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Case Report

Embolization of an anterior communicating aneurysm with a Woven EndoBridge combined with a coil: a case report

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Abstract: Cases of Woven EndoBridge (WEB) combined with coil embolization of ruptured anterior communicating aneurysms are rare. We report a 56-year-old male patient who underwent WEB spoiler device combined with coil embolization for ruptured anterior communicating aneurysms and benefited from it. Considering that the patient's aneurysm had ruptured and immediate hemostasis was urgently needed, a coil was introduced to reduce the patient's bleeding risk, in an effort to achieve immediate hemostasis. Considering that the patient's aneurysm morphology was long and narrow, WEB alone was not enough to completely occlude the aneurysm. The combined use of coils can ensure that the aneurysm neck is properly occluded and the aneurysm head is completely embolized. This article details the preoperative evaluation of the patient's condition, the surgical plan, and the postoperative management. The results of this case confirm the feasibility of WEB combined with coil embolization in patients with ruptured aneurysms.

Keywords: Anterior communicating artery aneurysm, subarachnoid hemorrhage, ruptured intracranial aneurysms, Woven EndoBridge, coil

Introduction

Subarachnoid hemorrhage caused by ruptured intracranial aneurysms (RIA) is a cerebrovascular disease that seriously endangers human health [1, 2]. Among them, anterior communicating artery aneurysms (ACoA) located at the junction of the circle of Willis have a high rupture rate [3] and are difficult to operate on [4]. In recent years, with the development of interventional materials and technologies, interventional embolization has become the main method for treating ruptured anterior communicating artery aneurysms [5]. Currently, "Y"-shaped and "T"-shaped stent-assisted coil embolization or balloon-assisted coil embolization are commonly used in clinical practice, but the immediate haemostasis effect during the operation is poor, and overcoming the problems of aneurysm recurrence, branch vessel stenosis or occlusion is still difficult, and the operation process is complicated, with a high incidence of thrombosis occurring during and after the operation [6]. WEB is representative of the newly emerged intratumoral flow disturbance devices [7]. It can be placed in the tumour body to self-expand, thereby blocking the aneurysm neck and disturbing blood flow to close the bifurcation aneurysm and the wide-necked bifurcation aneurysm. It can also increase aneurysm wall strength, overcoming the shortcomings of traditional blood flow guidance devices, such as high long-term recurrence rates and branch vessel stenosis or occlusion [8-11]. This article reports the diagnosis and treatment of a case of WEB-assisted coil embolization for anterior communicating aneurysm rupture, with the aim of providing clinical treatment experience.

Materials and methods

A retrospective analysis was conducted on the treatment process of a 56-year-old male patient

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with anterior communicating artery rupture who underwent WEB turbulence device combined with coil embolization and benefited from it.

Case presentation

Chief complaints

Paralysis of the lower limbs leading to incontinence for 21 hours.

History of present illness

The patient was a 56-year-old male admitted to the hospital on December 16, 2023, presenting with lower limb paralysis and incontinence for 21 hours. The patient had fallen due to dizziness and lower limb weakness without an apparent cause 21 hours earlier. No other complications, such as nausea and vomiting, were present. He had sought emergency treatment at a local hospital, where a plain scan and enhancement of cranial magnetic resonance angiography (MRA) and cerebral vascular magnetic resonance (using the TOF method) were conducted. The findings indicated: 1. An abnormal signal in the anterior cerebral artery course area of the suprasellar cistern, suggesting an aneurysm with partial thrombosis and perifocal edema; 2. Subarachnoid hemorrhage; 3. Hemorrhage in the ventricular system; 4. Local stenosis of the lumen of the bilateral middle and posterior cerebral arteries (follow-up recommended); and 5. Manifestations of intracranial atherosclerosis. The patient was transferred to our hospital with a diagnosis of "subarachnoid hemorrhage". Since then, the patient's onset of the disease, appetite, sleep, urination, and defecation have been normal, and his mental state has been stable. He had a history of hypertension for 8 years, with a maximum blood pressure of 210/120 mmHg, and had not taken antihypertensive medication in a timely manner. He had also been suffering from diabetes for 10 years without regular treatment and had unsatisfactory blood sugar control. When experiencing hyperlipidemia, he did not take lipid-lowering drugs promptly. Physical examination at our hospital revealed a body temperature of 37°C, a heart rate of 109 beats per minute, and a blood pressure of 182/118 mmHg. The patient was diagnosed with "rupture of the anterior cerebral-anterior communicating artery aneurysm with subarachnoid hemorrhage". After excluding surgical contraindications, the patient underwent "whole cerebral angiography + anterior communicating artery aneurysm WEB spoiler device combined with coil embolization" on December 16, 2023.

