Thromboembolism during coil embolization of ruptured and unruptured cerebral aneurysm

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Introduction

Although endovascular coiling has been accepted as the first line treatment of ruptured and unruptured cerebral aneurysms, thromboembolism during and after the procedure still remains the most important adverse event. Reported incidence of thromboembolic comlication varies from 4% to 28% of the cases depending on the case selection, definition and the method of detection. However, most of thromboembolic events during the procedure can be successfully managed without clinical consequence, and reported incidence of procedure-related morbidity and mortality due to thromboembolism is 3 to 5 %. We retrospectively analyzed the incidence and the outcome of thromboembolism during and after coil embolization of saccular cerebral aneurysms.

Methods

Since 2005, we treated 91 patients with 96 aneurysms, in whom 103 procedures were performed. 22 patients were male, and 69 patients were female. The median age was 65 years (range 38-88). 49 aneurysms were ruptured, and 47 aneurysms were unruptured. In two patients, coil embolization of a ruptured aneurysm and an unruptured aneurysm was performed simultaneously. Retreatment was performed in 8 patients. An X-ray image intensifier assembly without 3D reconstruction was used in 42 procedures, and an X-ray angiography system that incorporates flat panel detecotrs with 3D reconstruction was used in 61 procedures.

Results

Thromboembolic events occurred in 17 cases (16.5%) during (14) and after (3) the procedures. Ozagrel sodium, a thromboxane A2 synthase inhibitor, was immediately administered in 8 patients, and thrombectomy using Penumbra system® was performed in a patient. Major cerebral artery occlusion was observed in 8 patients, in 5 of whom recanalization could be achieved. 7 patients remained asymptomatic, and 3 patients had transient ischemic symptoms. 2 patients with ruptured aneurysms died due to causes unrelated to thromboembolism. Permanent neurological deficit was observed in 3 patients (2.9%) exclusively in ruptured group, one of whom had unfavorable outcome (mRS>2). 3 patients died due to causes unrelated to thromboembolism. Thus, procedure related morbidity was 1 percent, and procedure-related mortality was zero. In multiple regression analysis, wide neck (>=4mm) was associated with thromboembolic events (p=0.024). In addition, anterior communicatiing aneurysms, and wide neck aneurysms were siginificantly associated with symptomatic thromboembolic events (p=0.036 and 0.023, respectively). The use of x-ray image intensifier assembly without 3D reconstruction was marginally associated with symptomatic thromboembolic events (p=0.053).

Conclusions

Our data showed that the incidence and the outcome of thromboembolism during coil embolization of ruptured and unruptured aneurysm can be acceptable.

Learning Objectives

Immediate administration of ozagrel sodium is an effective option for the management of thromboembolism during the procedures. The use of an X-ray angiography wihtout 3D reconstruction in clinical practice should no longer be allowed in the current management of cerebral aneurysms.

References

1) Molyneux A, Kerr R, Stratton I, et al. International Subarachinoid Aneurysm Trial (ISAT) of neurosurgical clipping versus endovascular coiling in 2143 patients with ruptured intracranial aneurysms: a radomised trial. Lancet 360: 1267-1274, 2002

2) White PM, Lewis SC, Gholkar A, et al. Hydrogel-coated coils versus platinum coils for the endovascular treatment of intracranial aneurysms (HELPS): a randomised controlled trial. Lancet 377: 1655-1622, 2011

3) Lanzino G. The Barrow Ruptured Aneurysm Trial. J Neurosurg 116: 135-144, 2012

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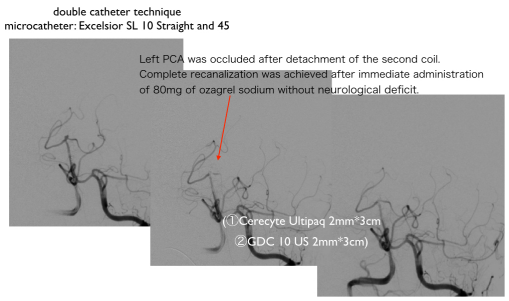
Table 1

