Efficacy and Safety of Coiling Versus Clipping for Ruptured Middle Cerebral Artery Aneurysms: Retrospective study of Double center experience

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ABSTRACT

Background:

Middle cerebral artery (MCA) aneurysms constitute about 22% of all intracranial aneurysms (IAs). The middle cerebral artery is the commonest location for unruptured IAs. Ruptured MCA aneurysms are commonly associated with intracerebral hematomas. Rebleeding has a catastrophic morbidity of up to 78%.The goal of aneurysm management is complete, durable obliteration without neurologic consequence. Two options prevail: endovascular emboilization and open surgical clipping.

Aim of the study:

Our purpose was to address the feasibility, safety, and efficacy of endovascular coil emboilization versus clipping in ruptured MCA aneurysm.

Materials and methods:

A retrospective comparative study kept double center database of 104 MCA aneurysms seen at Neurosurgery Department, Sohag University Hospital and Neurosurgery Department, Alexandra University Hospital from January 2012 to December 2015.A total of 58 patients harboring 58 ruptured MCA aneurysms were primarily selected. Microsurgical clipping of MCA aneurysms was performed in 33 patients and endovascular coiling of MCA aneurysms was performed in 25 selected patients.

Results:

From our study, among 25 endovascularly treated patients, stand-alone coiling was approached for sixteen patients (64%), six patients (24%) were selected for balloon remodeling technique (BRT), two cases (8%) treated via stent assisted coiling (SACT), and only one patient (4%) treated by doubled microcatheter approach. In surgically clipped groups, three approaches were advised according to MCA aneurysmal location, and expected case scenario. The proximal sylvian approach selected in M1 aneurysms, while the distal sylvian approach recommended in MCA bifurcating aneurysms, and the superior temporal gyrus approach approved in distal MCA aneurysms. According to applied clips, eight cases (24.2%) reveled double clips application (six cases in MCA bifurcation aneurysms, and one case only in each M1, and distal MCA aneurysms), one case approached only via bipolar coagulation (3%), and single clip application was selected for the rest of the patients (72.8%).

Conclusion:

Clipping is still a cost effective treatment in ruptured MCA aneurysms especially in wide neck type. Coiling is a safe and effective treatment modality and nearly equal the results of surgical clipping especially in patients with medical comorbidities..

Keywords:

Middle, cerebral, ruptured, aneurysm, clipping, coiling

Introduction

Middle cerebral artery (MCA) aneurysms constitute about 22% of all intracranial aneurysms and are the third most common cause of aneurysmal subarachnoid hemorrhage (SAH). The middle cerebral artery is the commonest location for unruptured intracranial aneurysms (IAs) (1).

Ruptured MCA aneurysms are commonly associated with intracerebral hematomas, which are found in nearly 40% of cases. Rebleeding has a catastrophic morbidity up to 48% to 78% (2).

The goal of aneurysm management is complete, durable obliteration without neurologic consequence. Two options prevail: endovascular emboilization and open surgical clipping (3).

Surgical clipping is a more traditional and invasive technique. It is a versatile procedure and well established worldwide; but advances in endovascular techniques, including 3-dimensional angiography, operator experience, and adjunctives (balloon assistance, stents, etc…) have resulted in an increased performance of endovascular emboilization of MCA (IAs) (3).

Increasing number of ruptured MCA aneurysms with manifested dilemma about the ideal plane of management for ruptured MCA aneurysm is a challenging subject to wrap our hands around table (4).

Aim of the study

Our purpose was to address the feasibility, safety, and efficacy of endovascular coil emboilization versus clipping in ruptured MCA aneurysm.

Patients and methods

A Retrospective comparative study kept double center database of 104 MCA aneurysms seen at Neurosurgery Department, Sohag University Hospital and Neurosurgery Department, Alexandra University Hospital from January 2012 to December 2015.

A total of 58 patients harboring 58 ruptured MCA aneurysms were primarily selected.

Microsurgical clipping of MCA aneurysms was performed in 33 patients and endovascular coiling of MCA aneurysms was performed in 25 selected patients.

❖ ***The selection of treatment modality for MCA aneurysms whether microsurgical clipping or endovascular coiling was based on several factors including:***

A. Aneurysm (size, morphology, dome to neck ratio).
B. Anatomy (parent artery, branch artery or perforator originating from the neck).
C. Patient (clinical status, medical co-morbidity, preference, and socioeconomic status).
D. Presence or absence of mass effect from intracerebral or subdural hematoma.

❖ ***Patients who fulfilled the following criteria were selected for endovascular intervention:***

1- Small to medium sized aneurysms less than 15 mm in size, with dome /neck ratio 1-1.5, located at M1 or MCA bifurcation , not highly tortuous parent artery, and no any vessel or perforators arise from the neck of the aneurysm.
2- Absence of intracerebral hemorrhage > 35mml or subdural hematomas need decompression.
3- Presences of severe vasospasm on the original DSA with manifested medical comorbidities.
4- Presence of financial support
5- Finally, according to patient's desire.

❖ ***Data collection:***

A. Patient data

Including demographic, clinical and radiologic data (patient age, gender and co-morbidity, rupture state of the MCA aneurysm (SAH), and presence of intracranial hemorrhage (ICH), intraventricular hemorrhage (IVH) or hydrocephalus).

B. Procedure data

Including type of intervention, feasibility, or difficulties of the selected approach, and procedure complication (intraoperative, and postoperative).

C. Outcome data:

* Angiographic outcome

1. Immediate occlusion grade of the aneurysm was evaluated with DSA at the end of endovascular procedures and with CTA within 3days after microsurgical clipping of MCA aneurysms. Then aneurysm occlusion grade was re-evaluated at 3 and 6 months follow-ups. Angiographic occlusion was assessed using the 3-point Raymond classification scale: complete obliteration (Grade A) which equal 100%, residual neck (Grade B) which equal 95-99% and residual aneurysm (Grade C) which equal <95%. Recurrence was considered when there was any increase in the size of neck remnant of partially occluded aneurysm or remnant appeared in previously completely occluded aneurysm.
2. Vessel occlusion in control angiograph

* Clinical outcome

The patient's outcome was recorded according to Glasgow Outcome Scale (GOS) at discharge, after one month and 6 months and at the last follow-up point (mean, 8.7 months). Poor outcome was assigned for patient who had GOS of 3 to 5 (table 1).

❖ ***Statistical analysis***

We used IBM SPSS Statistics, version 24 for Windows for analysis of our data. To compare groups, we used Pearson Chi square or Fisher's exact test for categorical variables (patient gender, side (left/right), wide neck (neck size ≥ 4mm and/or dome/neck ratio ≤1.5) and management (surgery/endovascular)), and the Mann-Whitney U-test for continuous variables (Patient age, aneurysm size, neck size). We considered probability value < 0.05 statistically significant.

We analyzed the risk factors for morbidity and mortality after treatment of MCA aneurysms. In univariate analysis we included age, gender, Fisher grade, size and morphology of the aneurysm, possible re-bleeding, shunt-dependent hydrocephalus، H & H grade in no-SAH (H & H 0), good-grade (H & H 1 and 2) and poor grade (H & H 3 to 5) groups and treatment technique. To calculate odds ratios (ORs) and 95% confidence intervals (CIs) of independent factors associated with morbidity and mortality, we used unconditional binary logistic regression analysis.

Results

❖ ***Demographic data***

There was a clear male predominance of 2.1: 1 as there were 40 male (68.5%). Age ranged from 25-62 years old with a mean age of 56 years old. MCA aneurysms were more common on the right side (n=31, 53.4%). Thirty-two (55.1%) of MCA aneurysms were small in size (< 7mm), and 33 patients revealed predominance of MCA bifurcation (56.9%) regards location. In 4 patients (7.4%), there were multiple aneurysms (2 patients with ACOM aneurysms, 1 patient with ICA bifurcation aneurysm, and 1 patient with PCOM aneurysm) ; one patient treated by clipping, and 3 cases treated endovascularly. The multiple aneurysms had been managed at the same session in all patients, but not included in our study.

SAH observed in all our case series was classified according to Hunt and Hess grade (table 2): I (12), II (14), III (10), IV (17), and V (5). Fisher grading was 19 patients with grade II (32.7%), 17 case with grade III (29.3%), and 22 patients (38%) with grade IV.

