An Early Experience of Endovascular Treatment for Cerebral Aneurysms Harboring Blebs

Y. MATSUMARU*, M. SONOBE, R. MASHIKO, Y. NAKAI, S. TAKAHASHI, T. NOSE*

Department of Neurosurgery; Mito National Hospital; Mito

* Department of Neurosurgery, Institute of Clinical Medicine; University of Tsukuba; Tsukuba

Key words: cerebral aneurysm, Guglielmi detachable coil, embolization, bleb

Summary

Re-rupture of cerebral aneurysms often occurs at their blebs, and the treatment of cerebral aneurysms harboring blebs has been considered difficult. To prevent rupture during embolization, the authors have tried to deliver coils only into aneurysm domes, without inserting coils, a microcatheter, or a microguidewire into the blebs. Here, to prove such a treatment strategy, the authors report early experience in 3 cases with cerebral aneurysms harboring blebs.

Introduction

Blebs of aneurysms are extremely thin-walled, and serial sectioning of ruptured aneurysms has revealed that a rupture often occurs by one of the blebs bursting¹. Therefore, endovascular surgeons should pay special attention to preventing aneurysmal ruptures while treating cerebral aneurysms harboring blebs.

We thought that endovascular procedures, including tight packing of aneurysm domes without inserting coils into blebs, were essential to prevent aneurysmal rupture during embolization.

In this article, we report our early experience in 3 patients with aneurysms harboring blebs to justify such a treatment strategy.

Case reports

Case 1

A 51-year-old female without significant illness was admitted to a local hospital with a complaint of severe headache. This patient was referred to our department on day 13 after the onset. A CT scan of the brain, which had been performed on day 3, revealed diffuse subarachnoid hemorrhage. An angiography demonstrated an aneurysm with a bleb arising from the anterior communicating artery (figure 1A). Endovascular embolization with Guglielmi detachable coils (GDC, Target Therapeutics, Fremont, CA, USA) was performed under general anesthesia on day 14. Fastracker 10 with Dasher 14 (Target Therapeutics) were navigated into the dome of the aneurysm. We paid special attention not to introduce these catheters or the guidewire into the bleb. A coil of GDC10 4 mm x 6 cm was placed into the aneurysm as the first coil, which was then followed by GDC10 3 mm x 4 cm and 2 mm x 4 cm. The dome of the aneurysm was completely packed with coils, and only one loop of coil stayed in the bleb (figure 1B). An angiography after embolization revealed complete obliteration of the aneurysm (figure 1C). Follow-up angiography after 1 year showed stable embolization without any opacification of the dome or the bleb.

Figure 1 A) Anterior posterior view of right internal carotid injection reveals an aneurysm on anterior communicating artery. A bleb of the aneurysm is projecting laterally. B) The aneurysm was embolized with GDCs. The dome was packed tightly; otherwise the bleb was filled with only one loop of the coil. C) Anterior posterior view of right internal carotid injection shows the complete occlusion of the aneurysm.

Case 2

A 58-year-old male with a history of hypertension was brought to our department by ambulance with an abrupt deterioration of consciousness and right hemiparesis. A CT scan on admission revealed an intracranial hemorrhage at the left basal ganglia.

An angiography at day 3 after onset showed an aneurysm with a bleb projecting superiorly at the horizontal portion of the left anterior cerebral artery (figure 2A). Fastracker 10 with Dasher 14 were navigated into the dome of the aneurysm under general anesthesia on day 4. Coils of the GDC 10 system were placed only into the dome (figure 2B).

The total length of inserted coils was 50 cm.

Figure 2 A) Lateral view of right internal carotid injection shows an aneurysm on the horizontal portion of the anterior cerebral artery. A bleb is projecting superiorly. B) The aneurysm was embolized with GDCs. The dome was packed tightly without placement of coils into the bleb. C) Lateral view of right internal carotid injection shows the complete occlusion of the dome and bleb of the aneurysm.

Neither coils, catheter, nor guidewire were introduced into the bleb during the procedure. An angiography after embolization showed complete obliteration of the aneurysm without placement of coils into the bleb (figure 2C).

Case 3

A 77-year-old female who had been suffering from heart failure visited our department with a complaint of severe, abrupt headache. A CT scan revealed subarachnoid hemorrhage. An angiography demonstrated an aneurysm with a bleb projecting superiorly at the bifurcation of the left internal carotid artery and the posterior communicating artery (figure 3A). Endovascular treatment was performed on the same day under general anesthesia. Fastracker 10 with Dasher 14 were navigated into the dome of the aneurysm.

GDC10 4 mm x 8 cm was placed into the dome as the first coil followed by GDC10 3 mm x 6 cm and 2 mm x 6 cm. Neither coils, catheter, nor guidewire were introduced into the bleb during the procedure. The dome of the aneurysm was completely packed, and an an-

giography after embolization revealed the complete obliteration of the dome and the bleb of the aneurysm.

