The Embolization of Ruptured Aneurysms in Acute Stage

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Summary

We have treated 93 ruptured aneurysms with Guglielmi Detachable Coils (GDC) in acute period. Seventy-three patients (78%) were independent on discharge. Among the patient of Hunt and Hess Grade I, II and III, 59 patients (88%) were independent. Acute re-rupture occurred in two elderly patients with insufficient embolization and two patients experienced re-rupture in the follow up period. Symptomatic vasospasm was reported in 17.6% of patients. The permanent morbidity rate is 4.4% and one patient died (1.5%). Although the long-term results remain to be determined, embolization with GDC is a safe and promising treatment for acutely ruptured aneurysms.

Introduction

The surgical clipping based on the development of microsurgical technique has long been a gold standard for the treatment of intracranial aneurysms. However, for patients with surgical difficulty due to the location of aneurysms or medical condition, other methods of treat-

ment were reported in the literature including the use of detachable balloons, pushable micro-coils, interlocking detachable coils and liquid embolic agents to occlude intracranial aneurysms with preservation of the parent artery. In 1991, Guglielmi et al developed GDC, which was an epoch-making tool for the treatment of intracranial aneurysms^{1,2}. Since then, a large number of aneurysms have been treated by GDC all over the world. There have been many reports concerning the efficacy of this new technique³⁻⁶. In cases of ruptured aneurysm, the primary object is to prevent the re-rupture. Currently several reports have shown that embolization is more beneficial than surgical clipping in terms of the less invasive approach. In our department, GDC embolization is the first choice treatment for cerebral aneurysms under the following conditions as described in previous report¹¹; the aneurysm is less than 15 mm and larger than 3 mm with clear neck, no intracranial hematoma and no severe atherosclerotic change. Patients who could not satisfy these criteria might be selected for embolization when surgical clipping was

Table 1

Locations of the aneurysms	
Anterior communicating A	33
Internal carotid A	27
(ICPC	21)
Middle cerebral A	13
Basilar tip	7
Distal ACA	6
Vertebral A	3
Posterior cerebral A	2
A1 portion	1
PICA distal	1

hazardous because of the location of the aneurysm or their medical condition.

Material and Methods

From March 1997 to October 2000, 93 aneurysms were treated with GDCs in acute period after subarachnoid hemorrhage (within 7 days after onset) at Mito National hospital.

The patients were classified according to Hunt and Hess Grade as follows; 11 into Grade I, 27 into Grade II, 29 into Grade III, 20 into Grade IV, 6 into Grade V. The locations of the aneurysms are listed in table 1. All aneurysms were small (the diameter was less than 12 mm).

The procedures were performed under general anesthesia in all cases. Systemic heparinization was applied only in the case considered having wide neck. GDC 10 system (Boston scientific) was used for all cases. Following or before the embolization of the aneurysm, spinal drainage had been placed until day 14 in principle to remove the clot, which was considered to be spasmogenic. Tissue Plasminogen Activator (TPA) was administered through the spinal drainage catheter if the patient had a dense clot in basal cistern where the Hounsfield number of CT scan was over 70 and the aneurysm was embolized sufficiently. In the recent cases, 1 mg TPA was injected only once within 72 hours after the hemorrhage. 30 mg Fasdil chloride was given intravenously every 8 hours to prevent vasospasm until day 14⁷. Mechanical or chemical angioplasty was performed when hyperdynamic therapy failed to resolve the symptoms of vasospasm.

Results

Hunt and Hess Grades and corresponding outcomes on discharge are summarized in table 2. Seventy-three patients (78%) were independent (GR or MD) on discharge. Among the patients of Hunt and Hess Grade I, II and III, 59 patients (88%) were independent.