❖ ***Guided by inclusion parameters, among 25 case of endovascularly treated group, we delineate our protocol in management according to the following criteria:***

1- Stand-alone coiling tried in every cases according to general inclusion criteria.
2- Double microcathter approach was indicated when dome/neck ratio nearly equal (1:1), in acute stage; angle of vessel is difficult to catheterize with balloon, and finally for financial cause.
3- Balloon remolding technique (BRT) was selected when, double microcathter approach failed, neck/dome ratio 1-1.5, associated with vasospasm, and with accessible angle of vessel that can withstand balloon.
4- Stent assisted coiling technique (SACT) was recommended in parent artery vessel more than 3 mm in size, non-bifurcating aneurysms, neck is wider than (> 5mm) those selected for BRT, no vasospasm, not in acute stage (coiling was 2-3 weeks after rupture), and finally to surgeon" decision toward prevents coil migration in the parent artery after the procedure, or recurrence that enables dense packing in aneurysms, and induces significant intra-aneurysmal flow modification, in addition to surgeon experience in stent delivery, Otherwise BAT was recommended. From our study, stand-alone coiling was approached for sixteen patients (64%), six patients (24%) were selected for balloon remodeling technique (BRT), two cases (8%) treated via stent assisted coiling (SACT), and only one patient (4%) treated by doubled microcatheter approach.

❖ ***In surgically clipped groups***

* Three approaches were advised according to MCA aneurysmal location, and expected case scenario. The proximal sylvian approach selected in M1 aneurysms, while the distal sylvian approach recommended in MCA bifurcating aneurysms, and the superior temporal gyrus approach approved in distal MCA aneurysms.

* According to applied clips, eight cases (24.2%) reveled double clips application (six cases in MCA bifurcation aneurysms, and one case only in each M1, and distal MCA aneurysms), one case approached only via bipolar coagulation (3%) with wrapping, and single clip application was selected for the rest of the patients (72.8%).

Associated comorbidities, primary occlusion rate, and follow up 6 months, in addition GOC at 1 and 6 months, and modalities in treatment in both groups were addressed after coiling and clipping as summarized in tables 3 and 4.

The selected treatment modality whether endovascular coil emboilization or microsurgical clipping, was feasible in all cases of our series.

No observed critical complication was found in coil emboilization group more than intraoperative aneurysmal perforation in one case, with smooth postoperative recovery, and groin hematoma in 2 cases which resoluted spontaneously.

Also in clipping group, no dangerous complications more than wound infection in 2 cases which traditionally treated by antibiotics, and CSF collection in one case which has been also treated conservatively with no additional intervention.

Risk factors were clearly noticed in our series, such as smoking in 47.8% of cases, obesity in 43.2%, drug abuse in 26.5%, and alcohol abuse in 6%.

Table 1. Glasgow Outcome Scale (GOS):

GOS Grade	Neurological status
1	Good recovery: patient can lead a full and independent life with or without minimal neurological deficit
2	Moderately disabled: patient has neurological or intellectual impairment but is independent
3	Severely disabled: patient is conscious but totally dependent on others to get through daily activities
4	Vegetative state: patient is breathing spontaneously but remains unresponsive
5	Dead

Table 2. Hunt and Hess (H&H) grade:

Grade	Hunt and Hess
I	Asymptomatic, minimal headache or slight nuchal rigidity
II	Moderate to severe headache، nuchal rigidity, neurological deficit confined to cranial nerve palsy
III	Drowsiness, confusion or mild focal deficit
IV	Stupor, moderate to severe hemiparesis, possibly early decerebrate rigidity, and vegetative disturbances.
V	Deep coma, decerebrate rigidity،moribund appearance

Table 3. Demographic data of the study group

Item		Value
Sex	Male	40(68.97%)
	Female	18(31.03%)
Age	Mean±SD	56.12±8.83
	Median(range)	59(25-62)
Special habits	Smoker	43(74.14%)
	Drug abuser	12(20.69%)

	Alcohol abuser	3(5.17%)
Medical comorbidities	Hypertension	22(37.93%)
	DM	14(24.14%)
	Hepatic	12(20.69%)
	Renal	3(5.17%)
	Atherosclerosis	2(3.45%)
	Cardiac	4(6.90%)
	Autoimmune diseases	1(1.72%)
Associated vascular diseases	Aneurysm	29(50%)
	Carotid stenosis	22(37.93%)
	AVM	7(12.07%)

Table 4.Clinical preoperative and intraoperative data of the study group

Item		**Value**
Mode of presentation	Seizures	17(29.31%)
	Headache	23(39.66%)
	DCL	18(31.03%)
Number of aneurysms	Single	54(93.10%)
	Multiple	4(6.90%)
Size of aneurysm	Small (<7 mm)	32(55.17%)
	Large (>7 mm)	26(44.83%)
Site of aneurysm	Bifurcation of MCA	33(56.90%)
	Proximal MCA	17(29.31%)
	Distal MCA	8(13.79%)

Table 5.Clinical and radiological outcome in the study group

Item		Microsurgical group (n=33)	Endovascular group (n=25)	P value
Clinical outcome	Good recovery	22(66.7%)	18(72%)	0.736
	Moderate disability	3(9.09%)	5(20%)	
	Severe disability	4(12.12%)	1(4%)	
	Died	4(12.12%)	1(4%)	
Radiographic outcome				
According to aneurysm occlusion	In 1st control angio	88.2%	84%	0.888
	Last follow up	94.8%	89%	0.242
According to neck remnant	In 1st control angio	15%	14.3%	0.888
	Last follow up	13.8%	20%	0.242

Table 6.Patients Treated by Coiling

Patient /Age /sex	H&H	her grad	Size (mm)/ neurysm neck mm	MCA Location	Endovascular approach	Co-morbidities	)cclusion Rate after EVT	cclusion Rate after 6 mo	GOS at 30 d	GOS at 6 mo
1/44/ M	5	G3	4 x 2 /1.5	R,MCB	S. Coiling	Renal, HTN, D.M	Grade A	Grade A	Grade 1	Grade 1
2/56/ M	4	G2	6 x 5 /4.2	L,MCB	Balloon+Coiling	Hepatic, HTN	Grade A	Grade A	Grade 1	Grade 1
3/61/ F	5	G3	5 x 3 /2	R,M1	S. Coiling	N	Grade A	Grade A	Grade 1	Grade 1
4/38/ M	4	G2	5 x 2 /4.4	R,MCB	S. Coiling	D.M, HTN	Grade A	*	Grade 2	*
5/28/ M	4	G3	7 x 5 /4.4	L,MCB	Balloon+Coiling	HTN	Grade A	Grade A	Grade 1	GR
6/60/ M	4	G2	10 x 5 /4.5	L,M1	Balloon+Coiling	Hepatic, HTN	Grade B	Grade A	Grade 1	Grade 1
7/61/ M	3	G3	3 x 2 /2	L,MCB	S. Coiling	Hepatic, HTN, D.M	Grade A	Grade A	Grade 1	Grade 1
8/62/ F	3	G2	5 x 5 /4.4	R,MCB	S. Coiling	HTN	Grade A	Grade A	Grade 1	Grade 1
9/47/ M	4	G3	14 x 5 /4	R,M1	Balloon+Coiling	N	Grade B	Grade C	Grade 2	Grade 2
10/51/ F	4	G2	6x 3 /2	R,MCB	S. Coiling	Hepatic, HTN	Grade A	Grade A	Grade 1	Grade 1
11/39/ M	5	G2	5 x 3 /1.6	R,MCB	S. Coiling	HTN	Grade A	Grade A	Grade 1	Grade 1
12/59/ M	3	G3	11 x 5 /5.2	R,M1	Stent+coiling	Renal, HTN	Grade B	Grade A	Grade 1	Grade 1
13/46/F	4	G2	4 x 3 /2.1	L,MCB	S. Coiling	HTN	Grade A	Grade A	Grade 1	Grade 1
14/58/ M	3	G3	3 x1.6 /1.1	R,MCB	S. Coiling	Hepatic, HTN	Grade A	*	Grade 2	*
15/29/ M	2	G2	6 x 3.5 /4.3	L,M1	Balloon+Coiling	N	Grade A	Grade A	Grade 1	Grade 1
16/50/ F	5	G2	9 x 4 /4.6	R,MCB	Double micro cath	Hepatic, HTN, D.M	Grade B	Grade B	Grade 1	Grade 1
17/34/ M	1	G2	5 x 2.7 /2	L,MCB	S. Coiling	N	Grade A	Grade A	Grade 2	Grade 1
18/38/ M	4	G3	2 x 1.4 /1	R,MCB	S. Coiling	HTN	Grade A	Grade A	Grade 1	Grade 1
19/47/ M	2	G2	4 x 1.8 /1.2	R,M1	S. Coiling	HTN	Grade A	Grade A	Grade 1	Grade 1
20/54/ F	4	G3	6 x 3 /4	L,MCB	Balloon+Coiling	N	Grade A	Grade A	Grade 2	Grade 1
21/56/ M	3	G2	13 x 4.8 /5.5	L,M1	Stent+coiling	Hepatic, HTN	Grade A	Grade A	Grade 2	Grade 1
22/27/ M	4	G2	3x 2 /1.4	R,MCB	S. Coiling	Auto	Grade A	*	Grade 2	*
23/57/ F	2	G3	4 x 3 /1.5	L,MCB	S. Coiling	N	Grade A	Grade A	Grade 1	Grade 1
24/55/ M	4	G2	6 x 4 /1.3	R,M1	S. Coiling	Renal, HTN	Grade A	Grade A	Grade 1	Grade 1
25/61/ M	3	G3	2 x 2 /1	R,MCB	S. Coiling	Hepatic, HTN	Grade A	D	Grade 2	D

