Endovascular Treatment for Ruptured VA Dissecting Aneurysm Involving the Origin of PICA

S. KOBAYASHI, H. KARASUDANI**, Y. KOGUCHI*, K. TSURU, M. WADA, A. MIYATA, H. NAKAMURA, A. SATOH, Y. WATANABE, T. YAGISHITA*

Department of Neurosurgery, Neurology*, Chiba Emergency Medical Center, Chiba; Japan

**Department of Neurosurgery, Kimitsu Central Hospital, Chiba; Japan

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Summary

Ruptured vertebral artery dissecting aneurysms (VADA) re-bleed frequently especially during first 24 hours, which makes the prognosis of the patients with this disease poor. Recently endovascular trapping with detachable platinum coils at an acute stage has been done for preventing re-bleeding. However, for the cases with dissecting aneurysm involving the origin of the posterior inferior cerebellar artery (PICA), these methods are hardly indicated because of the risk of ischemic complication in the PICA territory.

We proposed a simple and effective therapeutic method for these cases. We occluded the affected vertebral artery (VA) near its root intending to introduce collateral blood flow from the deep cervical artery into the VA trunk. The controlled antegrade VA flow and retrograde flow from the contralateral VA make a watershed at the dissecting aneurysm, which promotes thrombosis of pseudolumen with preserving the antegrade blood flow of PICA. We treated two cases with ruptured VADA involving PICA, and in both cases thrombosis of aneurysm was obtained without any ischemic complication.

This method would be considered as a treatment of choice to the cases with VADA involving PICA.

Introduction

Ruptured vertebral artery dissecting aneurysms (VADA) require urgent treatment because of the high incidence of re-bleeding especially during the first 24 hours. Recently, endovascular proximal ligation or "endovascular trapping" in which vertebral artery (VA) is packed with platinum coils from the proximal portion of the aneurysmal entry to the just distal of the aneurysm at an acute stage has been done for preventing re-bleeding. However, for the cases with VADA involving the origin of the posterior inferior cerebellar artery (PICA), these methods are hardly indicated because of the risk of ischemic complication in the PICA territory. In this report we propose a new method that prevents re-bleeding from aneurysm with preserving blood flow of PICA.

Material and Methods

Between 1997 and 2002, we treated 17 patients with ruptured VADA using endovascular technique at an acute stage. Four patients had dissecting aneurysm involving the PICA origin and we performed our new therapeutic methods for two of these four cases. Clinical course, outcome and angiographical result of these two patients were evaluated.

Figure 1 R-VAG (A) and L-VAG (B) performed 1 month after bilateral VA occlusion. In both side, antegrade blood flow through the collateral channels fill the VA trunk.

Our Method

Our method is a kind of proximal parent artery occlusion. It is well known that there exists rich anastomotic channels between the VA trunk and many cervical arteries represented by the deep cervical artery. After occluding VA near its root, many anastomotic vessels open and much collateral blood flow streams develop to the VA trunk. On the contrary, when VA is occluded near PICA, collateral blood flow streams to VA through anastomotic vessels is little. This means that we can regulate antegrade blood flow of VA by changing the level of VA occlusion. We got the hint on this method from the case demonstrated in figure 1. This 51-year-old man had a persistent severe occipital headache. Angiogram showed bilateral intracranial VADAs with large pseudolumens. We performed bilateral VA occlusions

with detachable balloons at the level of C4 on the right and at the origin of VA on the left after occlusion test. As shown in figure 1, antegrade blood flow through the collateral channels fills VA. He has been completely freed from headache after these procedures. We speculate that reduction of the VA flow decreased internal pressure of the pseudolumen, which then resulted in improvement of the symptoms.

Results

Of 17 cases with ruptured VADAs, aneurysm located proximal to the PICA origin in two cases and distal in five cases, and aneurysm involved the origin of PICA in four cases. In the other 6 cases, the origin of PICA was not recognized in the affected VA. For 13 cases in which

VADA did not involve the origin of PICA, we performed "endovascular trapping" (eleven cases) and endovascular proximal ligation (two cases). And for the cases in which aneurysm involved the PICA origin, we performed endovascular proximal ligation (two case) or our new method (two cases). Clinical courses of the two cases treated by our new method are as follows.

Case 1

This 52-year-old man presented with Hunt & Kosnic grade 3 subarachnoid haemorrhage (SAH). The left vertebral angiogram (VAG) revealed aneurysmal dilatation which located just distal to the origin of PICA. And the right VA was hypoplastic. Stent-assisted coil embolization was performed on day 2 (figure 2). The patient recovered without any neurological symptoms and returned to his normal life. A 7-month follow-up angiogram showed the development of large and irregular shaped pseudo-aneurysm located just distal to the origin of PICA (figure 3). And we tried our new method. After test occlusions at several levels, we occluded the left VA at the level of C3.