Concerning the aneurysmal occlusion immediately after initial embolization, 36 (38%) aneurysms demonstrated complete occlusion and 25 (26%) aneurysms demonstrated neck remnant, whereas 32 aneurysms (34%) exhibited body filling. Surgical clipping after em-

Table 2 Hunt and Hess Grade on admission and Glasgow Outcome Scale on discharge

GOS						
		GR	MD	SD	VS	D
H & K	I	10	1			
	II	23	2	1		1
	III	22	1		1	5
	IV	9	2	2	2	5
	V	3		1		2
total		67	6	4	3	13
78%						

bolization was performed in 7 cases (7.5%) and additional embolization was performed in 10 cases (11%). Follow-up angiography have been obtained for 58 cases (62%) at least 3 months after initial embolization. Thirty-three aneurysms (56%) exhibited complete occlusion, 13 (22%) neck remnant and 12 (20%) body filling.

Symptomatic complication related to the procedures included one death and two cerebrovascular accident from emboli and two neurological deterioration by aneurysm perforation. Permanent morbidity related to the procedures was 4.3% and mortality was 2.1%. Asymptomatic accident occurred in three cases including two emboli and two aneurysmal perforation. Two elder patients (80 and 74 year olds) with severe atherosclerotic change of proximal vessels suffered from re-rupture of body filling aneurysms in the acute period. One patient who was waiting for additional embolization re-ruptured on the 45th day after the embolization.

Symptomatic vasospasm was evaluated by neurological examination and cerebral angiography in 87 cases until October 31, 2000. Nineteen patients were excluded from this evaluation because of the persistent conscious disturbance. Symptomatic vasospasms occurred in twelve patients (17.6%) and five patients required chemical or mechanical angioplasty. Permanent morbidity due to vasospasm occurred in three patients (4.4 %). There was only one death related to vasospasm (1.5%).

Discussion

In 1991 and 1992, Guglielmi and colleagues reported the use of detachable platinum micro-coils to occlude intracranial aneurysms^{1,2}. Currently several reports have shown that embolization is more beneficial than surgical clipping in terms of the less invasive approach. In our department, GDC embolization is the first choice treatment for cerebral aneurysms under the following conditions; the aneurysm is less than 15 mm and larger than 3 mm with clear neck, no intracranial hematoma and no severe atherosclerotic change. Anatomical and angiographical configuration is very important for

successful embolization. We consider that our treatment results are favorable, because the morbidity and mortality rates were low and 21 patients (22.5%) aged over 70 and some surgically difficult cases were included. Two elder patients (80 and 74 year olds) who re-ruptured during acute period by insufficient embolization were not indicated for surgical clipping due to their medical condition. We could not deliver enough coils to prevent re-rupture for these patients because of severe atherosclerotic change. Another patient who re-ruptured during waiting period of reembolization should have been treated sooner.

Direct removal of clot is impossible for endovascular treatment of aneurysms. Therefore, we placed spinal drainage for all patients in principle and administered TPA to patients with dense clots in basal cistern where the Hounsfield number of CT scan was over 70 in order to remove the clot for prevention of vasospasm. According to the symptomatic vasospasm, permanent morbidity and death rates were 4.4% and 1.5% respectively. Murayama et Al reported symptomatic spasm in 23%, permanent morbidity in 2.9% and mortality in 2.9%¹⁰. Debrun et al reported 22% symptomatic spasm, 3.6% permanent morbidity and 5.3% mortality⁸. Our result shows the lowest incidence of symptomatic vasospasm. We think that endovascular treatment does not have adverse effect on vasospasm. Continuous drainage of bloody cerebrospinal fluid and intrathecal administration of TPA for facilitating clot lysis might decrease the incidence and severity of vasospasm after subarachnoid hemorrhage.

Conclusions

In conclusion, endovascular treatment for ruptured cerebral aneurysms is less invasive than clipping and can make the same results as clipping. Endovascular treatment following spinal drainage led to a low incidence of symptomatic vasospasm. Therefore, this method can be considered as the first choice of treatment for cerebral aneurysms.

The long-follow up outcome of this type of treatment, however, must be confirmed.

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