M= Male F= Female R= Right L= Left S. Coiling= Simple Coiling

HTN= Hypertension Auto= Autoimmune disease D.M= Diabetic

MCB= Middle Cerebral artery Bifurcation *= Lost in Follow Up D= Died N=Nothing Detected

Table 7.Patients Treated by Clipping

Patient No./Age /sex	H&H	Fisher grade	Size (mm)/ Aneurysm neck mm	MCA Location	Clipping approach	Co-morbidities	Occlusion Rate after Clipping	Occlusion Rate after 6 mo	GOS at 30 d	GOS at 6 mo
1/53/ F	1	G2	8 x 4.5 /3	R,M1	S. clipp	Cardiac, HTN, D.M	Grade A	Grade A	Grade 2	Grade 1
2/41/ M	4	G4	20 x 7 /4.2	L, MCB	Double clipp	N	Grade B	Grade A	Grade 3	Grade 1
3/27/ F	1	G4	2 x 1 /1	L, M1	Bipolar coagulation	D.M	Grade A	*	Grade 1	*
4/49/ M	2	G3	10 x 5 /2.7	R, MCB	S. clipp	HTN	Grade A	Grade A	Grade 2	Grade 2
5/33/ M	3	G4	6 x 4.2 /3	R,M1	S. clipp	HTN	Grade A	Grade A	Grade 1	Grade 1
6/57/ M	2	G4	17 x 8 /4.1	L, MCB	Double clipp	N	Grade A	Grade A	Grade 3	D
7/46/ F	1	G2	11 x 5 /2.8	R, Distal	S. clipp	HTN	Grade A	Grade A	Grade 1	Grade 1
8/36/ M	2	G4	5 x 3 /2.6	R, MCB	S. clipp	HTN, D.M	Grade A	Grade A	Grade 2	Grade 1
9/48/ M	4	G4	19 x 7.5/5	L, MCB	Double clipp	HTN	Grade A	Grade A	Grade 1	Grade 1
10/27/ M	1	G4	7 x 5 /2.5	R,M1	S. clipp	HTN	Grade A	Grade A	Grade 1	Grade 1
11/59/ F	2	G3	15 x 6 /4	R, MCB	S. clipp	N	Grade A	Grade A	Grade 1	Grade 1
12/42/ M	3	G4	7 x 5 /3	R, Distal	S. clipp	Renal, HTN	Grade A	Grade A	Grade 1	Grade 1
13/49/ F	2	G4	3 x 2 /2	R, MCB	S. clipp	HTN	Grade A	*	Grade 1	*
14/44/ M	4	G4	18 x 8.5 /4.7	L, Distal	Double clipp	D.M	Grade B	Grade A	Grade 1	Grade 1
15/42/ M	1	G3	9 x 6 /3.5	L, MCB	S. clipp	N	Grade A	Grade A	Grade 2	Grade 2
16/57/ M	1	G2	10 x 4 /4.3	L, M1	S. clipp	HTN	Grade A	Grade A	Grade 1	Grade 1
17/59/ F	2	G4	4 x 3 /2.5	R, MCB	S. clipp	D.M, HTN	Grade A	Grade A	Grade 3	D
18/45/ M	3	G4	7 x 3 /3	R, Distal	S. clipp	HTN	Grade A	Grade A	Grade 1	Grade 1
19/56/ M	1	G4	13 x 8 /4.6	L, MCB	S. clipp	N	Grade A	Grade A	Grade 2	Grade 2
20/62/ F	2	G3	5 x 3 /2	L, Distal	S. clipp	Hepatic, HTN	Grade A	*	Grade 1	*
21/49/ M	4	G4	17 x 9 /4.4	R,M1	Double clipp	Cardiac, HTN	Grade A	Grade A	Grade 1	Grade 1
22/44/ M	1	G2	11 x 4 /3.5	L, MCB	S. clipp	D.M	Grade A	Grade A	Grade 3	Grade 1
23/61/ F	2	G4	6 x 3.7/3.2	L, M1	S. clipp	HTN, D.M	Grade A	Grade A	Grade 1	Grade 1
24/48/ M	1	G4	13 x 5.2 /3.7	R, MCB	S. clipp	HTN, D.M	Grade A	Grade A	Grade 2	Grade 1
25/55/ M	5	G4	20 x 9.3 /5.4	L, MCB	Double clipp	N	Grade B	Grade A	Grade 1	Grade 1
26/38/ M	2	G3	7 x 5 /4	R,M1	S. clipp	HTN, D.M	Grade A	Grade A	Grade 1	Grade 1
27/45/ M	4	G4	22 x 11.5/5.8	R, MCB	Double clipp	HTN, D.M	Grade B	Grade A	Grade 3	D
28/53/ F	2	G4	12 x 7 /4.6	R, Distal	S. clipp	N	Grade A	Grade A	Grade 1	Grade 1
29/4/ M	1	G2	5 x 3 /2.5	L, Distal	S. clipp	HTN	Grade A	*	Grade 1	*
30/62/ M	1	G4	15 x 7 /4.2	L, MCB	S. clipp	D.M, HTN	Grade A	Grade A	Grade 1	Grade 1
31/57/ M	3	G4	4 x 4 /3	R,M1	S. clipp	HTN	Grade A	*	Grade 1	*
32/45/ F	4	G4	16 x 6.8 /4.8	R, MCB	Double clipp	N	Grade B	Grade A	Grade 2	Grade 2
33/62/ M	2	G3	12 x 7/4.3	R, Distal	S. clipp	HTN, D.M	Grade A	Grade A	Grade 1	Grade 1

