Treatment and Results of Partially Thrombosed Giant Aneurysms

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Abstract

Partially thrombosed giant aneurysms are one of the most difficult diseases in the neurosurgical field. We have had 18 of these cases namely, three in vertebral artery, four in basilar artery, four in internal carotid artery, five in middle cerebral artery, and two in anterior communicating artery. Nine aneurysms were clipped, two aneurysms were removed with anastomosis, two cases were treated inter-ventionally, and five cases were treated conservatively because of serpentine and fusiform types of aneurysms in internal carotid artery bifurcation. These conservatively treated patients died due to in-farction. When surgery is selected in the thrombosed giant aneurysms, the approach is the most im-portant to secure the neck. Three-dimensional computed tomography angiography was useful to plan the strategy for surgery. If the neck is big enough for placement of a clip, arterial reconstruction is the choice. The reconstruction must be done including an adequate size of the artery because of the thick wall. If the aneurysm neck is too small to reconstruct, aneurysmectomy with anastomosis is one of the choices.

Key words: partially thrombosed aneurysm, giant aneurysm

Introduction

The treatment of intracranial aneurysms has become very safe due to recent advances in neu-roradiological and neurosurgical procedures.^{5,7,8)} However, the giant intracranial aneurysms remain to be one of the most difficult diseases^{1,2)} to manage especially when they are partially thrombosed.^{6,9-11)} In such cases a coil placed by intervention can easily migrate into the thrombus. Thrombus has a possibi-lity to disseminate and occlude peripheral sites of branches or prevent complete closure of the neck and so on. Therefore, we will discuss about treat-ment and result of partially thrombosed giant aneurysms, which is very controversial. There are several merits and demerits in either modes of treat-ment.

Materials

We have had 18 cases of partially thrombosed giant aneurysms, namely four in internal carotid artery, five in middle cerebral artery (MCA), two in anterior communicating artery (AComA), four in basilar ar-tery, and three in vertebral artery.

Case 1: A 59-year-old male developed left hemipa-resis. Computed tomography (CT) and angiography revealed a giant aneurysm with thrombus. The neck of the aneurysm was not so wide and was without a thrombus. Helical three-dimensional (3D) CT an-giography revealed that the aneurysm neck was difficult to be secured by pterional approach. Hence interhemispheric approach was chosen and the aneurysm was easily clipped. The postoperative an-giography revealed good clipping (Fig. 1). The patient's recovery and progress were uneventful.

Case 2: A 41-year-old male developed subarachnoid hemorrhage grade II in a foreign country. CT was suggestive of a giant partially thrombosed aneurysm in the left MCA. The patient was transferred in the chronic stage. The angiography revealed only the neck of aneurysm which was of adequate size for reconstruction. The surgery was performed by open-ing the sylvian fissure widely. The aneurysm neck was wide and it seemed possible for a clip to easily slip and occlude the main trunk of MCA. Therefore, a combination clipping with a fenestrated clip and a straight clip was done in order to maintain the blood flow through the fenestrated site. Then the aneurysm was opened, the thrombosed area was

Fig. 1 Case 1. A: Angiogram and magnetic resonance image showing an anterior communicating artery thrombosed giant aneurysm. Neck is out of thrombus. B: Three-dimensional computed tomography (3D CT) angiogram showing right pterional approach is difficult to secure the aneurysm neck. C: 3D CT angiogram showing interhemispheric approach is easy to secure the aneurysm neck. D: Operative view of interhemispheric approach. E: Aneurysm was well clipped. F: Postoperative angiograms showing disappearance of aneurysm.

Fig. 2 Case 2. A: Contrast-enhanced computed tomography scan showing a partially thrombosed aneurysm on the left middle cerebral artery (MCA). B: Angiogram showing the neck of the aneurysm. C: Operative view and schema showing a MCA aneurysm. D: Tentative clips were placed on the aneurysm by combination clipping method. E: Final clipping was performed. F: Postoperative angiograms showing disappearance of the aneurysm.

trimmed, and then the final clip was applied. The postoperative angiography revealed good arterial reconstruction (Fig. 2). The patient's progress was uneventful.

Case 3: A 45-year-old female developed motor aphasia. CT revealed a thrombosed aneurysm. Angiography revealed no neck and occlusion of the MCA. The operation was performed to find a giant thrombosed aneurysm. The aneurysm was opened and the thrombectomy was performed. Thrombus involved tightly into M_2 branches. Therefore, we tried to reconstruct the remaining artery by clips, however, it was found to be capable of easily getting obliterated with thrombus. Then aneurysmectomy and end-to-end anastomosis was performed between

M_1 and remaining M_2 branch. Pulsation became much better. The postoperative angiography revealed patency of the anastomosis (Fig. 3). The patient's aphasia improved to the level of dysarthria.

