

Original Article

Effect of clipping anterior communicating artery aneurysms via pterional approach contralateral to supply of dominant blood: report of 15 patients

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Abstract: Background and purpose: Anterior communicating artery aneurysm (ACoAA) is a common cerebrovascular disease. This research is to observe the curative effect and safety of clipping anterior communicating artery (ACoA) aneurysms by microsurgery through the pterional approach contralateral to supply of dominant blood. Materials and methods: Before the surgery, three-dimensional-DSA (3D-DSA) was performed to study the regional anatomy of ACoA complexes in all 15 patients with ACoA aneurysms. According to 3D-DSA, the aneurysms and ACoA complexes could be satisfactorily exposed by the microsurgery through the pterional approach contralateral to the supply of dominant blood. And then the microsurgery through the pterional approach contralateral to the supply of dominant blood was performed in 15 patients with ACoA aneurysms. Results: Clipping of ACoA aneurysms were successfully performed in all patients. The aneurysms and ACoA complexes were satisfactorily exposed via 3D-DSA. Among 15 patients with ACoA aneurysms, 14 cases were cured and 1 case need further care. Conclusions: The ideal side of pterional approach may be cheese via simulation of pterional approach with 3D-DSA. The ACoA complex and aneurysm can be clearly exposed, and the aneurysm may be smoothly clipped safely by the microsurgery through the ideal side pterional approach contralateral to supply of dominant blood in the patients with ACoA aneurysms.

Keywords: Anterior communicating artery aneurysm, operative approach, microsurgery, pterional approach contralateral, three-dimensional-DSA

Introduction

Anterior communicating artery aneurysms (ACoAA) is a common cerebrovascular disease, which could cause aneurysmal subarachnoid hemorrhage (aSAH), about 21.0%~25.5% of percent of spontaneous subarachnoid hemorrhage (SSAH) [1-3]. In the past 30 years, with the rapid development of nerve surgery and endovascular treatment technique, disabling and fatality rate of aneurysmal SAH has fallen. In recent years, with the development of CTA, MRA and 3D-DSA, more and more patients with intracranial aneurysms have been detected [4, 5]. The prevention and treatment of intracranial aneurysms would be an important problem for patients and doctors. Otherwise, this would increase the burden of family and society.

At present, the treatment of anterior communicating artery aneurysms includes endovascular

interventional surgery and microsurgery clipping surgery. Microscopic surgery is still a very important treatment. There are two approaches in the treatment of anterior communicating artery aneurysms, pterion approach and the approach between the hemispheres [6, 7]. There are several changes in pterion approach, including additional lateral supraorbital approach and frontotemporal orbital zygomatic approach, etc [8].

In the surgery of clipping of intracranial aneurysm, proximal control as a technique is often used. So in clinic, the pterional approach of the supply of dominant blood was often performed in the microsurgery of clipping of anterior communicating artery aneurysms [9, 10]. However, the local anatomy of communicating artery complex is very complicate, in some conditions aneurysm was shade by communicating artery complex and very difficult to be clipped, such as



Figure 1. The right internal carotid artery angiography. Artery A_1 segment on the right side of the brain and anterior communicating artery imaging were not seen.



Figure 2. The left internal carotid artery angiography. Artery A_2 segment of bilateral was seen and the aneurysm was located between the A_2 section.

artery tumors located in the A_2 section of the anterior cerebral artery between bilateral [11-13]. So the operative approach to expose completely the artery tumors is very important for the effect of clipping of intracranial aneurysm. In our present research, we performed the microsurgery through pterional approach contralateral to supply of dominant blood in 12 patients and determined its effect in clinic.

Clinical data

Patients' information

15 patients with anterior communicating artery aneurysms had disease because of spontaneous subarachnoid blood and were cheese in our present research. There were 7 males and 8 females, and the average age was 56 (between 38 and 69). In 14 cases the time from onset to surgery was 1-14 days. According to Hunt-Hess degrades, there were 3 cases with I degrade, 6 cases with II degrade, 5 cases with III degrade; only one with IV degrade. According to CT imaging data, there was visible subarachnoid hemorrhage in all 15 patients, at the site of longitudinal crack, saddle pool, lateral fissure pools and pool between brain pool, etc. At the same time, there was intraventricular hemorrhage in 9 cases.

Diagnosis and preoperative planning

Before surgery, all patients were performed the detection of three dimensional-DSA (Innova 3100, Co. GE). In three-dimensional mode of AW workstation, the relationship of artery aneurysm and anterior communicating artery complex was researched. Then focus on the local anatomy of anterior communicating artery complex in the position of double flank point.

Treatment

Anterior communicating artery aneurysms by microsurgery through pterional approach contralateral to supply of dominant blood were clipped. Then cut the tumors to confirm that the clipping was complete. After surgery, patients were performed with routine postoperative treatment.