History of past illness

The patient had a history of diabetes for more than 10 years, which had not been formally treated, and had poor blood sugar control. When the patient was suffering from hyperlipidaemia, he did not take lipid-lowering drugs in time.

Personal and family history

He had high blood pressure for 8 years, the highest was 210/120 mmHg, and he did not take antihypertensive drugs in time. He had had diabetes for 10 years, but he did not receive regular treatment, and his blood sugar control was not satisfactory. He had hyperlipidaemia and did not take antihypertensive drugs in time. He had no personal or family history of drug abuse. He had smoked for 20 years, averaging 40 cigarettes/day, and had quit smoking for 15 years. He had a history of drinking alcohol, with 50 milliliters of alcohol consumed every day. His father had cerebral infarction, his mother had cerebral infarction, his brother had cerebral thrombosis, and his sister had hemiplegia. His father and mother are deceased: the father succumbed to cerebral thrombosis, and the grandmother passed away due to hemiplegia.

Physical examination

T 37°C; HR 80 times/min; P 109 times/min; R 17 times/min; BP 182/118 mmHg. Physical examination revealed the following: normal spinal movement of the spine and limbs, no scoliosis, lordosis, kyphosis, no tenderness or percussion pain, free movement of the upper limbs, no deformity, varicose veins of the lower limbs, clubbing of the fingers (toes), and oedema. No redness, swelling, pain, tenderness, effusion, limited range of motion, deformity, or muscle atrophy occurred. Nervous system tests revealed the following: normal abdominal wall reflexes, normal muscle tone, muscle strength grade V, lower limb paralysis, normal bilateral bicipital and triceps tendon reflexes, abnormal bilateral knee and Achilles tendon reflexes,

bilateral Babinski's sign negative, bilateral Hoffmarm sign negative, and Kernig's sign negative. The National Institutes of Health Stroke Scale (NIHSS) score was 15 points (2 points for consciousness, 1 point for gazing, 2 points for dysarthria, 2 points for partial facial paralysis, and 8 points for limb weakness). The modified Rankin scale (MRS) score was 4.

Laboratory examinations

Magnetic resonance imaging of the head in the outer hospital + enhancement, cerebrovascular magnetic resonance (TOF method) display. 1. an abnormal signal in the course of the anterior cerebral artery in the suprasellar cistern, which was considered an aneurysm with partial thrombosis and perifocal oedema; 2. subarachnoid haemorrhage; 3. blood accumulation in the ventricular system; 4. local stenosis of the lumen of the bilateral middle and posterior cerebral arteries (follow-up recommended); and 5. manifestations of intracranial atherosclerosis.

Imaging examinations

The patient was admitted in an ambulance with limited mobility in a coma state. We obtained MRA results from external hospitals and confirmed the diagnosis; therefore, no additional imaging examinations were performed. Please refer to the results of intraoperative digital subtraction angiography for detailed information.

Final diagnosis

The diagnosis based on physical and auxiliary examinations was as follows: (1) rupture of anterior cerebral-anterior communicating artery aneurysm with subarachnoid haemorrhage; (2) diabetes; (3) hypertension stage 3 (high risk); (4) group C hyperlipidaemia; (5) cerebral artery atherosclerosis; and (6) cerebral vascular stenosis.

Multidisciplinary expert consultation

After consultation with experts from the Department of Neurology, Department of Neurosurgery, Department of Interventional Radiology, and Department of Emergency, they unanimously decided to perform whole-brain angiography of the anterior communicating artery aneurysm with a WEB spoiler device combined with coil embolization.

