

Management of Complex Middle Cerebral Artery Aneurysms: the Pivotal Role of Cerebrovascular Bypass Surgery

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Introduction

Complex aneurysms have angiographic or anatomic features that preclude microsurgical or endovascular reconstruction:

- . large or giant size (> 10 mm),
- . wide neck (> 4 mm) or low dome/neck ratio (< 2),
- . intraluminal thrombus,
- . calcified or atherosclerotic neck,
- . arterial branches or perforators (e.g. lenticulostrates) originating from aneurysm,
- . recurrent lesions (previously coiled or clipped),
- . non-saccular morphology: fusiform, dolichoectatic, serpentine, dissecting, blister, mycotic, etc.

1-2% of MCA aneurysms are complex, necessitating a deconstructive strategy, hence the need for surgical revascularization to replace blood flow in the MCA territory.

Methods

All consecutive patients with complex MCA aneurysms, who underwent microsurgical or endovascular deconstruction between 2004 and 2017, were included.

Charts were retrospectively reviewed. Demographic, clinical, imaging, operative, and outcome data were recorded.

Results

Table 1

Patient and Aneurysm Characteristics (N=22)					
Sex	Female	13 (59.1%)	Morphology		
	Male	9 (40.9%)			
Age (years)	Mean	51	Rupture Status		
	Range	16-72			
			Unruptured	19 (86.4%)	
Location	M1	6 (27.3%)	Ruptured	3 (13.6%)	
	MCA bifurcation	9 (40.9%)	Size (mm)		
	M2	6 (27.3%)		Mean	19
	M3	1 (4.5%)		Range	5-60
Side	Left	13 (59.1%)			
	Right	9 (40.9%)			

Patient and Aneurysm Characteristics (N=22)

Table 2

Surgical Techniques (N=22)				
Flow Replacement	In Situ MCA-MCA Bypass	8 (36.4%)	Aneurysm Deconstruction	
	without STA-MCA	5 (22.7%)		
	with STA-MCA	3 (13.6%)		
	STA-MCA Bypass	7 (31.8%)		
IMaxA-MCA Bypass	5 (22.7%)		Microsurgery clips	13 (59.1%)
Vessel Reimplantation	2 (9.1%)		Endovascular coils, n-BCA, Onyx	5 (22.7%)
			Combined	4 (18.2%)

Surgical Techniques (N=22)

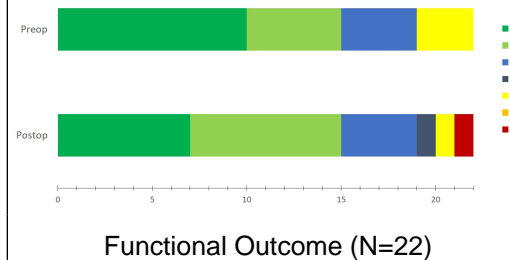
Table 3

Technical Outcomes, Angiographic Outcomes, and Complications (N=22)				
Bypass	Successful	21 (95.5%)	Complications	
	Unsuccessful	1 (4.5%)		
Aneurysm Obliteration	Complete	20 (90.9%)	Transient/Minor	11 (50%)
	Small Remnant	2 (9.1%)	transient neurologic deficit	4 (18.2%)
			small perianeurysmal infarct	3 (13.6%)
Angiographic Follow-up (21 Survivors) mean 17 months, range: 1-97 months	Patent Bypass	21 (100%)	cerebral edema (requiring craniectomy)**	3 (13.6%)
	Delayed Bypass Occlusion	0 (0%)	epidural hematoma (requiring evacuation)	1 (4.5%)
	Stable Aneurysm	20 (95.2%)	Permanent Morbidity	0 (0%)
	Occlusion	2 (9.5%)	Death	1 (4.5%)
Aneurysm Recurrence*	1 (4.8%)	hemorrhagic venous infarction	1 (4.5%)	

Technical Outcomes, Angiographic Outcomes, and Complications (N=22)

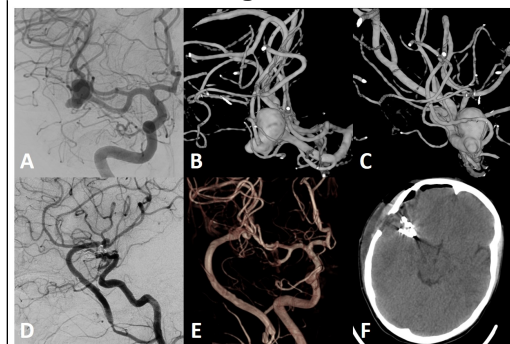
Figure 1

mRS at last follow-up
mean follow-up: 17 months (range: 1-97)



Functional Outcome (N=22)

Figure 2



Illustrative case: 17-year old girl with new-onset seizures. A-C, Cerebral DSA: Large complex MCA (M2-M3) aneurysm incorporating an M3 branch. Patient underwent IMaxA-MCA bypass using saphenous vein graft, then clip trapping of aneurysm. D and E, Postop DSA: complete aneurysm obliteration, patent IMaxA-MCA bypass. F, Postop head CT. The patient had an uneventful postoperative course with mRS 0 at 6 months.

Conclusions

Microsurgery remains the best treatment option for complex MCA aneurysms. Despite significant postoperative rates of transient morbidity and/or minor complications, permanent morbidity and mortality in experienced hands are rare and long-term outcomes are generally favorable. Cerebrovascular bypass skills are thus an absolute prerequisite for any neurosurgeon willing to tackle those challenging lesions.

Massive cerebral edema remains a significant concern with large and giant MCA aneurysms, especially after endovascular deconstruction. A low threshold for prophylactic craniectomy (i.e. not replacing the bone flap) at the time of initial surgery must be maintained with such lesions.

References

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2. Tayebi Meybodi A, Huang W, Benet A, Kola O, Lawton MT. Bypass surgery for complex middle cerebral artery aneurysms: an algorithmic approach to revascularization. J Neurosurg 2017;127:463-79.