S. clip= Single Clipping

Figure 1. Procedures done for the study groups

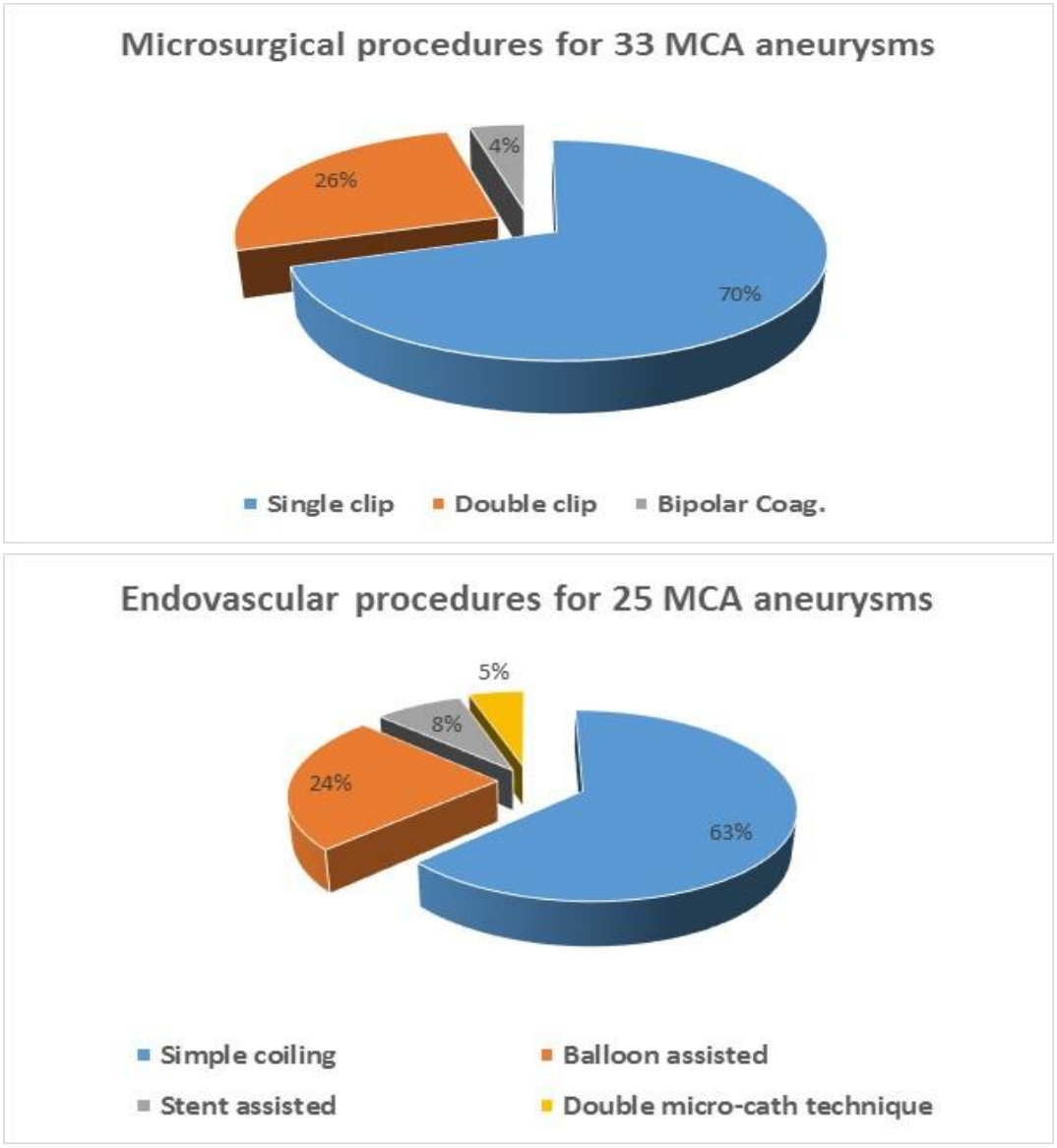
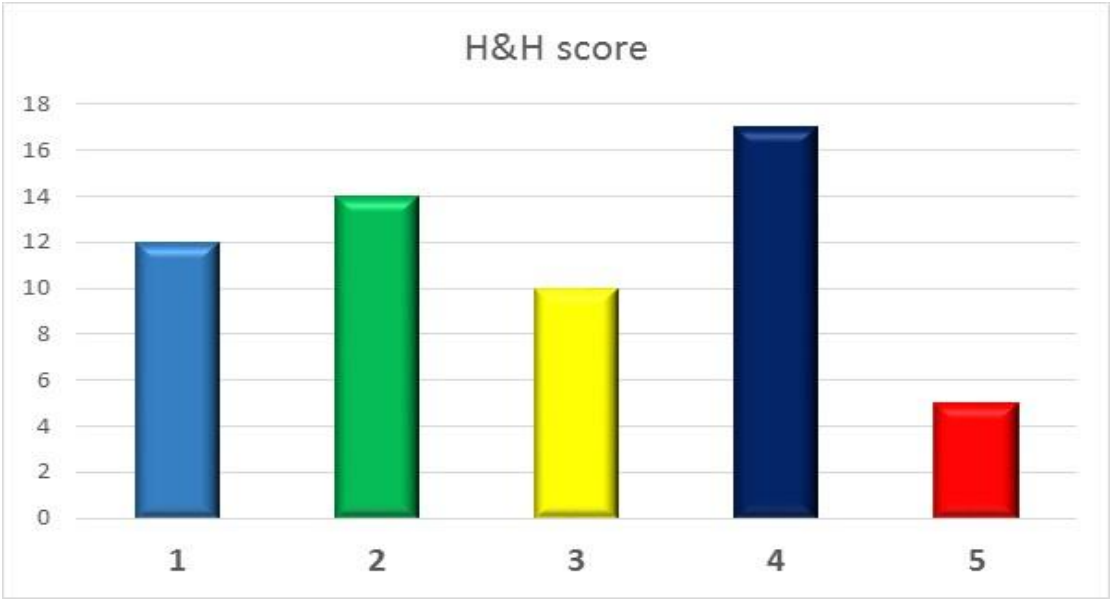


Figure 2. The H&H score



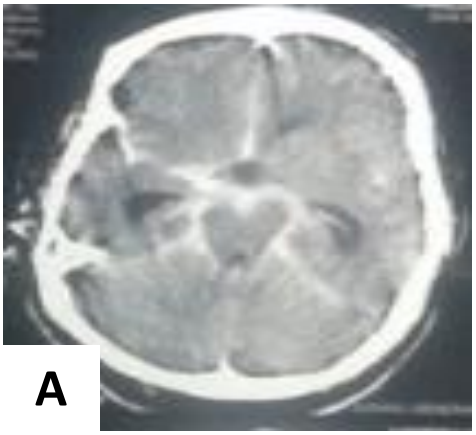
Case samples

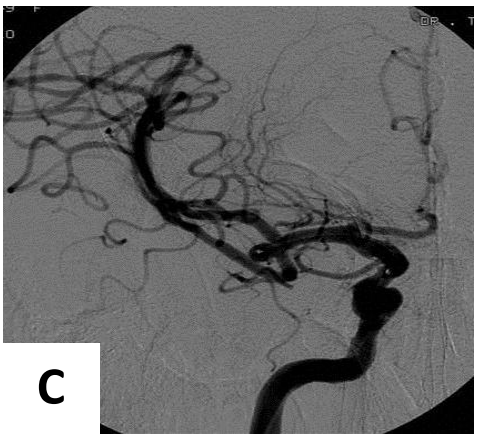
Case 1

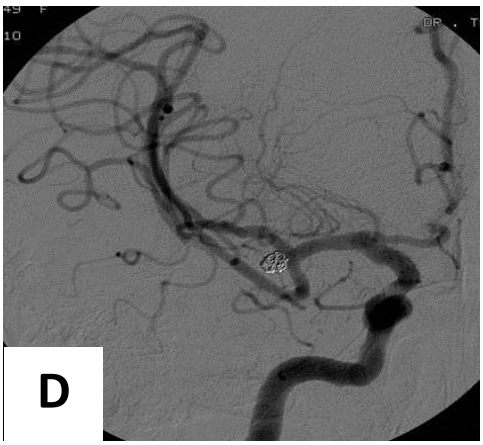
Clinical data: A 56 years old female, (hypertensive) presented with severe headache, and nuchal rigidity (H&H grade 4). Cerebral angiography showed a small MCA bifurcation aneurysm on the right side. Transfemoral catheter angiography and stand alone coiling was done.

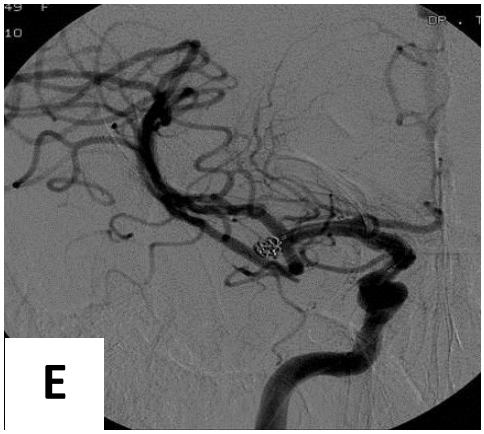
Photo plate 2

A. Pre-operative axial CT showing SAH.
B. 3D reconstruction CTA showing right small MCA bifurcation aneurysm (white arrow)
C. DSA (A-P view) of right ICA showing small MCA bifurcation aneurysm.
D. DSA (Towne view) of right ICA during coiling procedure
E. DSA (Towne view) of right ICA at the end of coiling procedure showing complete occlusion of the aneurysm and the coil mass.







