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Circumferential Wrapping and Clipping with Temporalis Fascia for Treatment of Unclippable Intracranial Aneurysms

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We utilized a clip-reinforced wrapping technique using temporalis fascia for treating unclippable aneurysms in 14 patients. Herein, we describe a modification of the clip-reinforced wrapping technique and report on the results. An appropriately sized strip of temporalis fascia is passed around the aneurysms with cuts made to accommodate perforating arteries. After applying fibrin glue, the aneurysm clip is positioned to secure the circumferential wrapping. Of the 14 patients, 4 (29%) were unclippable microbleb, 4 (29%) were wall defect, 3 (21%) were imperfect clipping due to the complexity of the aneurysm, 2 (14%) were bleb at the base of the aneurysm and 1 (7%) was a fusiform aneurysm. Multiple aneurysms were found in 6 (43%) patients and half (50%) of the 14 patients had MCA aneurysms. Postoperative angiography demonstrated no narrowing of parent arteries or enlargement of the aneurysms. No subsequent bleeding was observed during the 1 year follow-up period. These results suggest that circumferential wrapping-clipping with temporalis fascia and biological glue provides an alternative and safe method of treatment for unclippable intracranial aneurysms.

Key Words: Circumferential wrapping, clipping, intracranial aneurysm, temporalis fascia

INTRODUCTION

The most widely accepted treatment for intracranial aneurysms is exclusion from the circulation by clipping the neck of the aneurysm. However complete clipping is not always possible, particularly in the case of fusiform and atherosclerotic aneurysms which do not have a well-defined neck. Various methods are used for treating unclippable aneurysms, including proximal occlusion of parent artery or trapping of the aneurysm, microsurgical bypass,[1,2] reinforcement of the aneurysm dome[3-7] and intravascular techniques.[8] Wrapping is frequently used when the other techniques are thought to be unsafe. Whatever treatment is chosen, complete obliteration of the aneurysm is required to avoid bleeding[3,9] and perforating arteries must be spared to prevent ischemic deficits.

In this report, we describe a modification of the clip-reinforced wrapping technique using temporalis fascia, and present our experience in 14 patients with unclippable aneurysms.

MATERIALS AND METHODS

We performed the clip-reinforced wrapping technique for unclippable aneurysms using temporalis fascia in 14 patients between 1997 and 1999. The vascular lesions we operated on seemed to be unclippable at the time of surgery and endovascular treatment is not available at our hospital. The purposes for which clip-reinforced wrapping was used were to reinforce a residual or additional ectasia next to the clipped aneurysm, to treat an arterial ectasia which proved unclippable at surgery, and to protect a nervous or vascular neighboring structure which was compressed by clip grip.

An appropriately sized strip of temporalis fascia

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was passed around the aneurysms with cuts made to accommodate perforating arteries. After applying biological glue, the aneurysm clip was positioned to secure the circumferential wrapping (Fig. 2). All patients were graded according to the Hunt and Hess system and underwent brain CT and cerebral angiography prior to surgery. Postoperative brain CT and cerebral angiography were performed in all patients. The outcome of the procedure was assessed to identify the rate of rebleeding, overall morbidity and mortality.

RESULTS

Clinical features and results are summarized in Table 1. We classified unclippable aneurysmal lesions into five categories (Fig. 1 and 2). Of the 14 patients, 4 (29%) were unclippable microbleb, 4 (29%) were thin vessel wall due to wall defect, 3 (21%) were imperfect clipping due to the complexity of the aneurysm, 2 (14%) were bleb at the base of aneurysm and 1 (7%) was a fusiform aneurysm (Table 2). Multiple aneurysms were found in 6 (43%) patients and half (50%) of the 14 patients had MCA aneurysms. Postoperative angiography was performed in all patients and demonstrated no narrowing of parent arteries or enlargement of aneurysms. All patients were available for follow-up and we currently have 7 (50%) patients with good recovery, 6 (43%) patients with moderate disability and 1 (7%) patient with severe disability. There was no mortality and no evidence of any episodes of rebleeding during the follow-up period.

DISCUSSION

With the advent of microsurgical techniques and advances in the management of patients with subarachnoid hemorrhage, the optimum treatment for most patients with subarachnoid hemorrhage is early surgical clipping of the aneurysm. However, there remains a small number of patients in whom surgical clipping is technically not feasible.