Results

DSA detection

According to DSA detection, in 15 patients with anterior communicating artery aneurysms, there were 10 cases with dominant side to the left side of the brain artery A_1 , 3 cases with dominant side to the right side of the brain artery A_1 . There were 3 cases with the absence of the right side of A_1 segment. There was 1 case of both Moyamoya disease and occlusion of left middle cerebral artery. Aneurysm was

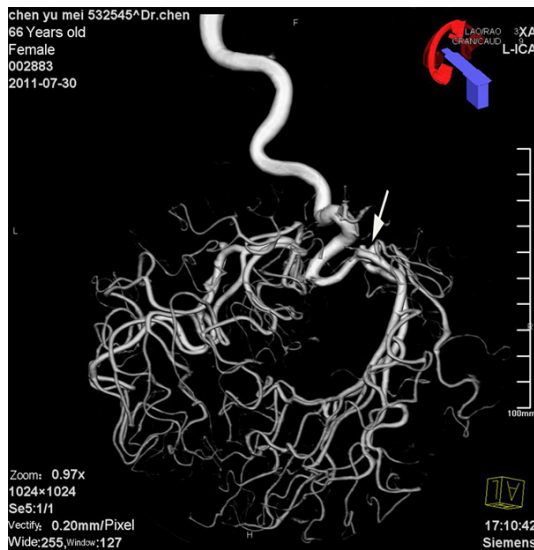


Figure 3. The simulation of the pterion approach of left side via 3D-DSA. The aneurysm was blocked by the A_2 segment of left side of the brain arteries. The A_2 section on the left side was not completely seen (the arrow shows the aneurysm).

pointed to the rear, and located in section A_2 between bilateral.

3D-DSA simulation operation plan

The relationship between anterior communicating artery aneurysms and perspective communicating artery complex was observed from the site of $LAO \setminus RAO \ 30^\circ$ of $CAU \ 0 \sim 5^\circ$ (the advantage site to internal carotid artery angiography three-dimensional images in similar to the left and right click on the road against Shang Shi head). In our patients, the necks of tumors were located in the anterior communicating artery and the bodies of tumors were in the section A_2 of anteromedial brain artery. From the site of the supply of dominant blood, the lateral section A_2 hides most of tumors and the neck of tumor was difficult to be shown. And from the site of contralateral to the supply of dominant blood, the body, neck of tumor and bilateral section A_2 can clear display (**Figures 1-4**).

Observation of local anatomy

Normal anatomy of the saddle area pool in 13 cases indicated that the early of contralateral A_1 segment (dominant side) can be exposed clearly so that patients could be obtained proximal control. The aneurysms of 10 cases were

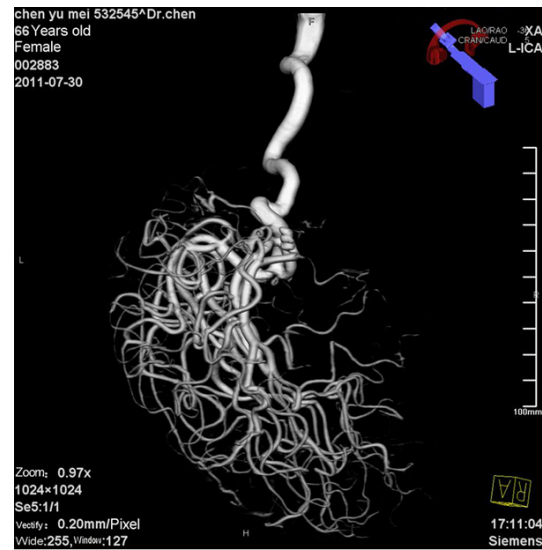


Figure 4. The simulation of the pterion approach of left side via 3D-DSA. The aneurysm was located between the A_2 section.

clipped under the proximal control. There were 3 cases with intraoperative rupture, which was clipped satisfactorily under the proximal control. In all 15 patients, part of straight back was removed to expose the aneurysm, with scene of aneurysm sandwiched between bilateral section A_2 , and the neck of tumor showed clearly. After clipping the aneurysm, it was completely free and be cut to confirm whether it was clipped completely, not clipped through artery. During the surgery, the local anatomy was very close to the intraoperative vascular anatomy of 3D-DSA.

Effect of treatment and follow-up

After surgery, 14 patients recovered out of hospital and 1 needed further life care. With following up for 1 year to 3 years, 6 cases were counterchecked with CT angiography, 7 cases with CT and 2 case with DSA. And no recurrence and rehaemorrhagia occurred again in all patients.