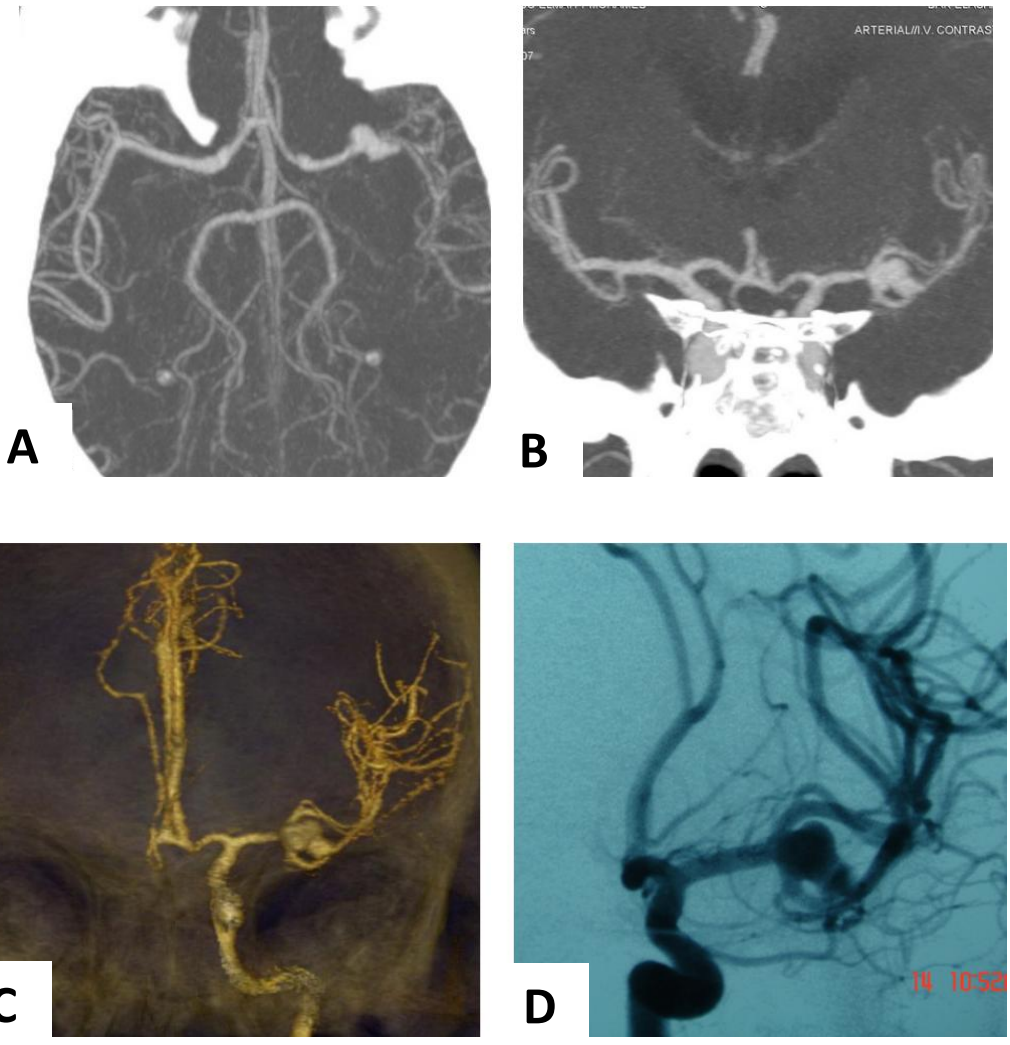


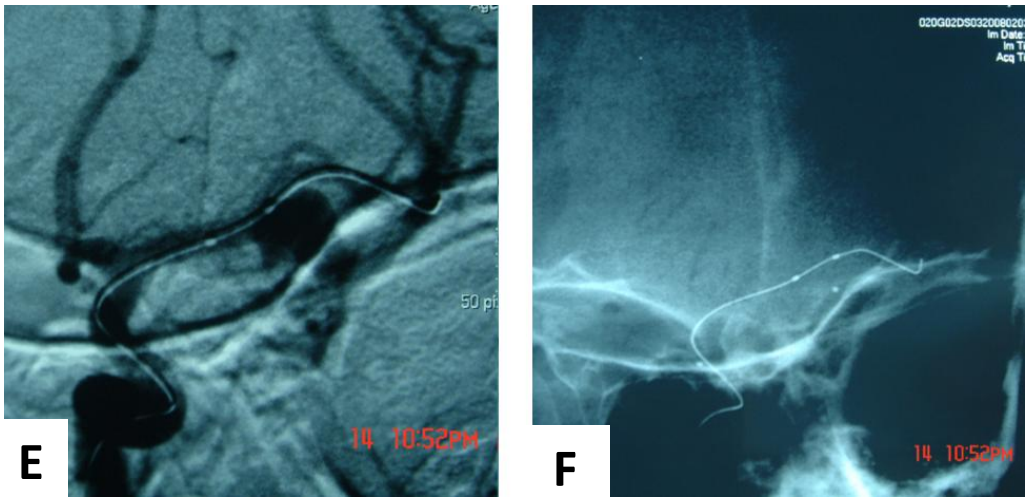
Case 2

Clinical data: A 46 years old man (hypertensive, smoker) presented with severe headache, six nerve palsy and nuchal rigidity (H&H grade 2). Cerebral angiography showed an irregular MCA bifurcation aneurysm on the left side. Transfemoral catheter angiography and coiling was done with the help of balloon remodeling technique.

Photo plate 2

A. Pre-operative axial CTA showing an irregular MCA bifurcation aneurysm on the left side.
B. Pre-operative coronal CTA showing an irregular MCA bifurcation aneurysm on the left side.
C. 3D reconstruction CTA showing an irregular MCA bifurcation aneurysm on the left side.
D. DSA (Towne view) of left ICA showing an irregular MCA bifurcation aneurysm.
E. DSA (Towne view) of left ICA during coiling procedure showing the balloon wire across the aneurysm neck.
F. Non-subtracted X ray (Towne view) during coiling procedure showing the tip of microcatheter inside the aneurysm and the balloon wire across the aneurysm neck.
G. Non-subtracted X ray (Towne view) during coiling procedure showing the balloon wire across the aneurysm neck and coils inside the aneurysm.
H. DSA (Towne view) of left ICA at the end of coiling procedure showing non-filling of the aneurysm and the coil mass.





Case 3

Clinical data: A 56 years old man (smoker) presented with severe headache, disturbed consciousness and mild hemiparesis on the right side (H&H grade3).CT brain showed SAH (Fisher grade 3). Cerebral CTA showed a ruptured left proximal MCA aneurysm. Transfemoral catheterization and microcatheter navigation was done. Stent assisted coiling as performed with complete filling of the aneurysm.

Photo plate 3

A. Axial CT brain showing diffuse SAH with maximal thickness in the left sylvian fssure.

B. Coronal CT brain showing diffuse SAH with maximal thickness in the left sylvian fssure and mild ventricular dilatation.

C. Preoperative axial CTA showing a broad base aneurysm arising from proximal MCA on the left side.

D. Preoperative coronal CTA showing a broad base aneurysm arising from proximal MCA on the left side.

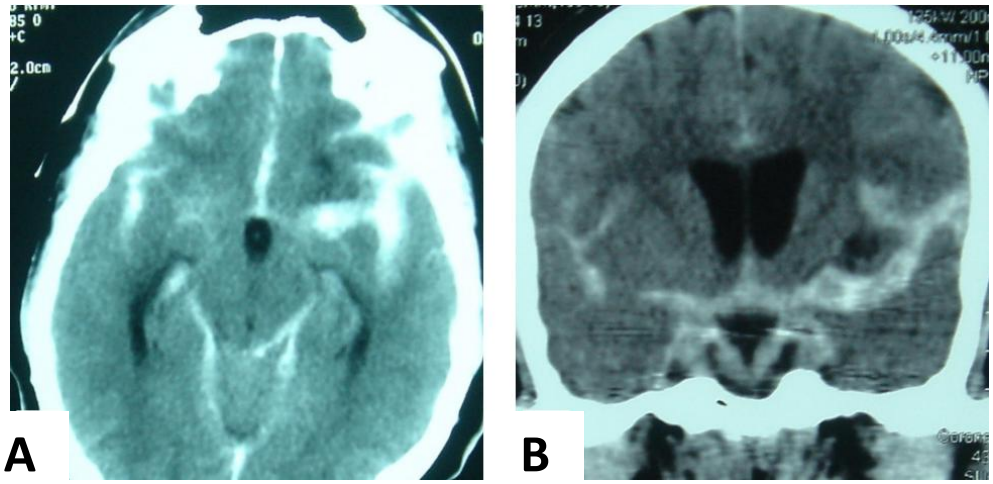
E. Preoperative sagittal CTA showing a broad base aneurysm arising from proximal MCA on the left side.

