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Diagnosis and treatment of pericallosal artery aneurysms

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ABSTRACT

Objective: Pericallosal artery aneurysms are not common clinically. The microsurgery and endovascular therapy are surgically challenging operations. The objective of the study is to summarize their clinical symptoms and optimal treatment strategies of pericallosal artery aneurysms.

Methods: Nine cases of pericallosal artery aneurysms detected by digital subtraction angiography (DSA) were reviewed. The clinical manifestation, brain imaging characteristics, and optimal treatment methods were summarized.

Results: Patients with spontaneous aneurysm had good clinical outcomes after endovascular coiling or microsurgical clipping treatment. There were no any neurological function deficits in five patients. One patient suffered from permanent neurological function deficits. Patients with traumatic aneurysm pericallosal had relatively poor outcomes, including two patients showing disturbed consciousness and the paralysis of the lower limbs with slow recovery, and one patient was dead after the surgery.

Conclusion: Spontaneous subarachnoid hemorrhage and interhemispheric fissure hematoma suggest spontaneously pericallosal aneurysm, while traumatic corpus callosum hematoma as well the accompanying embryo of intraventricular hemorrhage suggest traumatic pericallosal aneurysm. Endovascular embolization is the primary surgical treatment for pericallosal aneurysm, while patients with pericallosal aneurysm are not suitable for surgical treatment. Microsurgical clipping treatment may be a choice. However, both of these treatment strategies have high risk.

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1. Introduction

Pericallosal artery aneurysms are uncommon clinical disease, accounting for about 5% of intracranial tumors [1–3]. It can be divided into two types: spontaneously pericallosal aneurysm and traumatic pericallosal aneurysm. Pericallosal aneurysm has special anatomical location and low incidence. The clinical manifestations, imaging symptoms and treatment strategies are different from conventional skull base aneurysm. It is also easy to be misdiagnosed and delayed in the clinical treatment, which will result in disability, death because of recurrent bleeding. Once discovered, pericallosal aneurysm should be actively treated. The direct surgical clipping of these aneurysms via an interhemispheric approach [4–7] or endovascular treatment of cerebral aneurysms using detachable coils were always choose [1–3,8,9]. However, the direct surgical clipping approach is challenging due to the limited surgical exposure [3–5], especially within the swollen brain after subarachnoid hemorrhage. It is necessary to sacrifice a bridging vein for adequate surgical exposure, and thus postoperative morbidity has been reported in a relative high frequency (with an incidence risk of 0–25%). In recent years, with the development of microcatheters, guidewires and coil materials, the performance of intracranial intravascular operation has been improved greatly. However, coiling of pericallosal artery aneurysms is also not possible in some cases owing to the distal location [1,2,9].

In this study, we reported the clinical and angiographic results of nine patients with spontaneous or traumatic pericallosal artery aneurysms, who were treated with endovascular embolotherapy or microsurgical clipping operation.

2. Materials and methods

2.1. Patients

The clinical data of nine patients with pericallosal aneurysms (six males and three females), were comprehensively reviewed. The aged from 18 to 62 years (mean ages of 37.2 years). Among them, six patients suffered from spontaneity pericallosal aneurysm, including five patients arising from spontaneous subarachnoid hemorrhage, and one patient discovered from MRA scanning due to chronic headache. Three patients suffered from traumatic pericallosal aneurysms, including two patients arising from traffic accident injuries, and one patient due to falling injuries, manifesting as disturbance of consciousness after traumatic brain injury, traumatic intracranial hematoma, and ventricular casting. Five patients (3 patients with traumatic pericallosal aneurysms, two patients with spontaneity pericallosal aneurysm) showed coma, varying degrees of intracranial hypertension and were manifested as severe headache accompanied by vomiting. Three patients with spontaneous pericallosal aneurysm were in the state of between somnolence and lethargy and without coma. One patient with unruptured aneurysms week had clear mind state.