Treatment

The patient was placed in the supine position and anaesthetized. The groin area was disinfected and covered with sterile towels. The right femoral artery was punctured, and an 8F catheter sheath was introduced. Under the coordination of the guidewire, aortic arch angiography was performed with a 5F pigtail catheter, and whole-brain angiography was performed with a 5F vertebral artery catheter. The results revealed that an aneurysm was visible in the anterior communicating artery, which was approximately 6.6 mm*14 mm in size, approximately 3.5 mm long at the neck of the aneurysm, 2.2 mm in diameter at the distal end and 2.3 mm in diameter at the proximal end. The 8F Calvada (Changyi Da) long sheath was delivered to the C2 segment of the left internal carotid artery with an ultrasmooth guidewire, and the 6F intermediate catheter (Changyi Da) was delivered to the C6 segment of the left internal carotid artery with an ultrasmooth guidewire. A Synchro-14 microguidewire with an Echelon-10 microcatheter was used to access the aneurysm cavity. A NUMEN 5 mm*10 cm spring coil was inserted along the microcatheter. Then, Via-21 was superselectively delivered to the aneurysm with the Synchro-14 microguidewire, and the flow disturbance device WEB (7 mm*5 mm) was delivered to the aneurysm. The device was slowly released at multiple angles. The contrast agent in the tumour was obviously retained during reexamination, and no contrast agent overflow was observed. The tumour neck was fully covered (**Figure 1**), and the indwelling microcatheter was removed. The operation went smoothly, the puncture port was blocked with Exoseal, fixed and bandaged, and the patient was safely returned to the ward. After the operation, symptomatic supportive treatment, such as hypotension, intracranial pressure reduction, anti-infection, electrolyte disorder correction, peritoneal effusion drainage, and nerve nutrition, was given.

Results

Following the operation, nitroglycerin injection was administered via a micro-pump to lower the patient's blood pressure, which was then continuously monitored. Additionally, mannitol injection was given to reduce intracranial pressure. To nourish the nerves and enhance circu-