Discussion

In clinic, it's very common to find out the unequal development of section A_1 of anteromedial brain artery. The resulting hemodynamic changes are considered to be one of the main reasons for the formation of anterior communicating artery aneurysms [14]. In the surgery of clipping aneurysms, it is very often to

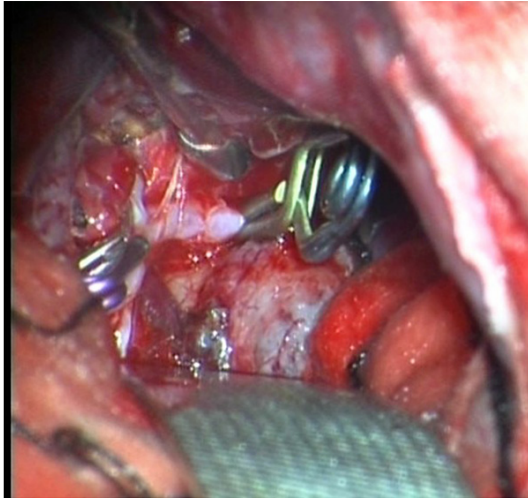


Figure 5. The proximal control of A_1 section of the anterior cerebral artery during the surgery.

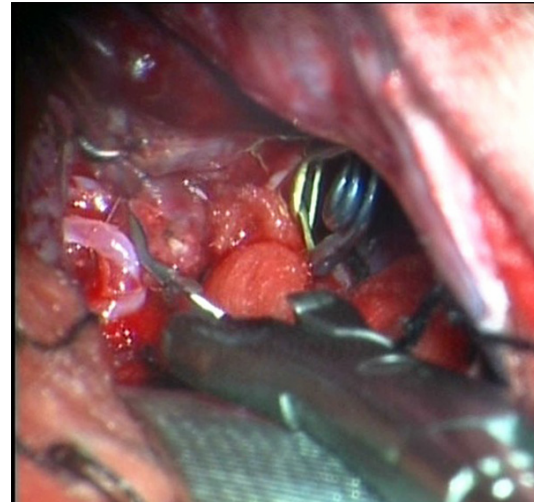


Figure 6. After clipping the aneurysm, the aneurysm and A_2 segment of anterior cerebral artery were seen clearly.

perform the proximal control. So it is very normal to choose the pterional approach contralateral to supply of dominant blood to clip the anterior communicating artery aneurysms [15, 16]. The local anatomy of the anterior communicating artery aneurysms is very complex and there are 13 arteries in them. According to 2D-DSA, the points of aneurysm are divided into 5 types [17, 18]. Among them the aneurysm located in bilateral A_2 section and the complex deep are very difficult to be clipped. When the aneurysm is located in between bilateral section A_2 , it was completely in the shadow of the ipsilateral section A_2 and difficult to be separated, coagulated, and cut [4, 19]. At the same time, the neck of tumor was also hid under the A_2 section and the body of tumor, which cause the possibility of tearing tumor neck. Otherwise, the contralateral approach is adapted to aneurysm and bilateral section A_2 fully display in the operation area [20, 21]. In the field, the relationship among the neck, the body of tumor and artery is very clear, which make it easier to separate and clip the aneurysm.

Anterior communicating artery aneurysms make the local anatomy of anterior communicating artery complex more complicated. So from the conventional 2D-DSA, it can't fully understand the outline of the local anatomy beforehand [22, 23]. In previous studies, according to the information provided by the CT angiography and MR angiography, the anterior communicating artery was classified to provide

the guide for the choice of surgical approach [24].

3D-DSA is now considered the "gold standard" of diagnosis of cerebral aneurysms and the 3D-workstation could provide the performer with comprehensive, fully understanding of the local anatomy and simulation of the operation conditions [25, 26]. According to simulating the position of both flanks approach, it could strengthen the prediction and judge of local conditions during the surgery, which can indicate the most convenient approach of exposing and clipping the aneurysms. It is very important for the operating strategy and the prevention of an emergency during the surgery [27, 28]. In our present research, according to 3D-DSA, we found it difficult to clip the aneurysms by microsurgery through pterional approach to supply of dominant blood. The local anatomy of anterior communicating artery during the surgery was very close to the vascular anatomy of 3D-DSA simulation, which provided good guide for the microsurgery through pterional approach contralateral to supply of dominant blood.

In the surgery of clipping the aneurysm, the proximal control is a very useful technology. The bilateral A_1 segment could be exposed and under in control when pterion approach to clip the anterior communicating artery was performed (Figures 1-6). In our present study, 1 case didn't get the proximal control beforehand. But after separating the bilateral section

A₂ and the aneurysm, the segment A₁ was also under control again. So it was unnecessary to worry that the dominant side into the approach was not easy to obtain proximal control [11, 29, 30].

In conclusion, according to the simulation of 3D-DSA pterion approach, the pterional approach contralateral to supply of dominant blood is the best way to expose the aneurysm and anterior communicating artery complex for clipping the aneurysm. This approach can still get good proximal control, which is more convenient, safe and effective for the treatment of aneurysm.

Disclosure of conflict of interest

None.

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