

Embolization of the Middle Meningeal Artery for Refractory Chronic Subdural Haematoma

Usefulness for Patients under Anticoagulant Therapy

S. HIRAI, J. ONO, M. ODAKI, T. SERIZAWA, O. NAGANO

Department of Neurosurgery, Chiba Cardiovascular Center, Ichihara; Japan

Key words: chronic subdural haematoma, middle meningeal artery, embolization, coagulopathy, warfarin

Summary

Endovascular embolization of the middle meningeal artery was performed in two cases of refractory chronic subdural haematoma (CSDH) after repeated burr hole and irrigation surgeries. The embolization prevented expansion of the CSDH in both cases, and the haematoma disappeared completely in one case. The expansion of CSDH is considered to result from repeated bleeding from the macrocapillaries on the haematoma capsule. Embolization of the middle meningeal artery appears to be useful to eliminate the blood supply to this structure.

Introduction

The chronic subdural haematoma (CSDH) is usually treated with burr hole and irrigation surgery combined with or without subdural drainage. Surgical results are successful in most cases, but recurrence of haematoma sometimes occurs, especially in patients with coagulopathy or under anticoagulant therapy. Repeated irrigation, reservoir installment and aspiration, subdural-peritoneal shunt or capsule removal with large craniotomy have been treatment options for these patients. Invasive treatment like craniotomy should be avoided for those with such status. The patients with refractory CSDH who underwent endovascular embolization of

the middle meningeal artery (MMA) were reported recently^{1,2}. We experienced two patients with refractory CSDH, and successfully treated with endovascular embolization of the MMA. We report the clinical courses of the patients who underwent this procedure, and discuss the mechanism of growth in CSDH and usefulness of this treatment for this disease.

Case Presentation

Case 1

An 81-year-old male previously underwent cardiac surgeries (aortic valve replacement) three times, and 1-2 mg warfarin had been continued postoperatively. In March 2002, he fell down and hit his back and occiput. He experienced motor weakness of four extremities and gait disturbance on May 21, and came to our outpatient clinic. A CT scan revealed bilateral CSDH (figure 1A), which disappeared after burr hole irrigation on both sides under local anesthesia on May 22. Massive bleeding was seen in making burr holes, despite preoperative administration of Vitamin K and fresh frozen plasma. Then recurrence of bilateral CSDH was demonstrated on the postoperative CT scans, though warfarin had not been resumed after surgery (figure 1B). Second irrigation of haematoma on both sides was performed on