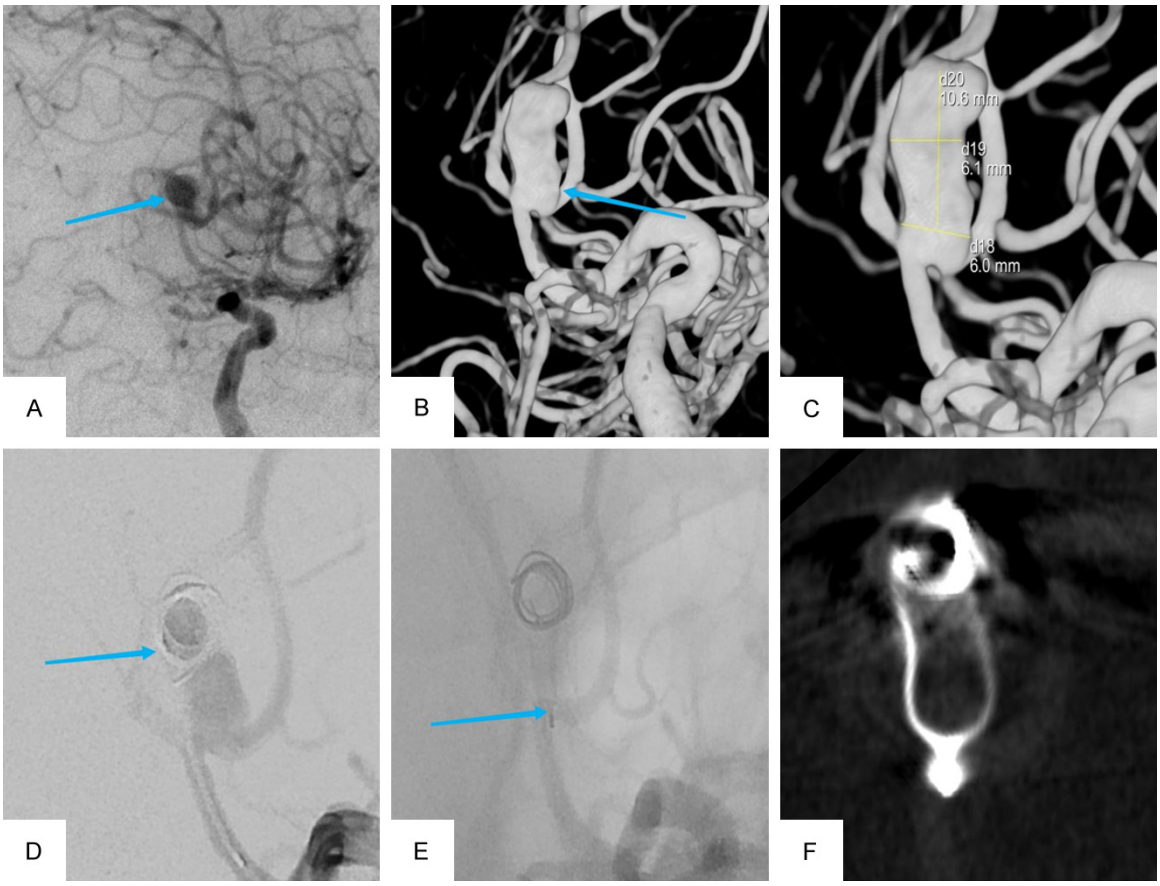

Figure 1. A. Digital subtraction angiography (DSA): showed the aneurysm of the anterior communicating artery before operation; B. The size of the anterior communicating artery aneurysm was measured before operation; C. One NUMEN 5 mm*10 cm coil was introduced along the microcatheter; D. The flow disturbance device WEB (7 mm*5 mm) was sent to the aneurysm; E. The aneurysm was completely undeveloped after operation, there was no residual embolism at the neck of the aneurysm, and both anterior cerebral arteries were unobstructed. F. Postoperative follow-up angiography: the contrast agent was obviously retained in the aneurysm, no contrast agent overflow was observed, and the neck of the aneurysm was fully covered.

lation, the patient received glycerin fructose, nimodipine, sodium butylphthalide chloride, and compound brain peptide ganglioside injection. Furthermore, treatments were actively administered to combat infection, correct electrolyte imbalances, and provide other supportive symptomatic care. Physical examination on the 5th day after surgery: T 36.5°C; P 109 times/min; R 18 times/min; BP 130/80 mmHg. Specialized examination: bilateral pupils were equal in size and round, with a diameter of 3 mm, sensitive to light, and normal accommodation reflex. Abdominal wall reflex was normal, muscle tone was normal, right upper limb strength was grade V, left upper limb strength was grade V, right lower limb strength was grade V, left lower limb strength was grade V, bilateral biceps and triceps tendon reflexes were normal, bilateral knee and Achilles tendon reflexes were normal, bilateral Babinskis's sign was negative, bilateral Hoffmarm's sign was negative, and Kernig's sign was negative. On the 6th day after surgery, the patient had a routine blood test: white blood cell count 11.94×10^9/L, neutrophil percentage 79.5%, electrolytes: potassium 2.93 mmol/L. Oral potassium chloride sustained-release tablets and intravenous potassium supplementation. On the 9th day after surgery, a head CT scan (**Figure 2**) revealed postoperative changes in the intracranial anterior communicating artery aneurysm and ventricular hemorrhage; electrolyte recheck: potassium 4.07 mmol/L. On the 14th day after surgery, the patient's muscle tone was normal, the strength of the limbs was grade V, and the bilateral knee and Achilles ten-

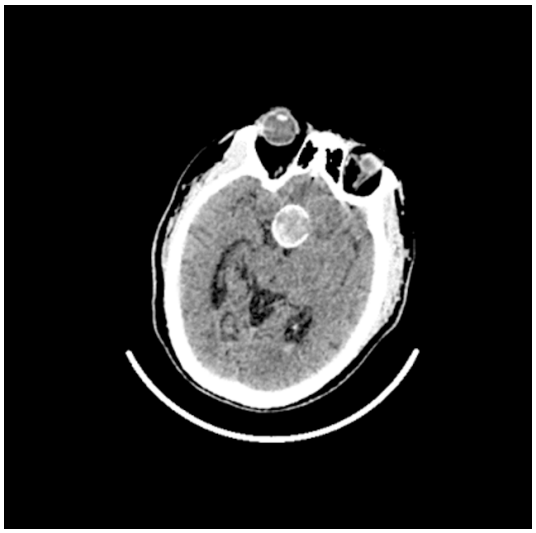

Figure 2. CT scan on the 9th day after surgery: The amount of bleeding was significantly improved compared with before the operation.

don reflexes were normal. He was discharged from the hospital on 2024-01-02. The MRs and NISHH scores were 0 points at the 3-month follow-up after surgery. The patient recovered well without postoperative complications.