The left VAG obtained 12 months later demonstrated antegrade blood flow of the left VA trunk supplied from branches of the deep cervical arteries filled the left PICA and the dissecting aneurysm was completely obliterated (figure 4A). And aneurysm was also not shown in the right VAG (figure 4B).

Case 2

This 45-year-old man presented with a Hunt & Kosnic Grade 2 SAH. The right VAG revealed aneurysmal dilatation which located just distal to the origin of the right PICA (figure 5). After test occlusions at several levels, we occluded the right VA at the level of C3 with Guglielmi detachable coils on the day of SAH. His clinical course was uneventful and recovered without any neurological symptoms. A one-month follow-up angiogram revealed a little blood flow of the right VA supplied from collateral arteries which barely filled the right PICA.

And pseudoaneurysm was partially filled with retrograde blood flow from the contralateral VA (figure 6). We performed an end-to-side anastomosis of the right occipital artery

Figure 2 A) L-VAG of Case 1. Aneurysmal dilatation located just distal to the origin of the left PICA. B) Neck X-P performed just after stent-assisted coil embolization shows a deployed stent.

and the caudal loop of the right PICA and clipped the right VA at just distal to the PICA origin (figure 7) in order to prevent subsequent bleeding completely.

Figure 3 3D DSA at seven months after the 1st treatment in Case 1 demonstrates the development of a large and irregular shaped pseudoaneurysm located just distal to the origin of PICA.

Discussion

It is well known that ruptured VADA re-bleeds frequently especially during the first 24 hours, which makes the prognosis of the patients with this disease poor. For preventing re-bleeding, endovascular or surgical proximal occlusion of the parent artery has been widely performed. However, these methods could not completely eliminate the risk of re-bleeding and recently many authors recommend endovascular trapping in which VA is packed with platinum coils from the proximal portion of the entry to the just distal of the aneurysm including the aneurysm itself at an acute stage. In our series, we performed the endovascular trapping to most of the cases in which the aneurysm did not involve the origin of PICA. However, this therapeutic option is hardly indicated to the cases with VADA involving the origin of PICA considering ischemic complication in the PICA territory. Although it is clear that the ideal treatment

Figure 4 A) L-VAG (lateral view) at 12 months after the 2nd treatment. Antegrade blood flow of the left VA trunk supplied from the deep cervical arteries fills the left PICA and the dissecting aneurysm is completely obliterated. Large arrow indicates mass of Guglielmi detachable coils. B) R-VAG (frontal view) at 12 months after the 2nd treatment in Case 1.

Figure 5 R-VAG at admission in case 2. Aneurismal dilatation located just distal to the origin of right PICA.

Figure 6 A) L-VAG (frontal view) at one month after the treatment. The pseudoaneurysm becomes very small but is partially filled with retrograde blood flow from the left VA. B) R-subclavian angiogram (lateral view). The right PICA is barely filled with the blood flow from the collateral arteries.

Figure 7 A) L-VAG after the 2nd treatment. The pseudoaneurysm is completely obliterated. B) R-carotid angiogram (lateral view) after the 2nd treatment shows the occipital artery-PICA anastomosis.

for these cases is endovascular or surgical trapping of VADA with revascularization of the PICA such as occipital artery-PICA or PICA-PICA anastomosis, it is not feasible to perform these complicated treatments at an acute stage of SAH.

The principle of our method is as follows:

There are many anastomotic channels between VA and surrounding cervical arteries represented by the deep cervical artery. And the more proximally VA is occluded, the more collateral blood flow is introduced into the VA. So the antegrade VA flow can be controlled by changing the level of VA occlusion. And our

Figure 8 Schema demonstrates the principle of our method.

speculation is that the controlled antegrade VA flow and retrograde flow from the contralateral VA make a watershed at the dissecting aneurysm, which promotes thrombosis of pseudolumen with preserving the antegrade blood flow of PICA. It is actually not easy to decide the level of VA occlusion, because both development of the contralateral VA and collateral channels connecting the ipsilateral VA differ patient to patient. In order to evaluate collateral circulation, we temporally occluded the affected VA with microballoon at several levels and performed angiography from the ipsilateral subclavian artery. And we decided occlusion level referred to the degree of collateral flow.

In Case 1, the entry of the dissection located just distal to the origin of the left PICA, and the watershed might have been made at the

same point after our treatment. And this haemodynamic change induced complete thrombosis of the pseudoaneurysm, and antegrade VA flow from the collateral channels filled the left PICA (figure 8). In Case 2, antegrade flow of the right VA seemed to be insufficient to form the watershed at the entry of the dissection, but it might have reduced internal pressure of the pseudo-aneurysm sufficiently enough to keep the blood flow of the right PICA until surgical trapping with revascularization of PICA was performed.

Conclusions

In conclusion, because our method is simple and safe, it would be considered as a treatment of choice for the cases with ruptured VADA involving the origin of PICA at an acute stage.

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S. Kobayashi, M.D.
Department of Neurosurgery
Chiba Emergency Medical Center
Chiba, Japan