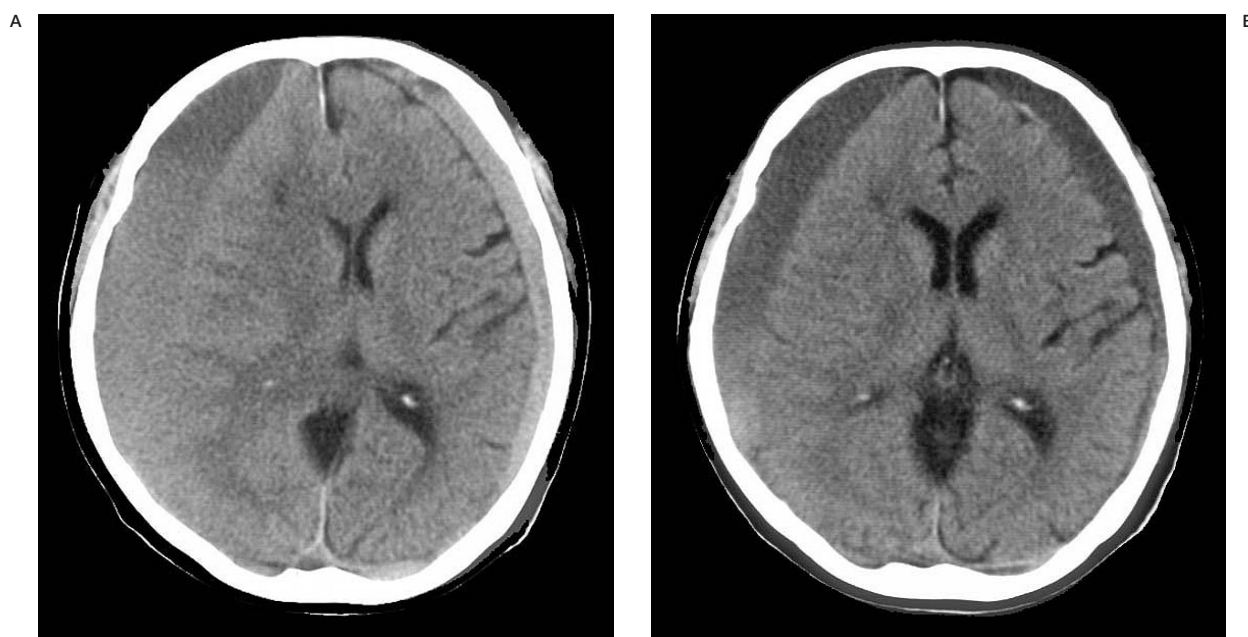


Figure 1 Preoperative (A) and postoperative (B) CT scans in Case 1. Bilateral subdural haematoma is noted even after the burr hole irrigation surgery.

June 21. But size and density of right subdural effusion gradually increased again on the CT scans. Further irrigation procedures appeared to be ineffective. Haematoma and capsule removal was not preferred because of his ad-



Figure 2 Superselective angiogram of the right middle meningeal artery, lateral projection. Abnormal vascular networks are demonstrated along this artery.

vanced age and massive bleeding probable in craniotomy. Then an endovascular embolization of the right MMA using polyvinyl alcohol particles and platinum coils was performed on July 22 to eliminate the blood supply to the haematoma capsule without neurological complications. The superselective angiogram of the MMA before embolization demonstrated abnormal vascular networks (figure 2). Because the right haematoma showed no growth on the follow-up CT scans, warfarin was started again in March 2003. Neurological status remained stable after resumption of warfarin.

Case 2

A 63-year-old male with dilated cardiomyopathy and atrial fibrillation was managed using 5mg warfarin at the outpatient clinic of cardiology of our hospital. He fell down and hit his head after drinking in June 2003. On March 1, he showed abnormal behavior and disorientation, and his family members took him to our hospital. A CT scan revealed a CSDH in the right fronto-temporal area (figure 3A), and burr hole irrigation with drainage was immediately performed under local anesthesia. Vitamin K and fresh frozen plasma were administered preoperatively. The haematoma disappeared on the postoperative CT scan, and war-

