who were not suitable for inclusion in ISAT (Hui Li et al., 2013).

METHODS:

24 patients between March 2015 and February 2017 were diagnosed with aneurysmal SAH. All were admitted to the department of neurosurgery at Zagazig University. All had anterior circulation aneurysms. All aneurysms were saccular in shape. We had 2 groups. Group A with 12 patients treated with microsurgical clipping and group B with 12 patients treated with endovascular coiling.

Group A: All patients were diagnosed with CT brain showing SAH. CT angiography was the standard diagnostic tool for intracranial aneurysm however we arranged for catheter digital

subtraction angiography whenever further planning was needed to approach the aneurysm surgically. Patients were assessed clinically using Hunt and Hess grades.

All cases were treated on late surgery bases, 2 weeks or more after hemorrhage. We believe that surgery in vasospasm period would aggravate cerebral ischemia and worsen the outcome. Surgery performed via a standard pterional craniotomy to all anterior circulation aneurysms. clipping aneurysm neck was the standard surgical option.

Group B: Patients were diagnosed with CT brain showing SAH. Initial CT angiography followed by catheter DSA was performed in all cases. Clinical evaluation was done with Hunt and Hess grades. Coiling is arranged within one months of hemorrhage using GDC coils and variety of microcatheters and microwires

Peri-procedure protocol : Initially we kept all patients euvoletic with adequate monitoring of serum electrolytes, hematocrit value and central venous pressure. Nemedipine was routinely used for 21 days. Prophylactic phenytoin was used in all cases. DVT prophylaxis using pneumatic compression was done in high risk patients. Anticoagulation is typically administrated 24 hours after surgery and immediately after coiling procedure. Dehydrating measures kept to patients with high Hunt and Hess grades.

Follow up: Follow up CT angiography or catheter DSA is performed for surgery group and follow up catheter DSA for endovascular group. Clinical follow up for 3 months after procedure. Outcome was assessed using MRS with poor outcome defined with MRS >2. Any readmission or retreatment to any patient in either group was documented.

RESULTS:

Ruptured aneurysms were more common among age group older than 50 years (58.3%) and among female population. Most common aneurysm location was Acom aneurysm (45.8%) followed by MCA aneurysm (33.3%). Hypertension was the commonest association in (58.3%). On admission commonest Hunt and Hess grade was grade II in (45.8%).

In group A (surgery group): Among 12 patients treated with microsurgical clipping, ischemia was the commonest complication in 3 cases all were Acom aneurysms. We defined surgery related ischemia with a new deficit within the first 24 hours after surgery or presence of hypodense area on follow up CT brain. Ischemia was pericallosal artery distribution in 2 cases and perforator ischemia in 1 case. Ischemia affected the outcome in 2 cases of pericallosal ischemia discharged with MRS >2 . Intra operative rupture occurred in 2 cases however it did not affect outcome. We had one case with subdural hygroma that disappeared on follow up. No hematoma, retraction injury, rebleeding, infection or aneurysm remnant in surgery group.

In group B (endovascular group): among 12 patient treated with simple coiling we had only one major procedure related complication. One case of AcomA had a coil migration

Table 1 associated risk factors with ruptured aneurysms

Aneurysm location	Group		
	A	B	Both
<i>Acom A</i>	6	5	11(45.8%)
<i>MCA</i>	4	4	8 (33.3%)
<i>PcomA</i>	2	3	5 (20.8%)
Total	12	12	24

Table 2 Anatomical location of aneurysms

Risk factor	Number	%
Hypertension	14	58.3%
Diabetes	6	25%
Smoking	8	33.3%
>50 years	14	58.3%
Alcohol	0	0%

Table 3: endovascular related complications

Complication	Number
Coil migration	1 (8.3%)
Puncture site hematoma	2 (16.6%)
Retreatment	1 (8.3%)

Table 4: surgery related complications

Complication	Number
Ischemia	3 (25%)
Subdural hygroma	1 (8.3%)
IOR	2 (16.6%)

during deployment of a finishing coil. We did not have snare system to retrieve that coil which resulted in pericallosal ischemia that affected outcome (MRS >2). We did have minor puncture site hematomas in 3 cases resolved with conservative measures. We did not experience

aneurysm perforation. Only one case had minor rebleeding early after procedure and recoiling was done.