Case 4: This 73-year-old male was incidentally found to have a partially thrombosed giant aneurysm in AComA. The angiography and 3D CT angiography revealed a giant aneurysm in the anterior communicating artery with hypoplasia of right A_1 . Basal interhemispheric approach was done. A yellow giant aneurysm was observed. After left A_1 was secured and a short time temporary clip was placed on it, the upper part of the aneurysm was clipped with a straight fenestrated clip and then the anterior part of aneurysm was clipped with a curved fenestrated clip at the dome. Finally, a straight clip was placed between the two fenestrated clips to close the fenestrated site. Postoperative angiography revealed

Fig. 3 Case 3. A: Contrast-enhanced computed tomography (CT) scans showing a middle cerebral artery (MCA) giant partially thrombosed aneurysm. Angiograms showing occlusion of MCA branches and remaining aneurysm. B: A giant thrombosed aneurysm was seen under the sylvian vein. C: Reconstruction of the remaining artery was performed with clips after trimming of the aneurysm wall, however, it was easily obliterated. D: End-to-end anastomosis between M_1 and remaining M_2 . E: Postoperative CT scans. F: Postoperative angiograms showing disappearance of aneurysm and patency of a M_2 branch.

good arterial reconstruction (Fig. 4). The patient's progress was uneventful.

Results

Nine aneurysms were clipped, two aneurysms were removed followed by anastomosis, two were treated interventionally, and five were conservatively treated because they were of serpentine and fusiform types of aneurysms at the internal carotid artery bifurcation and vertebrobasilar artery. These conservatively treated patients died due to infarction.

Discussion

Treatment of partially thrombosed giant aneurysms

Fig. 4 Case 4. A: Computed tomography (CT) scans and contrast-enhanced CT scans showing a partially thrombosed giant aneurysm. B, C: Preoperative angiograms, anteroposterior (B) and lateral (C) views. D: Postoperative three-dimensional CT angiogram is easy to understand anatomical relationship of aneurysm and arteries. E: Operative view of the interhemispheric approach. F: An initial clip was applied to upper part of aneurysm using a straight fenestrated clip. G: An angled fenestrated clip was applied to the anterior part of aneurysm. A straight clip was put between two clips. Note that these clips were placed on the dome of the aneurysm. H: Postoperative angiogram showing perfect clipping.

is one of the most difficult issues even after advances in neurosurgical and endovascular techniques. A coil is likely to migrate into the thrombus and therefore embolization with coil is not an indica-

tion for partially thrombosed aneurysm. When surgery is selected in these cases, the selection of the approach is the most important so as to secure the neck easily. 3D CT angiography is very useful to understand the surgical anatomy,³⁾ especially in the cases of anterior communicating and basilar artery aneurysms. These aneurysms have many options for approaching. Simulative operative view is useful to select one. Usually in giant aneurysm such an approach should be selected so as to secure the parent artery or aneurysm neck and not the dome if possible.

The second important fact to know is the percentage and location of thrombus and whether the aneurysm neck remains free from the thrombus or not. If the aneurysm neck is small without thrombus, it is easy to place the clip on the neck of the aneurysm by any kind of approach that enables to secure the aneurysm neck even if the aneurysm dome is very huge.

Usually giant aneurysm has a wide neck and hence it is impossible to clip the neck with a simple clip. We have to consider arterial reconstruction using clips. As for the arterial reconstruction, there are some options. If it is not a thrombosed aneurysm, the most easy way is to trap and puncture the aneurysm to make it shrink and then clip it. But in the case of aneurysm with thrombus, aneurysm will not collapse by puncture. It takes a long time to reconstruct the artery with trapping. The risk of ischemic complication is more. So we prefer tentative clipping on the neck if the neck site of aneurysm has enough space. A tentative clip can easily slip and occlude main arteries; therefore, some special tactics are necessary like the combination clipping with a fenestrated clip and a straight clip in Case 2. Thereafter, we trimmed the aneurysm dome under tentative clipping. Finally, the permanent clip should be applied on the neck of the aneurysm.

On the other hand if the aneurysm neck was involved with thrombus, it is very difficult to preserve the artery after thrombectomy, especially small branches like that of MCA. In these cases aneurysmectomy with bypass or direct anastomosis is recommended. In Case 3 when the arterial reconstruction was performed with clips after thrombectomy, pulsation become weak. Aneurysm was opened again to find a new thrombus obliterating the artery again. Then end-to-end anastomosis was performed between M_1 and M_2 branches. We should always preserve the superficial temporal artery (STA) during the craniotomy in order to do an STA-MCA anastomosis if necessary for thrombosed M_2 branches.

Giant aneurysm has usually a thick wall, especially

if it is thrombosed. When an arterial reconstruction is performed with clips; clip must be placed far away from the neck. In Case 4 we put the clip on the dome of the aneurysm; however, postoperative angiography showed perfect reconstruction of the arteries.

The serpentine giant aneurysm especially in the basilar artery is still too difficult to treat. All these cases died because of infarction. This kind of aneurysm is another problem. There is a possibility of venous graft reconstruction under the hypothermia with cardiopulmonary bypass⁴⁾ and combination treatment with surgery and intervention.

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