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Endovascular Treatment of Unruptured Intracranial Aneurysm and Related Literature Review

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Abstract

Aneurysm formation is multifactorial, and specific risk factors are associated with the incidence and rupture of aneurysms. The prevalence of aneurysms in people without comorbidities was 2%, the mean age was 50 years, and 33% were male [1], while several other literature showed that the risk of aneurysm rupture was 1%-2.3%[2-3]. In addition to common smoking, alcohol consumption, hypertension, etc. [4,5,6], autosomal genetic diseases, polycystic kidney, Ehler-Danlos syndrome, myofibrodysplasia, Finnish and Japanese people, and female patients are generally at higher risk for aneurysm incidence, growth, and rupture [7]. Our research group recently admitted a patient with multiple intracranial aneurysms, and after evaluation, it was considered that the patient had a high rupture rate, so we adopted endovascular embolization therapy, that is, the spring coil filled with baskets.

1. Introduction

In recent years, the vast majority of cerebral aneurysm patients have been treated with one of two reconstruction methods: craniotomy microsurgical occlusion of the tumor bearing artery reconstruction, or intracapsular treatment, in which the detachable spring coil is placed into the aneurysm sac to generate thrombus, so that the aneurysm can be excluded from the intravascular treatment outside the tumor bearing artery circulation. However, endovascular techniques for the treatment of brain aneurysms offer a less invasive option than surgical clamping. Coil embolization of aneurysms at specific sites has fewer complications. In particular, after the Guglielmi detachable coil (GDC) was approved by the U.S. Food and Drug Administration (FDA) in 1995, the results of the International aneurysmal Subarachnoid Hemorrhage Test (ISAT) gave coil a wide acceptance for the treatment of ruptured and unruptured aneurysms [8-9].

2. Case Description

A 69-year-old female patient with intermittent episodes of dizziness was presented to the cerebrovascular department with "multiple intracranial aneurysms" for more than 1 month. In the process of questioning, it was found that hypertension for more than 30 years, dizziness attack process, not accompanied by nausea and vomiting, and no numbness of the limbs. He had an intracranial aneurysm clipped in 2020. Neurological examination showed no obvious abnormality.

Routine CTA shows [FIG 1]: 1. Postoperative modification of craniocervical aneurysms. 2. Bilateral internal carotid artery stenosis. 3. Bilateral vertebral arteries are slender. 4. Left middle cerebral artery M1 aneurysm. 5. Right middle cerebral artery M2 aneurysm. 6. Right embryonic posterior cerebral artery. In order to further confirm the diagnosis, DSA pancerebral angiography under local anesthesia was arranged in time [FIG 2]: conventional supine position, surgical sheet was laid after disinfection, right femoral artery puncture, 5F catheter sheath was inserted, 5F angiography catheter was sent, and left and right internal carotid artery and left and right vertebral artery angiography were performed respectively. The results showed that the right posterior communicating aneurysm was well clipped, the aneurysm did not develop, and the left middle cerebral artery aneurysm. In a comprehensive evaluation of the left middle cerebral artery aneurysm, we performed a left aneurysm coil embolization.