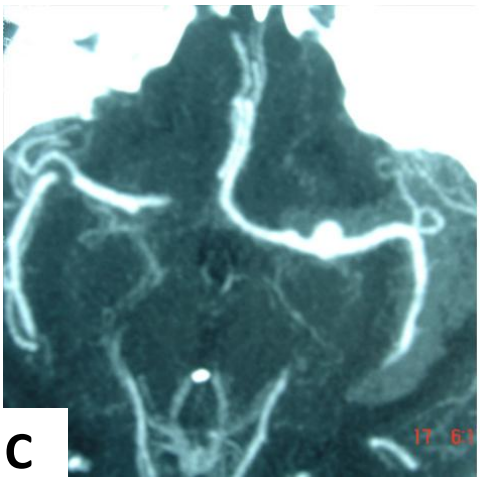
F. 3D CTA showing the aneurysm arising from proximal MCA on the left side.

G. Non-subtracted X ray (oblique view) during coiling procedure showing the stent across the aneurysm neck and microcatheter tip inside the aneurysm.

H. Non-subtracted X ray (oblique view) during coiling procedure showing the stent across the aneurysm neck and the first coil is reaching the aneurysm inside the microcatheter.

I. Non-subtracted X ray (oblique view) at the end of coiling procedure showing non-filling of the aneurysm and patency of the MCA.





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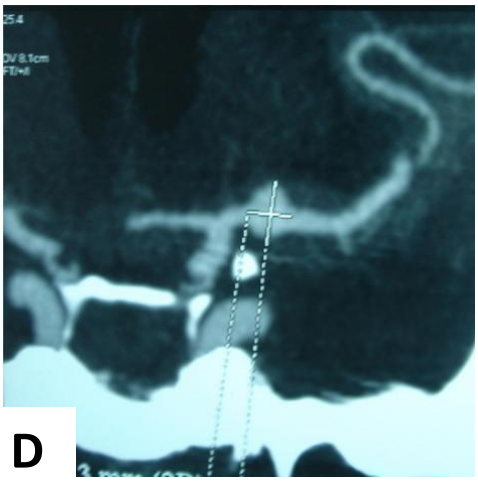

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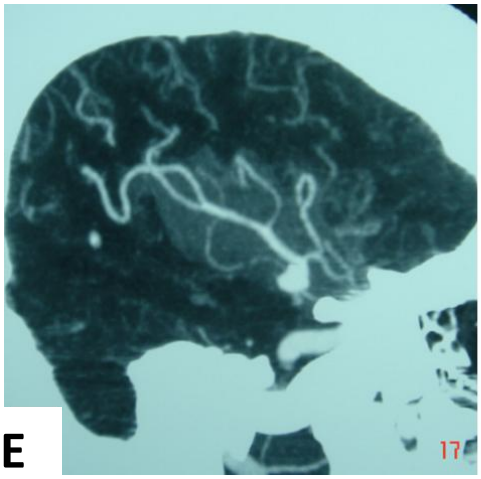

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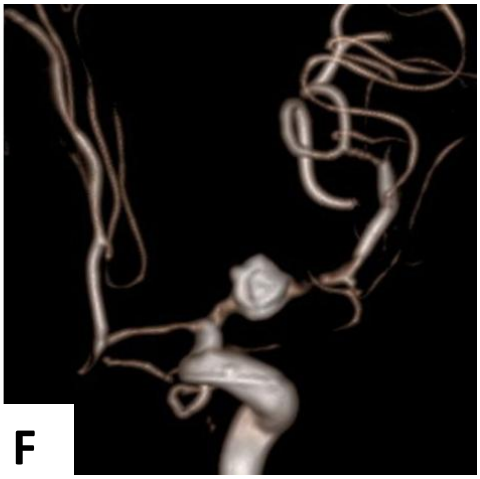

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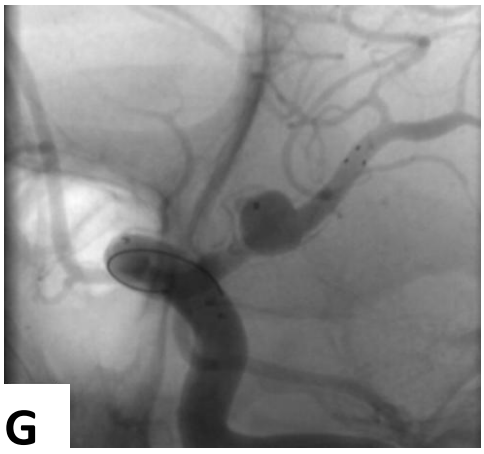

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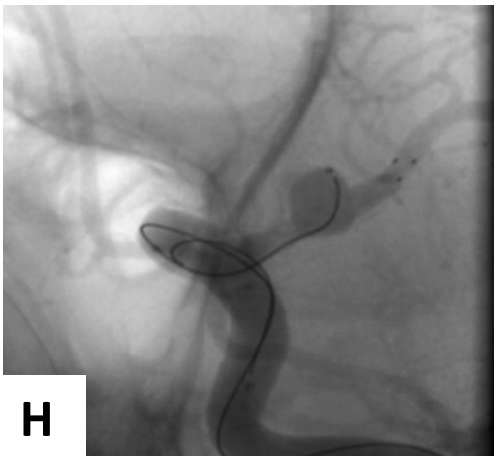

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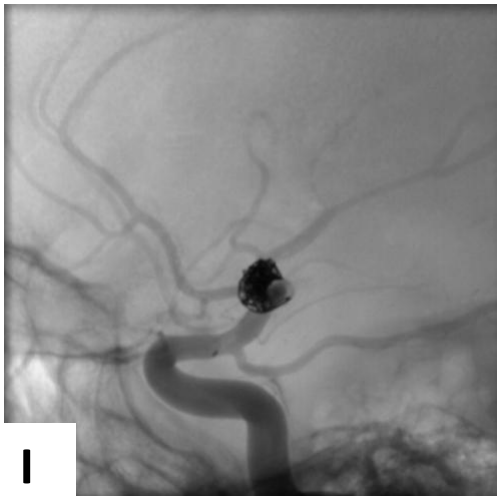