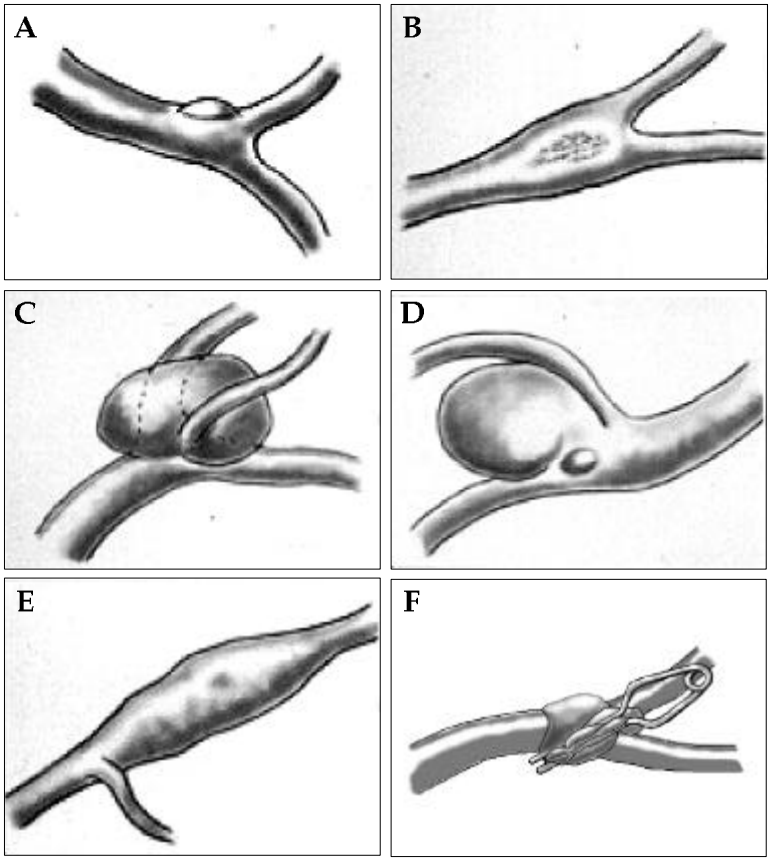

Fig. 1. Schematic illustrations of the unclippable cerebral aneurysms and the circumferential wrapping-clipping technique. A: microbleb, B: wall defect, C: complexity of aneurysm, D: bleb at base of aneurysm, E: fusiform aneurysm, F: circumferential wrapping with temporalis fascia and clip reinforcement.

Table 1. Clinical Summary of 14 Patients Treated using Clip-reinforced Wrapping Technique

Case No.	Age/ Sex	H-H* grade	Fisher grade	Aneurysm location	Wrapping site	Aneurysm shape	Outcome†	Follow-up period
1	37/M	II	III	ACoA	ACoA	complexity	good recovery	20 mo
2	59/F	III	III	PCoA, MCA, AChA	AChA	microbleb	moderate disability	18 mo
3	41/M	II	II	MCA	MCA	bleb	good recovery	22 mo
4	57/F	III	IV	ACoA, MCA	MCA	wall defect	moderate disability	24 mo
5	43/F	III	III	ACoA	ACoA	complexity	good recovery	17 mo
6	38/M	II	III	AChA	AChA	microbleb	good recovery	32 mo
7	39/F	III	III	AChA, PCoA	PCoA	wall defect	good recovery	30 mo
8	33/M	III	III	MCA	MCA	bleb	good recovery	21mo
9	68/M	III	IV	PICA	PICA	fusiform	moderate disability	25 mo
10	73/M	III	III	MCA	MCA	microbleb	moderate disability	34 mo
11	65/M	III	IV	MCA, both	MCA, lt	complexity	severe disability	28 mo
12	62/F	III	III	PCoA, MCA, AChA	AChA	microbleb	moderate disability	26 mo
13	58/F	III	III	ACoA, MCA	MCA	wall defect	moderate disability	19 mo
14	39/M	II	III	MCA	MCA	wall defect	good recovery	23 mo

ACoA, anterior communicating artery; AChA, anterior choroidal artery; MCA, middle cerebral artery; PCoA, posterior communicating artery; PICA, posterior inferior cerebellar artery; Complexity, complexity of aneurysm; Bleb, bleb at base of aneurysm.
*Hunt & Hess grade.
†Outcome according to the Glasgow outcome scale.