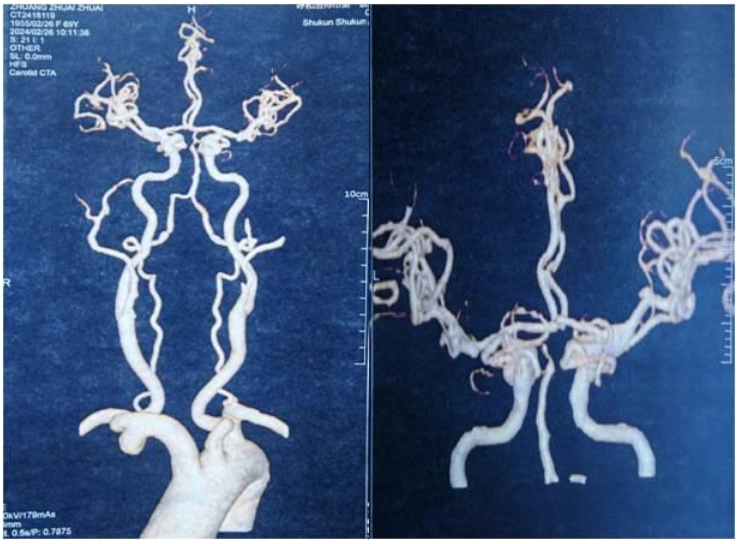

Fig 1. *CTA showed: 1. Postoperative modification of craniocervical aneurysms. 2. Bilateral internal carotid artery stenosis. 3. Bilateral vertebral arteries are slender. 4. Left middle cerebral artery M1 aneurysm. 5. Right middle cerebral artery M2 aneurysm. 6. Right embryonic posterior cerebral artery.*

Fig 2. *DSA showed that the right posterior communicating aneurysm was well clipped, the aneurysm did not develop, and the left middle cerebral artery aneurysm.*

Fig 3. *Coil embolization of left middle cerebral artery aneurysm. (Yellow arrow: aneurysm)*

3. DISCUSSION

Intracranial aneurysm is one of the major public health problems at present. The annual incidence of subarachnoid hemorrhage caused by spontaneous aneurysm rupture is high, and about 10% of patients die before arriving at the hospital, while the main factors affecting the disability rate and mortality of survivors of primary rupture are the risk of rebleeding and cerebrovascular spasm [10-11]. Since up to 50% of patients with subarachnoid hemorrhage eventually die from hemorrhage, it is urgent to develop a set of scientific bleeding risk assessment methods and active intervention measures.

In terms of patient selection, unless a large number of intracerebral hematoma or inappropriate geometry are involved, embolization of ruptured aneurysms should be considered. In this regard, surgical splinting or endovascular treatment should be decided in a multidisciplinary and multi-professional collaborative manner. Generally speaking, narrow-neck aneurysms have more suitable geometric shapes, such as patients with arterio-to-neck ratio greater than 2 are also suitable for filling with spring rings. These cases are placed in each loop in the lumen sequentially, and are more likely to stay in the lumen. In contrast, in a wide-necked aneurysm, the spring loop is more likely to burst into the vessel. Aneurysms with a neck greater than 4mm or a body neck ratio less than 2 are considered to have an inappropriate shape. In addition, the types of aneurysms that are not suitable for embolization include aneurysms involving branch points in the neck of the tumor, and aneurysms whose anatomical structure is still not defined by 3D angiography (such as aneurysms involving bifurcated or tripartite segments of the middle cerebral artery). If an aneurysm embolization is performed under these conditions, the surgical consequences can be catastrophic. Fortunately, in this case, embolization can be performed with auxiliary means such as blood flow reconstruction devices [12]. In this case, the patient underwent prophylactic surgery for an unruptured aneurysm. In view of the high incidence of aneurysm rupture, our team carefully evaluated the results and decided to intervene the patient's aneurysm in advance to prevent the catastrophic consequences caused by rupture and bleeding. For unruptured aneurysms, we first administer systemic heparinization and monitor active coagulation time (ACT) at 250-300s. When the guide catheter is placed in the appropriate position of the tumor carrier artery, a one-time mass injection of 3000-5000U heparin is given, and 1000U heparin is supplemented every hour during the operation. But, for ruptured aneurysms. To be on the safe side, we usually start the whole body heparinization after the first spring is inserted in the body. If the aneurysm ruptures during surgery, protamine or platelets and despressin acetate neutralizing heparin or antiplatelet agents are given, respectively, and the aneurysm is embolized until complete occlusion occurs. If thromboembolic events occur, additional heparinization or transarterial thrombolysis is required.

4. Conclusion

Intracranial aneurysm embolization was initially only used for the treatment of aneurysms that were not suitable for surgical clamping. With the conclusion of doctors all over the world, some convincing evidence gradually suggested that coil embolization was a safe and effective treatment method to replace traditional craniotomy clamping for suitable selected cases, and the application opportunity of this technology was increasing. Endovascular therapy is a feasible alternative treatment for ruptured or unruptured aneurysms that are difficult or impossible to be treated surgically due to their size, shape and location.

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6. Author Contributions

An Juan, Ruhong Wu contributed equally to this work.

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