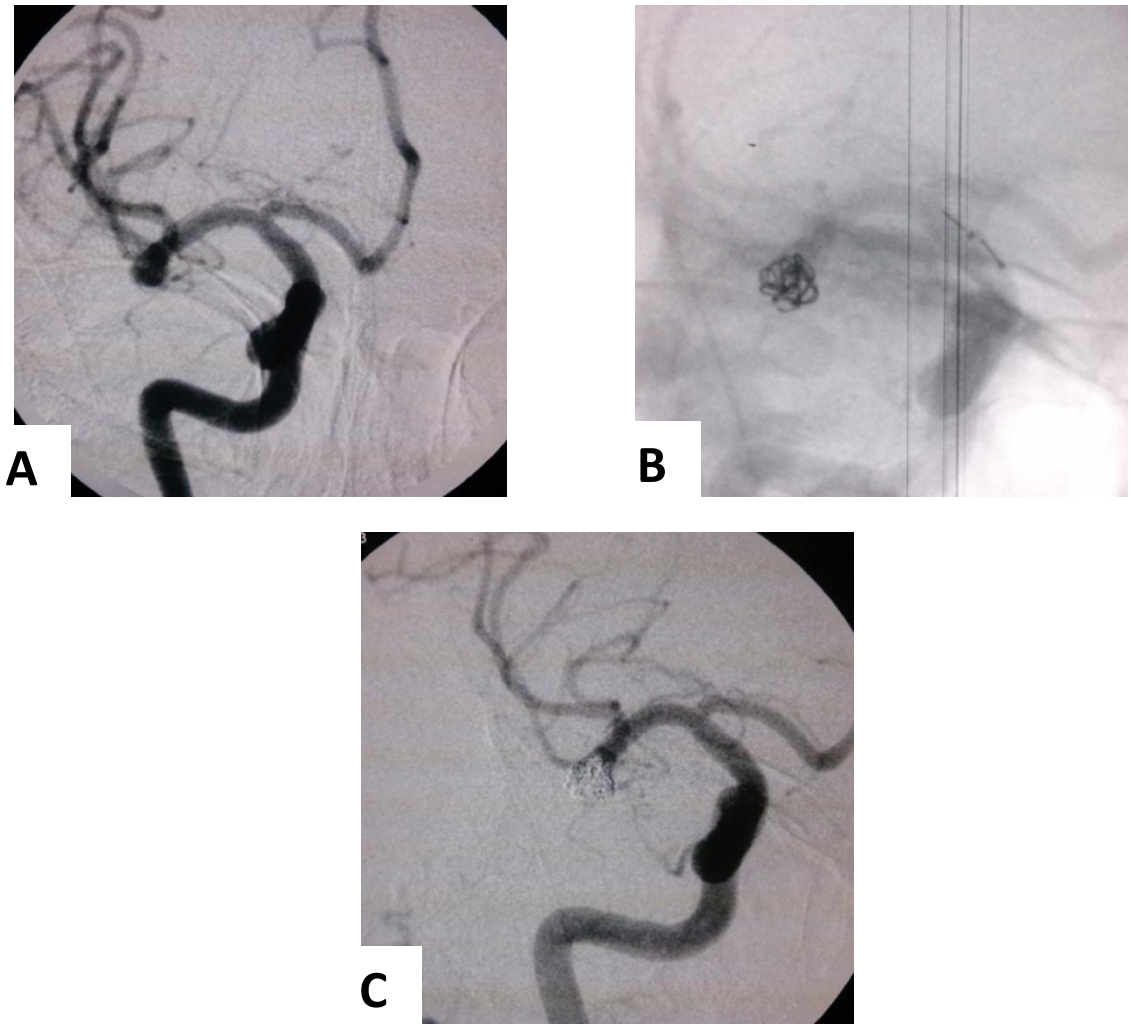
I

Case 4

Clinical data: A 50 years old woman (hypertensive). Presented with repeated attacks of tinnitus superimposed on chronic headache. Cerebral CTA showed an incidental non-ruptured MCA bifurcation aneurysm on the right side. Transfemoral catheterization and double microcather navigation was done to reach the aneurysm. Coiling of the aneurysm was performed using double micro-catheters technique.

Photo plate 4

A. DSA (oblique view) of the right ICA showing an MCA bifurcation aneurysm.
B. Non-subtracted X ray (Towne view) showing the micro-catheters inside the right MCA and coils inside the aneurysm.
C. DSA (oblique view) of the right ICA at the end of coiling procedure showing non-filling of the aneurysm and patency of MCA branches.



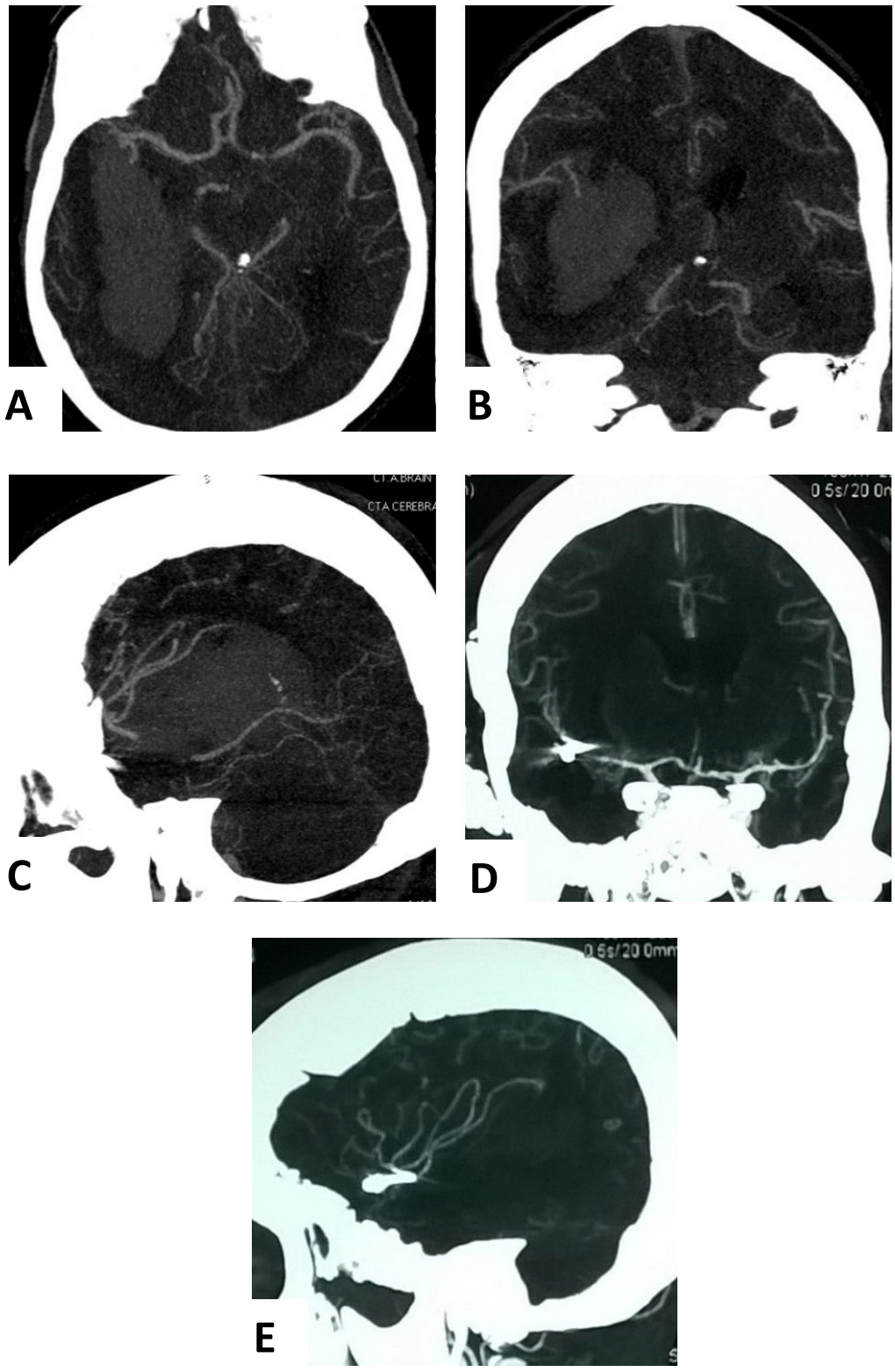
Case 5

Clinical data: A 45 years old woman (with uncontrolled hypertension) presented with disturbed consciousness and left hemiplegia (H&H grade 4). CT brain a large temporal ICH (Fisher grade 4). Cerebral CTA showed a ruptured Rt. MCA bifurcation aneurysm. The aneurysm was clipped and the ICH was evacuated through an extended right lateral supraorbital approach.

Photo plate 5

A. Pre-operative axial CTA showing a ruptured MCA bifurcation small aneurysm with accompanying temporal ICH.

B. Pre-operative coronal CTA showing the temporal ICH.
C. Pre-operative sagittal CTA showing a ruptured MCA bifurcation small aneurysm with accompanying temporal ICH.
D. Post-operative coronal CTA showing adequate clipping of the aneurysms and evacuation of the ICH.
E. Post-operative sagittal CTA showing adequate clipping of the aneurysms and evacuation of the ICH.



Discussion

MCA aneurysms are often wide necked and mostly incorporate the origin of arterial branches in the aneurysm base. Thus, in many institutions, the primary treatment technique for this location is surgical clipping (5).

Review of the literature revealed that surprisingly few data are available on the endovascular management of ruptured MCA aneurysms. Regli et al in a consecutive study of 40 ruptured MCA aneurysms for which endovascular therapy was considered suitable with simple coiling, only 6% could be successfully occluded and in 62% anatomic contraindications for simple coil emboilization was noticed. In 32%, the attempt at GDC treatment failed because factors such as arterial branch origin from the aneurysm neck or an unfavorable dome-to-neck ratio, were found. Thus the authors generally recommend not to attempt coil emboilization in MCA ruptured or even unruptured aneurysms or to be much more restrictive in the choice of endovascular therapy for this location (5, 6). On the other hand, Doerfler et al in consecutive series of 38 MCA ruptured aneurysms selected for endovascular treatment, coil emboilization was feasible in 81.5% of patients with a complete occlusion rate of 86.8% at last follow up that extend to one to two years (7). The study done by Iijima et al, upon 72 ruptured MCA aneurysms revealed that the treatment-related mortality rate was 6% (four of 72 aneurysms); the treatment-induced permanent thromboembolic events occurred in 20 patients (27.8%) and aneurysm perforation occurred in seven patients (9.7%). They also reported that recurrences were found in 21(29.2%), A second treatment was required for 12 aneurysms, and a third treatment was required for one (8).