Discussion

A bleb is a small bulge arising from the dome of an aneurysm. It is conceivable that a rupture may occur at the most fragile point of the aneurysmal wall². A pathological study re-

Figure 3 A) Lateral view of left internal carotid artery injection shows an aneurysm on the ostium of the left posterior communicating artery with the bleb projecting superiorly. B) Coils were placed into only the dome of the aneurysm without placement into the bleb. C) The aneurysm was completely occluded by the coils placed in the dome.

vealed that blebs are extremely thin-walled and that their bursting is often the cause of ruptures¹. Furthermore, aneurysms with blebs, regardless of these locations, showed a greater incidence of re-rupture than those without blebs³.

With the recent development of GDC, endovascular treatment of cerebral aneurysms is gaining favor as an attractive alternative to surgical clipping^{4,5}. There have been many reports with respect to the effectiveness of this new technique⁶⁻¹⁰. However, many questions still remain regarding the safety, efficacy, and long-term results of this technique. One of the most devastating complications of endovascular therapy for aneurysms is aneurysmal rupture during the treatment¹¹.

We examined the morphological aspects of aneurysms, including the presence of blebs prior to the procedure, to avoid inadvertent aneurysmal rupture. During the procedure, we navigated a microcatheter and a microguidewire only into the dome of the aneurysm, without penetration into the bleb.

Then, coils were placed only in the dome tightly, without coil placement into the bleb. In this step, choosing the largest coil as the first coil seems important, and the size of the first coil should be larger than the diameter of the bleb. This technique enables us to obliterate both the dome and the bleb without embolization of the bleb. In practical settings, however, coils do sometimes go into the bleb. In such cases, tight packing of the dome and loose packing of the bleb should be performed.

To avoid introducing coils, microcatheters, and microguidewires into blebs seems reasonable in the endovascular embolization of cerebral aneurysms harboring blebs. Further experience and long-term follow-up are needed to determine the efficacy of this method.

Acknowledgement

The authors wish to thank Kiyoyuki Yanaka, M.D., Ph.D. (Department of Neurosurgery, Institute of Clinical Medicine, University of Tsukuba, Japan) for his helpful comments on this manuscript.

References

- 1 Crawford T: Some observations on the pathogenesis and natural history of intracranial aneurysms. *J Neurol Neurosurg Psychiatr* 22: 259-266, 1959.
- 2 Mizoi K, Yoshimoto T et Al: Types of unruptured cerebral aneurysms reviewed from operation video-recordings. *Acta Neurochir (Wien)* 138: 965-969, 1996.
- 3 Aoyagi N, Hayakawa I et Al: Analysis of 223 cases of intracranial aneurysms--with special reference to re-rupture of the intracranial aneurysms. *No Shinkei Geka* 11: 63-71, 1983.
- 4 Guglielmi G, Viñuela F et Al: Electrothrombosis of saccular aneurysms via endovascular approach. Part 1: Electrochemical basis, technique, and experimental results. *J Neurosurg* 75: 1-7, 1991.
- 5 Guglielmi G, Viñuela F et Al: Electrothrombosis of saccular aneurysms via endovascular approach. Part 2: Preliminary clinical experience. *J Neurosurg* 75: 8-14, 1991.
- 6 Guglielmi G, Viñuela F et Al: Endovascular treatment of posterior circulation aneurysms by electrothrombosis using electrically detachable coils. *J Neurosurg* 77: 515-524, 1992.
- 7 Graves VB, Strother CM et Al: Early treatment of ruptured aneurysms with Guglielmi detachable coils: effect on subsequent bleeding. *Neurosurgery* 37: 640-648, 1995.
- 8 Malisch TW, Guglielmi G et Al: Intracranial aneurysms treated with the Guglielmi detachable coil: midterm clinical results in a consecutive series of 100 patients. *J Neurosurg* 87: 176-183, 1997.
- 9 Viñuela F, Duckwiler G et Al: Guglielmi detachable coil embolization of acute intracranial aneurysms: perioperative anatomical and clinical outcome in 403 patients. *J Neurosurg* 86: 475-482, 1997.
- 10 Byrne JV, Sohn M et Al: Five-year experience in using coil embolization for ruptured intracranial aneurysms: outcomes and incidence of late bleeding. *J Neurosurg* 90: 656-663, 1999.
- 11 McDougall CG, Halbach VV et Al: Causes and management of aneurysmal hemorrhage occurring during embolization with Guglielmi Detachable coil. *J Neurosurg* 89: 87-92, 1998.

Yuji Matsumaru, M.D., Ph.D.
Department of Neurosurgery
Institute of Clinical Medicine
University of Tsukuba
Tsukuba, Ibaraki 305-8575, Japan
E-mail: ymatumar@md.tsukuba.ac.jp