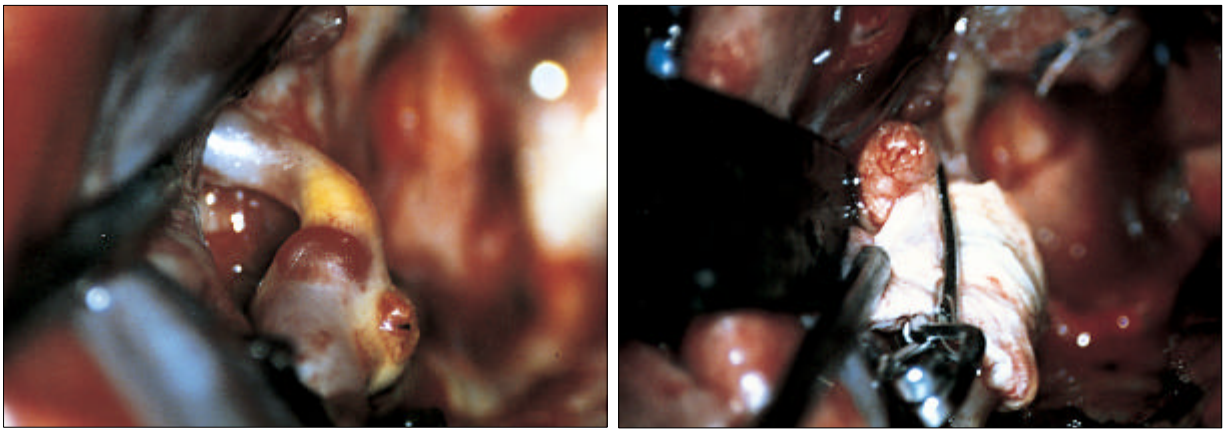

Fig. 2. Intraoperative photographs of left MCA aneurysm in case 10. Left: unclippable microbleb as found at MCA bifurcation. Right: circumferential wrapping with temporalis fascia and reinforced clipping were performed.

Table 2. Indications and Site for Clip-reinforced Wrapping Technique

Indications	ICA	ACA	MCA	VA	Total
Microbleb	3		1		4
Wall defect	1		3		4
Complexity of aneurysm		2	1		3
Bleb at base of aneurysm			2		2
Fusiform aneurysm				1	1
Total	4	2	7	1	14

ACA, anterior cerebral artery; MCA, middle cerebral artery; ICA, internal carotid artery; VA, vertebral artery.

We classified unclippable aneurysmal lesions into the following five groups. Microbleb, thin vessel wall due to wall defect, imperfect clipping due to the complexity of the aneurysm, additional bleb at the base of the aneurysm and fusiform aneurysm were found to be unclippable at the time of operation. In such cases, a number of treatment options which leave the lumen of the ruptured aneurysm intact are available, including reinforcement of the aneurysm sac by wrapping, trapping of the aneurysm, and proximal artery occlusion by surgical ligation or intravascular techniques.[10]

If an aneurysm is found to be unclippable and trapping is not possible at the time of operation, the surgeon is faced with little alternative but to reinforce the wall of the aneurysm to prevent rebleeding. Several methods that combine wrapping and clipping have been previously reported for treating fusiform or broad-based aneurysms,[11-13] and arterial perforation.[13,14] Furthermore, various materials have been used to reinforce the aneurysms including plastics,[6] cyanoacrylate,[15] histoacryl adhesive,[16] collagen-impregnated Dacron fabric,[13] and muscle or fascia.[3,6,7] Regardless of the materials used, traditional reinforcement techniques have attempted to prevent further expansion or hemorrhage by covering the aneurysm surface, however they usually do not obliterate the lesion or restore normal vessel diameter.[9,17] As a result, these methods have been associated with high rates of rebleeding or progression of symptoms.[7,9,17] A more recent review of patients treated with a variety of wrapping techniques showed a cumulative rebleeding rate of 17%.[16]

We used a wrapping technique with temporalis fascia and clip reinforcement to treat certain types of aneurysms, which were found to be unclippable at the time of operation. The operative technique we used is different from the classical wrapping technique. We used temporalis fascia instead of muscle, and we supplemented the classical wrapping technique with a method of clip reinforcement. The advantage of this modified technique is that it provides a uniform distribution of forces around the aneurysm.[11] The aneurysm can then be collapsed without excessive tension on the friable wall. Disadvantages of this technique include the need to perform circumferential dissection of the entire aneurysm,[11] atrophy and absorption of the muscle fascia and difficulty to adjust the caliber of the parent artery because of the opaqueness of the temporalis fascia.[12]

These findings suggest that circumferential wrapping with temporalis fascia and clip reinforcement provides an alternative method of treatment for unclippable intracranial aneurysms. Further studies involving a large number of cases and long term follow-up is needed to confirm the reliability of this techique.

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