Outcome: in surgery group only we had one mortality due to malignant MCA infarction after clipping of MCA bifurcation aneurysm in a patient presented with Hunt and Hess grade IV. We had 2 patients discharged with MRS >2. In Endovascular group we did not have any mortality. Only one patient of AcomA discharged with MRS >2. Regarding retreatment only one case in endovascular group needed retreatment.

DISCUSSION:

Regarding treatment outcome, In our study we had poor outcome (MRS >2) in only 1 out of 12 patients in endovascular group in comparison to 2 patients out of 12 patients in surgery group. We had one mortality in surgery group in comparison to no mortality in endovascular group. We had one retreatment in endovascular group.

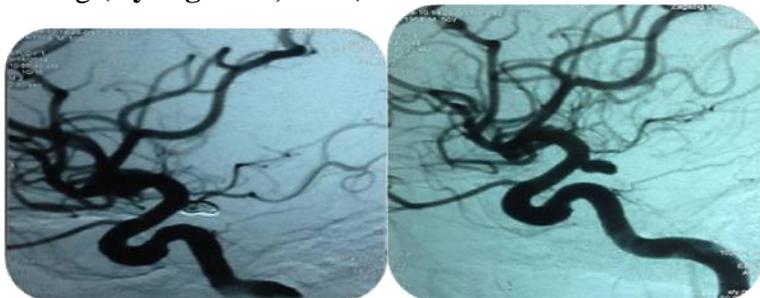
ISAT was the first multicenter randomized trial for evaluation of both safety and efficacy of endovascular coiling of ruptured aneurysm The relative and absolute risk reductions in dependency or death after allocation to an endovascular versus neurosurgical treatment were (22.6%) and (6.9%) respectively. Rebleeding rate in endovascular group during first 30 days

after treatment was higher than in surgery group (20 out of 1087 patients versus 6 out of 1004). At the end of first year, rebleeding occurred in 68 patients in endovascular group versus 43 in surgery group (Molyneux et al., 2005).

Table 5: Treatment outcome in both groups

Treatment option	Outcome				X ²	P
	Good	Morbidity	Mortality			
Surgery	9 75.0%	2 16.7%	1 8.3%	1 8.3%	3.06	0.21
Endovascular	11 91.6%	1 8.3%	0 0.0%	0 0.0%		
Total	20 100.0%	3 25%	1 8.3%	1 8.3%		

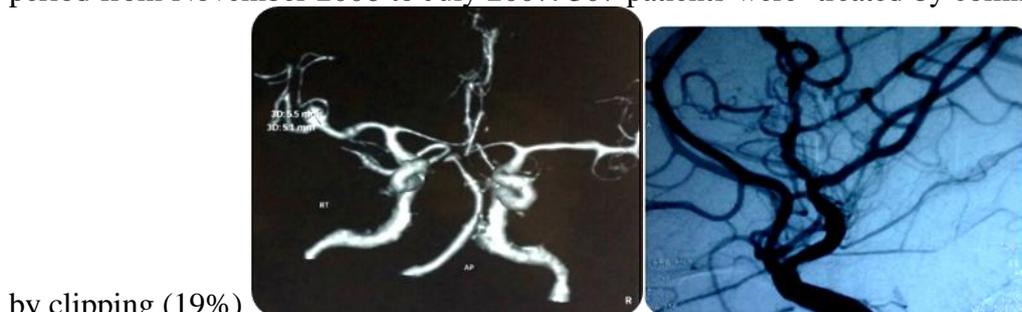
A recent analysis of the ISAT data revealed that patients undergoing neurosurgical clipping had higher rates of DCI compared with patients undergoing endovascular coiling of ruptured aneurysms, a finding that has been corroborated by other groups. Higher incidences of DCI after neurosurgical clipping can explain, at least in part, outcome differences between clipping and coiling (Ayling et al., 2015).



