Clinical Results of GDC Treatment for Ruptured Cerebral Aneurysms

Luc PICARD, M.D., Kazuhiro FUKUI, M.D., Serge BRACARD, M.D., Rene ANXIONNAT, M.D., and J.C. MARCHAL, M.D.

Summary: In this study we present recent clinical results of coil embolization for ruptured cerebral aneurysm. From May 1996 to March 1997, 99 patients presented with ruptured cerebral aneurysms, of which 82 cases (83%) were treated with endosaccular coil embolization using GDC. There were 32 males and 50 females, and the ages were 26 to 78 (average 50.1) years old. The locations were 28 A-com, 4 ACA, 21 ICA, 14 MCA, 6 VA, 6 BA and 3 of other locations. The sizes of the aneurysms were 63 small (2–7 mm), 15 medium (8–14 mm) and 4 large (15–20 mm). Hunt & Hess grades were 23 Grade I, 25 Grade II, 23 Grade III, 7 Grade IV and 4 Grade V. Seventeen cases were treated with open skull surgery because of anatomical problems for embolization (11 cases) or massive intracerebral hematoma (6 cases). Glasgow outcome scale (GOS) was assessed 2 to 5 months after the embolization.

Overall clinical results were 44 (54%) good recovery, 17 (21%) moderate disability, 12 (14%) severe disability, 1 (1.2%) vegetative and 8 (9.8%) death. The GOS was correlated with the clinical grade of SAH at admission and 44 (91.7%) of 48 Hunt & Hess Grade I or II patients had favorable outcomes. The location of the aneurysm was not associated with the GOS. Vasospasm was seen in 13.9% and influenced the GOS. The results of embolization as the initial treatment of ruptured cerebral aneurysms are comparable to direct open skull surgery.

Key words: aneurysm, Guglielmi detachable coil, embolization, clinical outcome

Introduction

After induction of Guglielmi electrodetachable coil (GDC), many ruptured or unruptured aneurysms have been treated with endosaccular coil embolization which resulted in good clinical outcome in Japan. However, the number of cases is not satisfactory compared with other institutes in the world. It is important to know the recent clinical results of coil embolization for ruptured aneurysm from the large series of cases. This report is the result of coil embolization of ruptured cerebral aneurysms during one year experience at the Department of Diagnostic and Interventional Neuroradiology in Saint-Julien Hospital of Nancy University, France.

Clinical Material and Method

1. Number of patients

From May 1996 to March 1997, 99 patients presented with ruptured cerebral aneurysms, of which 82 cases were treated with endosaccular coil embolization using GDC. There were 32 males and 50 females, and the ages were 26 to 78 (average 50.1) years old. The locations were as follows, 28 A-com, 4 ACA, 21 ICA, 14 MCA, 6 VA, 6 BA and 3 other locations. The sizes of the aneurysms were 63 small size (2–7 mm), 15 medium size (8–14 mm) and 4 large size (15–20 mm). The average size of the aneurysms was 5.45 mm.
Hunt & Hess grades were 23 grade I, 25 grade II, 23 grade III, 7 grade IV and 4 grade V. Eleven (11%) of 99 ruptured aneurysms were not embolized because of anatomical problem of the aneurysms or of the parent vessels. The anatomical problems include wide neck of the aneurysm, important branch originating from the sac and stenosis or tortuosity of internal or vertebral arteries.

2. Treatment course

All cases of subarachnoid hemorrhage were transferred to the angiography room for diagnostic Seldinger angiography under general anesthesia. After diagnosis of cerebral aneurysm, the embolization was continued following the discussion between the neurosurgeons and the interventional neuroradiologists (Fig. 1). All of the anatomically sufficient aneurysm for coil embolization was treated with endovascular treatment, however, wide neck, branches originating from the neck, tortuosity of the parent vessel and massive hematoma cases were treated with open skull surgery.

The angiography was performed using rotational and bi-plane DSA machine. Three dimensional reconstruction of cerebral vessels from the digital image of rotational DSA shows precise angio-architecture of the aneurysms and the associated vessels. With this method, we can measure the right of all aneurysmal dimensions, decide the best incidence of angiography for embolization and choose the best coil.

The aneurysm was catheterized with Tracker 18 or 10 microcatheter (Target Therapeutics/Boston Scientific Corporation, USA) introduced through 6 Fr catheter placed in the appropriate carotid or vertebral artery, and was embolized with Guglielmi electrodetachable coil (GDC) (Target Therapeutics/Boston Scientific Corporation, USA) which was passed through the microcatheter. The embolization was performed by packing of several GDCs. Including diagnostic angiography, the embolization was completed within 2 to 3 hours. To avoid thromboembolic complication, systemic heparinization was performed during embolization and anti-coagulation therapy was continued after the treatment.

After embolization, patients were treated with hypertension hypervolemic and hemodilution therapy with intravenous administration of nimodipine.
3. Post treatment follow up

Two to 5 months after the embolization, Glasgow outcome scale (GOS) of the treated cases was investigated.