In our consecutive series of 25 ruptured MCA aneurysms selected for endovascular treatment, coil emboilization was feasible in all cases and evaluation of primary occlusion rate (84%) was done immediately after emboilization and re-evaluated in 21 MCA aneurysms after 6 months (89%). In this circumstance, we have to object that the data of our study do not reflect long-term results; however, the 6 months follow-up demonstrated total aneurysm occlusion in 19 patients (90.4%).

We observed a very slight opacification of the base in one patient (4%) with evidence for coil compaction. We decided not to retreat the aneurysm, and prefer to follow, and patient clinically good but further follow-up for another 6 months was recommended, but patient refused, otherwise no history of recurrence or even additional interventions.

Not only ruptured MCA aneurysms is a challenging project to treat endovascularly, but also SACT, and BRT adding a marvelous risk in this field which delineated In a review article, Shapiro et al. (9), and a relatively more recent study done by Nishido et al. (10) which reported ischemic complication rates of around 10%, and 7% respectively and hemorrhagic complications of 2.2, and 2.3% respectively with an overall mortality rate of 1% and 2.7%. respectively. In our case series we didn't catch neither ischemic complication, nor hemorrhagic complication, and the mortality rate that occurred in one patient only 4% mostly due to medical comorbidities, and not referred to our intervention.

In surgically clipped group, the primary occlusion rate was nearly 88.2% and 94.8% after 6 month follow up. Subtotal occlusion or residual neck was found in one MCA bifurcation case (4.1%), with stable follow up. Recanalization with residual aneurysm occurred in one MCA bifurcation aneurysm case also (4.1%) which needs no further treatment. We could explain that by, when it is difficult to keep both M2 trunks patent without compromise while trying to totally occlude the aneurysm neck, it is advisable to leave some neck unclipped to avoid narrowing or occluding any of the M2 trunks. The neck remnant can then be secured with another clip, bipolar coagulation or just wrapping with a piece of gauze.

Few reports focused upon the surgical management outcome of a common aneurysm site such as the MCA. In a series of 413 patients with MCA aneurysms reported by Suzuki et al, 94% of the patients were in good or excellent condition 6 months after surgery. Half of these patients had unruptured aneurysms and good H&H grades (11). In contrast, in a large series of 561 patients with MCA aneurysms, Rinne et al reported surprisingly poor management outcomes at the 12-month follow-up for 32% (12).

In our study, most of selected patients had a poor H&H grade (84%) among coiling group, with good Fisher grade, the original GOS was moderate disability (MD) in 32%, which improved to 4.7% in 6 month follow up as we lost 3 patients (12%). One patient died due to hepatic coma, but good recovery (GR) was 68%, and 95.2% in original, and 6 month follow up respectively. In clipping group, although most of the patients had a good H&H grade (66%) and poor Fisher grade (85%) but we could obtain GR in 63.3%, and 60.6% in original and 6 months follow up; respectively, also our results showed improvement of MD from 7 case to 4 cases in original, and 6 month follow up respectively. Out of 5 cases revealed sever disability (SD) originally, 3 cases died which mostly due to medical causes
, and 2 cases revealed GR

Although good selection criteria in both groups, meticulous, wise interventions and carful dealing with vasospasm improved our results, but also we considered some sort of bias in our study as regards H&H grade because most of poor H&H grade directed toward the endovascular approach which can be explained through not preferring to add more surgical risk for a patient with poor H&H grade.

Our results in both group strongly support the major role of medical comorbidities, and risk factors as prognostic factors, which also approved by previous reporters(9,11).

The meta-analysis of King et al that included 733 patients reporting a procedural morbidity of 4% in clipped unruptured aneurysm. Neurosurgical clipping is still an important therapy for MCA aneurysms, especially for aneurysms with very wide necks or complicated geometry such as MCA aneurysms. Of course, in the case of a space-occupying hematoma, which is present in 35%of ruptured MCA aneurysms, immediate evacuation of the hematoma is mandatory, usually in combination with clipping of the aneurysm (13), which were highly approved in our case series.

Appropriate patient selection, Careful evaluation of the angioarchitecture by using rotational 3Dangiography, or 3D helical CT angiography, and wise assisted techniques selection (SACT, and/or BRT) are considered the corner stone to address the ideal treatment plane or algorithm (1,3).

Limitation of our study:

Being a retrospective study, small number of patients in both study groups, and short term follow up were considered.

Conclusion:

At the present time the treatment of ruptured MCA aneurysms remains controversial.

Clipping is still a cost effective treatment in ruptured MCA aneurysms especially in wide neck type or complex aneurysms.

Coiling is a safe and effective treatment modality especially with advances of assisted coiling techniques and nearly equals the results of surgical clipping especially in patients with medical comorbidities.

Neither clip first policy, nor coil first policy should be followed blindly, but we appreciate individualization case by case.

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الملخص العربي

فعالية وسلامة استخدام القطرة المخية مقابل الكليبسات الجراحية المخية في علاج التمددات الشريانية المنفجرة من الشريان الدماغي الأوسط: دراسة استعادية مزدوجة المركز

خلفية :

تشكل التمددات الشريانية للشريان الدماغي الأوسط ما نسبته 22٪ من إجمالي حالات تمدد الأوعية الدموية داخل الجمجمة. وتعد التمددات الشريانية للشريان الدماغي الأوسط هي الأكثر شيوعا بين التمددات الدماغية الشريانية غير المنفجرة. ويرتبط انفجار تمدد الأوعية الدموية للشريان الدماغي الأوسط عادة بوجود تجمع دموي داخل المخ. وعودة النزف لمثل هذه الحالات يمثل اعتلالاً كارثياً تصل إلى 78٪ من إجمالي الحالات .

الهدف من الدراسة :

دراسة فعالية وسلامة علاج التمددات الشريانية المنفجرة بالشريان الدماغي الأوسط والمقارنة بين خيارين: استخدام القسطرة المخية أو الكليبسات الجراحية المخية.

المرضى والطرق :

تمت هذه الدراسة بأثر رجعي على قاعدة بيانات مزدوجة المركز على 104 من حالات تمدد الأوعية الدموية المنفجرة بالشريان الدماغي الأوسط في قسم جراحة المخ والأعصاب في مستشفى جامعة سوهاج وقسم جراحة الأعصاب في مستشفى جامعة الإسكندرية خلال الفترة من يناير 2012 وحتى ديسمبر عام 2015. ما مجموعه 58 مريضا يعانون من 58 تمدد منفجر بالشريان الدماغي الأوسط تم إدخالهم في الدراسة. وقد أجريت عملية الكليبسات الجراحية الدماغية في 33 مريضا وأجريت لقسطرة المخية في 25 مريضا.

النتائج :

من بين 25 مريضا عولجوا بالقسطرة المخية، نجحت القسطرة وحدها في ستة عشر مريضا (64٪)، بينما احتاج ستة مرضى (24٪) لتقنية البالونات المخية الدقيقة غير القابلة للفصل، وحالتين (8٪) تم علاجها بالدعامات المخية الدقيقة، بينما عولج مريض واحد فقط (4٪) بالقسطرة المخية المزدوجة .

في حالات الكليبسات الجراحية تم استخدام ثلاثة طرق وفقا لمكان التمددات. تم استخدام النهج الداني في حالات تمدد الأوعية الدموية للتفريعه الاولى، في حين أن نهج القاصي استخدم في حالات التمددات المتفرعة، بينما استخدمت تقنية اللفيف الصدغي العلوي في حالات تمدد الأوعية الدموية القاصية .

الخلاصة :

لا يزال العلاج باستخدام الكليبسات الجراحية المخية لا تزال فعالة من حيث التكلفة في علاج تمدد الأوعية الدموية للشريان الدماغي الأوسط وخاصة في الأنواع ذات الرقبة الواسعة. ومع ذلك فإن تقنية القسطرة المخية هي طريقة آمنة وفعالة وتقريبا مساوية لنتائج الكليبسات الجراحية وخاصة في المرضى الذين يعانون من أمراض مصاحبة.