Patient with ruptured PcomA aneurysm underwent endovascular coiling with no filling of aneurysm on follow up DSA

A study by Ayling et al in 2015 showed a decline in GCS scores following the aneurysm-securing procedure was observed in 46% (80 of 174) of patients undergoing neurosurgical clipping and in 25% (53 of 208) of those undergoing endovascular coiling. The greatest difference in GCS scores was in postoperative Day 1. Postoperative neurological decline was significantly greater in patients who underwent neurosurgical clipping compared with those who were treated with coils (Ayling et al., 2015).

The Clarity GDC study included 381 consecutive patients from 15 French centers during the period from November 2006 to July 2007. 307 patients were treated by coiling (80.6 %) and 74



by clipping (19%)

Patient with ruptured right MCA bifurcation aneurysm underwent surgical clipping with follow up DSA showing no filling of aneurysm in follow up DSA.

Risk of procedural complications and long-term clinical results were similar in both center groups, knowing that 79.4% of clipped aneurysms were MCA aneurysms (**Cognard et al., 2014**).

In our study there was statistical significance (P value = 0.007 and 0.01 in endovascular and surgery groups respectively) in association of poor treatment outcome with higher clinical grades as measured with Hunt and Hess grades in both treatment groups.

In BRAT 3 years follow up results in 2013, Spetzler et al reported that Hunt and Hess grade was strongly associated with outcomes for the assigned clip and coil groups as a whole (**Spetzler et al., 2013**).

In M Taha study in 2006 including 53 patient with ruptured aneurysms. the periprocedural technical complications associated with endovascular embolization was lower than surgery related complications for ruptured cerebral aneurysms. The incidence of post-SAH vasospasm was lower in patients treated with coiling. As compared with patients treated with clipping, shunt-dependent hydrocephalus was comparable in both modalities of aneurysm treatment (**Taha et al., 2006**).

Mclaughlin et al in 2004 studied direct surgical complication after clipping. Twenty-nine (20.3%) of 143 patients in the studied population were found to have a surgery-related complication clinically and/or radiologically. The most frequently diagnosed surgical complication was brain tissue injury. These lesions were present in nine (6.3%) of 142 patients. The second most frequently diagnosed surgical complication was unpredicted residual aneurysm rests in 7 patients. Third most common complication was cranial nerve palsy in 4 patients (**Nancy Mclaughlin, 2004**).

Another Study on coiling versus clipping of aneurysm closure procedures by Rabinstein et al, Aneurysms treated with coiling increased from 20% in 2001 to 63% in 2008. For surgical clipping, the percentage of patients discharged to long-term facilities was 14.0% (4184/29,918) compared with 4.9% (1655/34,125) of coiled patients. Clipped patients also had a higher mortality rate because 344 (1.2%) clipped patients died compared with 215 (0.6%) coiled patients (**Rabinstein & Kallmes, 2011**).

In the editorial accompanying the publication of the 1st-year results from BRAT, Dr. Lanzino noted that the results favored endovascular management as a reasonable strategy for right of first refusal. Using the same logic, the 3-year results of BRAT suggest that clipping can be considered the preferable management strategy for anterior circulation aneurysms, as there is no difference in treatment risk between coiling and clipping and because clipping can treat all aneurysms (crossover rate less than 1%), results in better aneurysm occlusion, provides superior protection from rebleeding, and is associated with less need for frequent follow-up and retreatment (**Spetzler et al., 2013**).

CONCLUSION:

Endovascular coiling of ruptured intracranial aneurysms is safe and effective treatment modality.

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