Results

1. Overall clinical results

Overall clinical results were 44 (54%) good recovery (GR), 17 (21%) moderate disability (MD), 12 (14%) severe disability (SD), 1 (1.2%) vegetative (V) and 8 (9.8%) death (D). The GOS was correlated with clinical grade of SAH at admission, and the 44 (91.7%) of 48 Hunt & Hess grade I or II patients presented favorable outcomes (36 patients had good recovery, 8 patients had moderate disability) (Table 1). In moderate disability cases in grade I or II, 5 presented vasospasm, 1 presented thromboembolic complication and 2 were high aged cases.

Angiographically total occlusion of the aneurysm was observed in 40 (48.8%) of 80 cases, and 42 (52.5%) cases resulted in subtotal occlusion. As we consider that minimum slow enhancement in the coils after almost complete embolization to be the subtotal occlusion, the degree of occlusions was enough for hemostasis in subtotal occlusion cases.

2. Association of GOS and location of the aneurysm

GOS was not correlated with the location of the aneurysm. The unfavorable outcome of the vertebral artery aneurysms was associated with the poor clinical grade before treatment (Table 2).

3. Incidence of vasospasm

Vasospasms were seen in 5 of 52 acutely embolized patients, and 5 of 22 sub-acutely embolized patients. So the rate of vasospasm in the patients treated within 2 weeks was 13.9%. The occurrence of vasospasm influenced the outcome of the patients (Table 3).

4. Complications

Complications associated with the procedure were as follows: Thromboembolism occurred in 5 patients during the procedure, and all patients recovered after local fibrinolysis. Rebleeding associated with the procedure was seen in 1 case.

5. Case reports

Case 1: This 54 years old woman complained with slight headache. She was transmitted in our hospital the next day. The CT scan showed subarachnoid hemorrhage of Fisher group 2. Neurological deficit was not seen. Hunt and Hess grade was II. After angiography, emergency embolization was performed for A-com aneurysm (Fig. 2A). The aneurysm was completely packed with three GDC10s (3 mm ×6 cm, 3 mm ×4 cm and 2 mm ×4 cm soft) (Fig. 2B). The patient presented no vasospasm and dis-
charged with good recovery.

Case 2: This 30 years old woman complained with headaches and was hospitalized the next day. The CT scan presented subarachnoid hemorrhage of Fisher group 2 and Hunt & Hess grade I. The right MCA small aneurysm (arrow of A) was embolized with one GDC 10 (2 mm × 4 cm) resulted in excellent radiological result (B and C). GOS after 1 month showed good recovery without vasospasm.

Case 3: This 56 years old woman had a subarachnoid hemorrhage of Hunt & Hess grade I. The Fisher group was 1. On angiography, a small IC-PC aneurysm was detected (arrow of A) and was embolized with one GDC 10 (3 mm × 6 cm) (arrow of B). Outcome was good recovery.

Case 4: This 74 years old woman complained with
headaches and had left occulomotor nerve palsy. The Hunt and Hess grade was IV and Fisher CT group was 3 (Fig. 5A). Seldinger angiography revealed left MCA and left BA-SCA aneurysm (B and D). Embolization for left MCA aneurysm was performed with two GDC18s (5 mm × 15 cm and 4 mm × 10 cm soft) (C), subsequently the BA-SCA aneurysm was embolized with three GDC18s (10 mm × 30 cm, 8 mm × 30 cm, 4 mm × 10 cm soft) and two GDC10s (3 mm × 8 cm soft and 3 mm × 10 cm soft) (E). After the procedure, the patient was conscious but she was bedridden because of old age and initial brain damage. GOS assessment after several weeks was moderate disability. This case suggests that coil embolization can treat multiple aneurysms including posterior circulation at the acute stage even if the patient is aged.

Discussion

After induction of GDC (Guglielmi electrodetachable...
coil) system as the endovascular treatment of intracranial aneurysms, large numbers of cases have been treated and the clinical results were satisfactory. After approval of GDC system in Japan, many cases have been treated using cisternal drainage or calcium channel blockers.

However, these data showed that endovascular treatment does not have an unfavorable effect on cerebral vasospasm, and further analysis is needed to clarify this point.

In recent years, the clinical outcomes of direct surgery for ruptured cerebral aneurysms have improved compared to the outcome of the past years. This improvement was due to early surgery and advancement of medical treatment strategy for cerebral vasospasm.

However, the need of coil embolization has been stressed in the field of neurosurgery as the initial treatment for ruptured cerebral aneurysm in case of poor surgical candidates with poor clinical grade or with anatomical location of high surgical risk.

The recurrence of coil embolization for wide neck large and giant aneurysm is cautioned. To advance the long time clinical and radiological results of coil embolization, it is important to perform complete dense packing of the aneurysm under precise identification of radioanatomy. Also periodical radiological follow-up is essential.

Conclusion

Coil embolization for ruptured aneurysm was successfully performed in 83% of ruptured cerebral aneurysm. The clinical outcome was satisfactory because 74% of all cases presented good recovery or moderate disability. Our results showed that embolization as the initial treatment of ruptured cerebral aneurysm is comparable to direct surgery.

References

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要 旨

破裂脳動脈瘤に対するGDC塞栓術の臨床成績

Luc PICARD, 福井一裕, Serge BRACARD, Rene ANXIONNAT, J.C. MARCHAL

名古屋徳会病院 脳神経外科