Discussion

Endovascular treatment for RIA includes surgical clipping and intravascular interventional embolization [4] (**Table 1**). Surgical clipping has the disadvantages of substantial surgical trauma, complex intraoperative operations, long recovery periods, and poor patient acceptance [19].

The WEB device used in this case was an intratumoral perturbation mesh device designed specifically for the treatment of wide-necked aneurysms in the bifurcation of intracranial vessels. The mesh wires at both ends shrink into a cage shape through development markings to block the aneurysm neck and perturb the flow, thereby causing blood stasis in the bifurcated intracranial aneurysm to be occluded [20, 21]. Compared with conventional surgical options such as stent placement and simple coil embolization for the treatment of ACoA, the WEB device has the following advantages: (1) it overcomes the disadvantages of traditional blood flow guidance devices, such as long-term recurrence, branch vessel stenosis or occlusion [22]; (2) it is simple to perform during the operation; (3) it does not require dual antiplatelet therapy during the perioperative period and can effectively treat RIA [23]; and (4) according to the aneurysm morphology, WEB can properly handle the aneurysm neck position and protect the blood flow of the bilateral anterior cerebral arteries. Many clinical studies have confirmed that the intraoperative haemostasis rate of WEB for ruptured aneurysms is 100%, and the clinical prognosis rate is approximately 95.1%, all supporting its good safety and effectiveness [24-26]. Introducing one coil during surgery can achieve better immediate haemostasis during surgery and reduce the risk of bleeding in patients.

In this case, the patient had a ruptured aneurysm and was in critical condition, and he urgently needed immediate haemostasis. Simple WEB focuses on blood flow disturbance and cannot quickly achieve immediate haemostasis. In addition, the aneurysm in this patient was long and narrow, as shown in **Figure 1B**. The long axis length of the aneurysm was 10.6 mm, and the WEB length was not sufficient to reach the distal end of the aneurysm. Therefore, the distal end needed to be filled with one coil to ensure that the aneurysm head was completely embolized and that the aneurysm neck was properly treated.

As shown in **Figure 1E**, the aneurysm was completely undeveloped after surgery, there was no residual embolism at the neck, and both anterior cerebral arteries were unobstructed. Compared with **Figure 1E**, a small amount of contrast agent can be seen in the aneurysm after simple WEB embolization. In this case, WEB combined with coil angiography revealed no contrast agent residue, and the aneurysm was completely embolized.

Clinically, WEB combined with balloon or stent-assisted embolization is often used to adjust the verticality between the long axis of the aneurysm and the aneurysm neck so that the tip of the microcatheter can reach the optimal position, solving the problems of unsatisfactory positioning and poor wall adhesion during WEB release, incomplete aneurysm embolization, stenosis or occlusion of the flow-carrying artery, etc [27]. In this case, since the verticality between the long axis of the aneurysm and the aneurysm neck did not need to be adjusted and coil-assisted embolization had a good

Table 1. Literature review

Case	Age/Gender	Ruptured blood vessel	Treatment	Outcome
Kwon WK et al. 2013 [12]	59/Female	A1	Surgical clipping	-
Brassel F et al. 2016 [13]	63/Male	A1	Kissing-Y stent	Survival
Lv X et al. 2021 [14]	36/Female	M1	Solitaire AB stent	Survival
Kubota Y et al. 2023 [15]	64/Female	A1	Surgical clipping	Survival
Ahn HS et al. 2024 [16]	51/Male	A1	Neuroform Atlas stent	Survival
Toader C et al. 2024 [17]	71/Female	pericallosal	Surgical clipping	Survival
Koutsouras GW et al. 2024 [18]	15-month-old/male	A2	Surgical clipping	Survival

immediate haemostatic effect, WEB combined with coil embolization was selected for the ruptured aneurysm after comprehensive consideration.

This study suggests that the use of WEB combined with coils to treat ruptured anterior communicating artery aneurysms is effective and safe, has high clinical value, and can be extended to ruptured aneurysms at other bifurcations and wide-necked aneurysms. However, because the WEB device is a new aneurysm embolization device that is used in China and the follow-up time of this case was short, multicentre, large-sample studies are still needed to further verify its safety and mid- and long-term efficacy.

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Disclosure of conflict of interest

None.

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