According the definition of Hunt-Hess grades, (1) Grade I: one patient; (2) Grand II: three patients; (3) Grand III: four patients; (4) Grand IV: one patient. Six patients had different degrees of unilateral or bilateral paraparesis. Four patients had sphincter dysfunction, manifested as urinary incontinence. Two patients had varying degrees of mental symptoms manifested as being indifferent to external reaction and cognitive dysfunction. Most of patients with traumatic pericallosal aneurysm showed bleeding-hematoma and organizing-rebleeding patterns.

2.2. Imaging examination and treatment

For the patients with Hunt-Hess I-II, digital subtraction angiography was examined in acute bleeding stage (1–3 days after subarachnoid hemorrhage) to confirm it and the operation was carried out immediately. For the patients with Hunt-Hess III-IV, digital subtraction angiography was examined in acute bleeding stage (1–3 days after subarachnoid hemorrhage) to confirm it, but the operation were carried out after the peak of cerebral vasospasm. Three patients with traumatic pericallosal aneurysms and four patients with spontaneous pericallosal aneurysm received endovascular embolotherapy. Among them, two cases of traumatic pericallosal aneurysm and three cases of spontaneous pericallosal aneurysm received only coils intratumoral therapy, while one case of traumatic pericallosal aneurysm also received detachable balloon to occlude pericallosal artery that is close to aneurysms due to thin parent artery the one patient with pericallosal artery and callosomarginal artery bifurcation distal spontaneous aneurysms received detachable balloon to occlude pericallosal artery which is close to aneurysms. One patient with spontaneous pericallosal aneurysm received the therapy through clipping of pericallosal aneurysm by interhemispheric approach. And the remaining one patient with multiple aneurysms received aneurysm clipping surgery by the left-wing point and longitudinal joint approach.

3. Results

According to the CT examination, patients with spontaneous pericallosal aneurysm (Fig. 1A) had a small amount of spontaneous subarachnoid hemorrhage and interhemispheric fissure hematoma, mainly locating in the front of the corpus callosum. Patients with traumatic pericallosal aneurysm (Fig. 1D) had interhemispheric fissure hematoma, accompanied with recurrent intraventricular hemorrhage in a law of bleeding-hematoma formation and machine-rebleeding.

Digital subtraction angiography (DSA) examination revealed that all patients had pericallosal aneurysm and ten aneurysms were detected in total. Eight cases had solitary aneurysm, while one case had multiple aneurysms, which was cystic. The pericallosal aneurysms for six cases were located in the bifurcation of pericallosal artery and callosomarginal artery. In two cases, it was located in the anterior cerebral artery and frontopolar artery bifurcation aneurysm. For one case, it was located in the pericallosal artery and callosomarginal artery bifurcation distal aneurysm. Three cases were left-side pericallosal aneurysm, while six cases were right side of the corpus of peripheral aneurysm. The diameter of aneurysm was 3–10 mm in size. The case with multiple aneurysms had

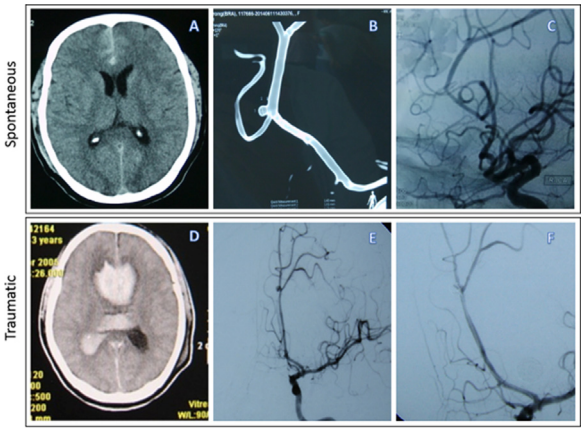

Fig. 1 – CT and DSA images from two representative patients with spontaneous (upper) and traumatic (lower) pericallosal aneurysm. Anterior interhemispheric fissure presented a small amount of bleeding in spontaneous pericallosal aneurysm (A). Pericallosal aneurysm was in morphological rule, with tumor body upwards (B). Pericallosal aneurysm was no longer recurrent six month after clipping operation (C). Traumatic corpus callosum hematoma was presented accompanying embryo of intraventricular hemorrhage in traumatic pericallosal aneurysm (D). Pericallosal aneurysm was not in morphological rule, with absent of aneurysms neck (E). Pericallosal aneurysm was no longer recurrent six month after spring coil embolization (F).

left anterior cerebral artery-pericallosal artery aneurysms, complicated by ipsilateral posterior communicating artery aneurysm.