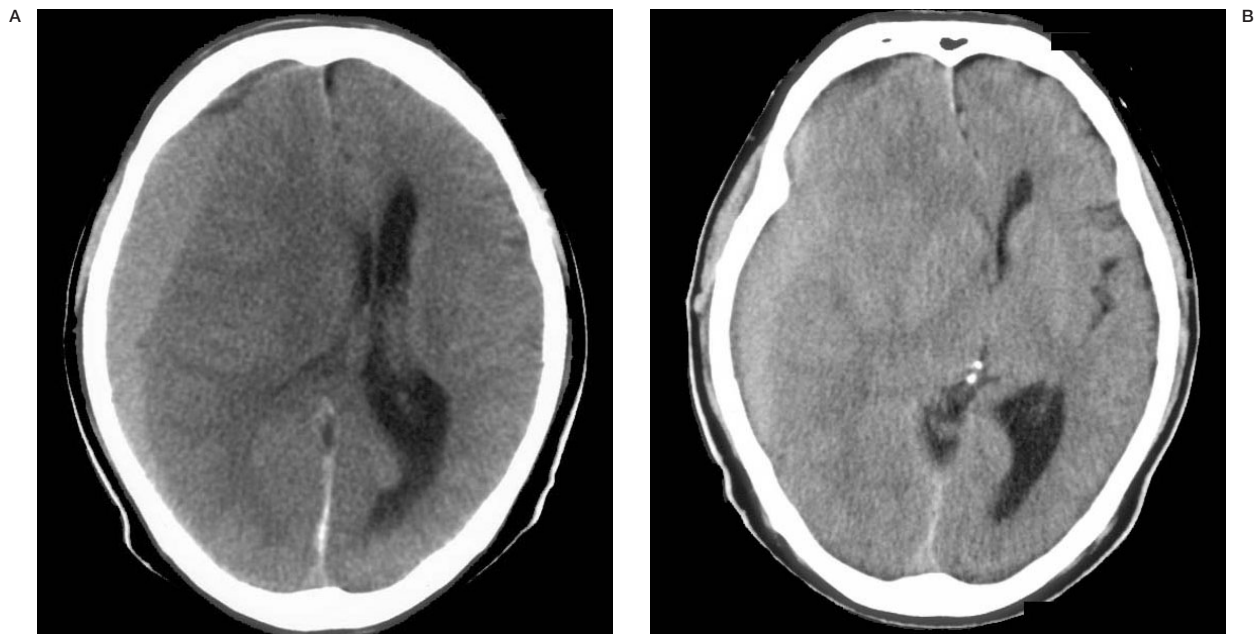


Figure 3 Preoperative (A) and postoperative (B) CT scans in Case 2. A subdural haematoma is noted in the right frontoparietal area with the midline shift, even after the burr hole irrigation surgery.

farin was administered again. The postoperative CT scans showed gradual increase of subdural collection on the right side with the midline shift (figure 3B), which required second irrigation of the haematoma on March 31.

Though his neurological status did not deteriorate, the haematoma remained on the CT scans. To prevent increase of the haematoma, an endovascular embolization of MMA using platinum coils was performed on April 7.



Figure 4 Superselective angiogram of the right middle meningeal artery, lateral projection. Abnormal vascular networks are demonstrated along the enlarged middle meningeal artery.



Figure 5 CT scan after the embolization of the middle meningeal artery. The right subdural haematoma decreased in volume and its density.

The superselective angiogram of the MMA before embolization demonstrated the enlarged MMA and abnormal vascular networks (figure 4). The haematoma decreased in size after the embolization (figure 5). Administration of warfarin was resumed after the treatment. The haematoma has disappeared to date on the follow-up CT scans.

Discussion

Expansion of CSDH is considered to result from inflammation and repeated bleeding from the haematoma capsule. The origin of the feeding vessels of the capsule was carefully examined by Tanaka et al³. They demonstrated diffuse dilatation of the MMA branches and scattered abnormal vascular network on superselective angiograms of the MMA in CSDH patients. Histological examinations revealed proliferated macrocapillaries and infiltration of macrophages in the outer membrane⁴. The abnormal vascular network on the angiogram is probably identical to these macrocapillaries (figure 2, 4), which might cause haemorrhage into the haematoma cavity.

In Case 1, the CT scan immediately after the embolization demonstrated increase of haematoma density, which suggested extravasation of contrast media from the MMA into the haematoma cavity through the macrocapillaries.

These histological and angiographic findings support usefulness of the MMA embolization for the refractory CSDH to prevent its expansion. This treatment appears to be a good option for the patients with coagulopathy or under anticoagulant therapy.

References

- 1 Mandai S, Sakurai M, Matsumoto Y: Middle meningeal artery embolization for refractory chronic subdural haematoma. Case report. *J Neurosurg* 93: 686-688, 2000.
- 2 Takahashi K, Muraoka K, Sugiura T et al: Middle meningeal artery embolization for refractory chronic subdural haematoma: 3 case reports. *No Shinkei Geka*. 30: 535-539, 2002.
- 3 Tanaka T, Fujimoto S et al: Superselective angiographic findings of ipsilateral middle meningeal artery of chronic subdural haematoma in adults. *No Shinkei Geka* 26: 339-347, 1998.
- 4 Nagahori T, Nishijima M, Takaku A: Histological study of the outer membrane of chronic subdural haematoma: possible mechanism for expansion of haematoma cavity. *No Shinkei Geka* 21: 697-701, 1993.

Shinji Hirai, M.D.
Department of Neurosurgery
Chiba Cardiovascular Center
575 Tsurumai, Ichihara
Chiba, 290-0512, Japan