#	age	sex	location	size (mm)	neck	unruptured	H&H grade	angio suite	adjunctive technique	time of complication	occluded vessel	symptom	treatment	recanalization	mRS
1	60	female	ICPC	16	wide	ruptured	2	FPD	balloon	intraprocedural	none	asymptomatic	none		1
2	60	female	ICPC	8	wide	ruptured	5	FPD	balloon	intraprocedural	none	asymptomatic	none		6
3	81	female	lopasoli noid	16	wide	ruptured	4	FPD	balloon	intraprocedural	none	asymptomatic	none		3
4	61	female	Balop	3	wide	ruptured	3	FPD	double catheter	intraprocedural	PCA	asymptomatic	ozagrel sodium div+cilostazol if	yes	0
5	69	female	MCA	7	narrow	unruptured	0	II	simple	postprocedural	none	transient amnesia	none		0
6	41	male	Acom	8	wide	ruptured	3	FPD	simple	intraprocedural	ACA	disturbed consciousness	ozagrel sodium div	yes	6
7	80	female	Acom	4	narrow	ruptured	2	FPD	simple	intraprocedural	ACA	coma	none	unknown	6
8	43	female	distal PICA	4	wide	ruptured (retreatment)	2	FPD	simple	intraprocedural	PICA	asymptomatic	none	no	0
9	62	male	Acom	13	wide	ruptured	5	II	simple	intraprocedural	ACA	left hemiparesis	ozagrel sodium div	yes	5
10	72	female	BA-SCA	6.5	narrow	unruptured	0	II	simple	intraprocedural	SCA	asymptomatic	ozagrel sodium(da)	no	0
11	75	female	ICPC	7	wide	ruptured	3	II	simple	postprocedural	none	left hemiparesis	argatroban (div)		2
12	61	female	Acom	4.5	narrow	ruptured	2	II	simple	intraprocedural	none	left hemiparesis	ozagrel sodium div		3
13	66	female	MCA	4	narrow	ruptured	2	II	simple	intraprocedural	MCA(M3)	asymptomatic	ozagrel sodium div	yes	0
14	65	male	VA	9	wide	unruptured	0	II	stent-assisted	postprocedural	none	transient hemiparesis	argatroban (div)		4
15	62	female	BA-SCA	8	wide	ruptured	4	II	simple	intraprocedural	none	hemianopsia	none		1
16	59	female	Ictop	3.5	wide	unruptured	0	II	balloon	intraprocedural	ACA	transient aphasia & hemiparesis	ozagrel(da)+ Penumbra	yes	0
17	59	female	Acom	4	short	ruptured	3	II	simple	intraprocedural	none	asymptomatic	ozagrel sodium div		2

Lists of patients complicated with thromboembolic events

Fig 1. case presentation



61 y.o., female. ruptured BA top aneurysm (2.9mm)

Fig2

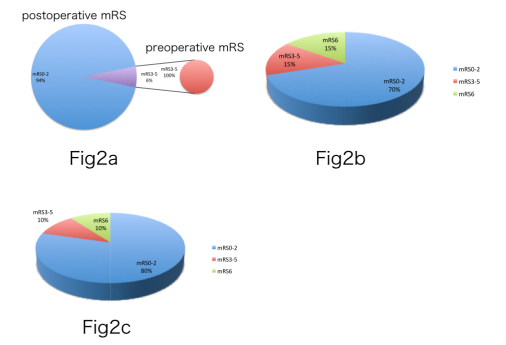


Fig2a Fig2b

Fig2c

No clinical worsening was observed in unruptured group (Fig2a). Clinical outcomes in grade 1-5 SAH group (Fig 2b) and in grade 1-4 SAH group (Fig 2c) were compatible to those of larger prospective studies.