More specifically, the aneurysms of spontaneous pericallosal aneurysm were mainly located above the anterior communicating artery bifurcation, pericallosal artery from the anterior cerebral artery and callosomarginal artery bifurcation (Fig. 1B). The tumor body was in the forward direction, and the aneurysm neck was very obvious in morphological rules, there was absence of delayed contrast agent filling and delayed emptying (Fig. 1B). In contrast, the aneurysms of traumatic pericallosal aneurysm were mainly located in the pericallosal artery and were from the anterior cerebral artery or bifurcation of the corpus marginal arteries to the peripheral artery distal corpus. The irregular shape (gourd-like or dumbbell-like), no obvious presence of aneurysm neck he presence of delayed contrast agent filling and delayed emptying were shown.

All patients received surgical treatment. One case of level-1 aneurysm chose selective surgery. Three case of level-2-subarachnoid hemorrhage chose early surgery. Four cases of level-3 and level-4 aneurysm chose late surgery (SAH or post-trauma 14 days). After treatment with endovascular embolotherapy or microsurgical clipping operation, patients with spontaneous aneurysm recovered well (hospital stay of 14–52 days with mean of 19 days). Five patients were cured and did not show any neurological function deficits. One patient suffered from permanent neurological function deficits, mainly due to the declining of the lower limbs muscle strength after applying detachable balloon to occlude the pericallosal artery. Patients with traumatic aneurysm pericallosal recovered relatively poor, including two patients showing disturbed consciousness and the paralysis of the lower limbs with slow recover, and one patient die away seven days after the surgery due to the recurrent hemorrhage, brain damage and severe intracranial hypertension.

The patients were followed up. DSA examination showed that no aneurysm was developed for the eight patients (Fig. 1C and F). GOS prognostic score within 3–12 months (mean of 8 months) showed that five patients recovered well, 1 patient had severe disability, 2 patients had coma, and 1 patient died.

4. Discussion

The diagnosis and treatment of pericallosal aneurysms should be conducted as early as possible, which will prevent rebleeding. Endovascular embolization is primarily considered for both spontaneous and traumatic pericallosal aneurysm to block aneurysm cavity and reserve parent artery patency [2,3,8–10]. Several ways of endovascular coiling have been proposed, including detachable balloon, micro coil, and intravascular stents [1,9]. In the present study, seven patients with pericallosal aneurysms (four for spontaneous and three for traumatic) accepted endovascular embolotherapy, and six patients recovered well without recrudescence (Fig. 1C), except one patients with traumatic pericallosal aneurysms. For the remaining two patients with spontaneous pericallosal aneurysms, we adopted the craniotomy clipping treatment strategy. One patient received interhemispheric approach and the other patient accepted wing-point joint interhemispheric approach through pericallosal aneurysm surgery. The clipping treatment can be applied to aneurysm (1) in the peripheral artery distal corpus, (2) with severe artery hardening distortions, or severe vasospasm, difficult to micro-catheter into the aneurysm cavity, (3) with multiple aneurysms (Fig. 1F).

In summary, spontaneous subarachnoid hemorrhage and interhemispheric fissure hematoma suggest spontaneously pericallosal aneurysm, while traumatic corpus callosum hematoma as well the accompanying embryo of intraventricular hemorrhage suggest traumatic pericallosal aneurysm. With the application of DSA, the pericallosal aneurysm are easily diagnosed and the treatment should be carried out as early as possible. Endovascular coiling is the primary treatment for both spontaneous and traumatic pericallosal aneurysm. The embolism strategies should be designed according to the patient's clinical data.

Conflict of interest

None declared.

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