Successful treatment of a ruptured dissecting basilar artery aneurysm

Case report

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Dissecting basilar artery (BA) aneurysms in patients presenting with subarachnoid hemorrhage are life threatening, especially in those who experience subsequent bleeding or progressive dissection, and immediate surgical or endovascular intervention may be necessary. The authors report on a 52-year-old woman whose dissecting BA aneurysm was treated successfully with proximal occlusion and flow reversal. Clipping of the proximal BA above the level of the anterior inferior cerebellar arteries facilitated retrograde flow from a radial artery graft placed between the left vertebral artery and the left posterior cerebral artery, thereby providing continuous perfusion of the BA and its branches. Postoperative angiograms obtained 1 year later revealed good retrograde flow through the BA and dilation of the radial arterial graft. There were no episodes of recurrent hemorrhage.

KEY WORDS • basilar artery • dissecting aneurysm • anastomosis • radial artery graft

A D V A N C E S in diagnostic methods have led to the recognition of dissecting BA aneurysms as important contributors to cerebrovascular disorders of the vertebrobasilar system. We do not know much about the natural history of these aneurysms because of their rarity, but if we can extrapolate from experience with VA dissecting aneurysms or dissecting aneurysms that extend to the BA from the VA, we must assume that it is likely that their natural history is unfavorable. These lesions reportedly produce brainstem ischemia rather than SAH.4,6,17 Because dissecting BA aneurysms in patients presenting with SAH are life threatening, especially in those with subsequent bleeding or progressive dissection,1,18,22,29 we stress that immediate surgical or endovascular treatment is necessary.

We report on a patient whose dissecting BA aneurysm was treated successfully with proximal occlusion and flow reversal. We clipped the proximal BA above the level of the AICAs, thereby facilitating retrograde flow from a radial artery graft placed between the left vertebral artery and the left posterior cerebral artery to provide continuous perfusion of the BA and its branches. We offer this as a potential treatment for dissecting BA aneurysms in a select group of patients.

Management Options. Surgical intervention was judged to be necessary given the evidence of a progressive dissecting formation in the setting of BA dissection. Based on angiographic evidence we determined that trapping or proximal occlusion of the dissecting BA aneurysm was inadvisable because the small size of the bilateral PCoAs put the patient at risk for poor flow in the BA. The goal of surgery was to induce flow reversal in the BA, thereby removing the impetus for continued aneurysm growth. Safe occlusion of the BA above the AICA necessitated retrograde flow from the bypass between the left PCA and VA. We might have considered a balloon test occlusion of both VAs at the time of initial treatment, but because balloon occlusion of both VAs carried the risk of rebleeding (the second angiogram pro-

Abbreviations used in this paper: AICA = anterior inferior cerebellar artery; BA = basilar artery; PCA = posterior cerebral artery; PCoA = posterior communicating artery; RA = radial artery; SAH = subarachnoid hemorrhage; VA = vertebral artery.
vided evidence of enlargement of the aneurysm, it was not performed.

Operation. On the 21st day after her initial presentation the patient underwent ligation of the BA and RA grafting via the posterior transpetrosal approach. First we performed bypass surgery by placing an RA graft between the left PCA and VA. The superior petrosal sinus was sacrificed and the tentorium cerebelli was cut to the level of the in-<br>cisura. After securing the P2 segment of the left PCA we harvested a 12-cm radial artery graft and performed a side-to-end anastomosis between the distal end of the RA and the P2 segment by using interrupted No. 8-0 proline sutures. The proximal end of the RA was then anastomosed to the extradural VA in an end-to-side fashion by using interrupted No. 8-0 proline sutures. We identified the junction of the VA and the origins of the AICA before placing a straight aneurysm clip across the BA above the AICA. The proximal end of the BA dissection was recognized at a level just distal to the AICA bifurcation. At its surface, the site of dissection was anomalously dark, and this portion was thought to be the rupture site. The presence of several perforating vessels to the brainstem was confirmed in the mid-BA; another small aneurysm at a site more distal from the BA was occluded directly with a long clip. We did not trap the BA to treat the dissection. After ligation of the BA we were able to confirm by Doppler ultrasonography that there was blood flow in the BA and the bilateral AICA.

Postoperative Course. Postoperatively the patient experienced transient diplopia caused by left abducent palsy. An angiogram obtained on the 1st postoperative day revealed retrograde flow through the BA to the AICA and a marked decrease in the size of the BA pseudoaneurysm. The patient was then switched from heparin to anticoagulation therapy for continued protection against thrombotic complications and was discharged on the 15th postoperative day in stable neurological condition. There have been no further complications and an angiogram obtained at her 1-year follow-up review revealed continued good retrograde flow through the BA to the AICA and dilation of the RA graft (Fig. 2).

Fig. 1. Upper Left: Computerized tomography scan demonstrating a high-density area in the basal cistern. Upper Right: Lateral view of the left VA angiogram revealing irregular dilations at the mid-BA (arrows). Lower Left: A T1-weighted magnetic resonance image demonstrating increased signal intensity within the wall of the BA. Note the double lumen in the mid-BA (arrow). Lower Right: Lateral view of the left VA angiogram obtained 21 days postsurgery. The irregular dilations at the mid-BA had expanded (arrows and large arrow).
In the presence of SAH, dissecting aneurysms may be life threatening, especially in patients with subsequent bleeding episodes or progressive dissection. Because patients with SAH are at high risk for early rebleeding, it may be advisable to consider early surgical or endovascular intervention. Surgical options include wrapping and proximal ligation with or without arterial reconstruction.

Because wrapping does not prevent aneurysm rupture, proximal occlusion by surgical or endovascular methods has been explored as a means of preventing further dissection. Although unilateral VA occlusion is safer than BA occlusion because fewer perforating arteries branch from the VA, it cannot prevent rebleeding if it fails to induce thrombosis of the false lumen or if a resulting pseudoaneurysm is overlooked. Basilar artery occlusion generally produces few or no neurological deficits. Generous flow through the PCoA must be ascertained before considering BA occlusion. In patients with a ruptured dissecting BA aneurysm and a small PCoA, treatment options include BA ligation accompanied by revascularization.

Revascularization by direct extracranial–intracranial anastomosis or insertion of a saphenous vein or RA graft to enhance the safety of BA occlusion has been reported in patients with deficient collateral circulation and posterior circulation aneurysms that cannot be treated with clips. The reportedly high early closure rate of saphenous vein grafts may be the result of inadequate flow through the graft to the upper BA circulation, which generally requires the immediate establishment of higher flow. For VA revascularization, we propose the RA as a desirable graft because the size of its lumen makes it suitable for anastomosis to the P2 segment of the PCA. We use its wider, proximal end for the VA, and its smaller, 2- to 3-mm distal end for the PCA. Because the proximal and distal diameters of the RA satisfy the anastomosis requirements, surgical revascularization of the BA system by using an RA graft to the PCA is a prerequisite for therapeutic BA occlusion. In our patient the RA graft remains patent at 1 year postsurgery, and angiographic examination revealed that the diameter of the graft was remarkably enlarged. We conclude that this graft was appropriate for anastomosis between the PCA and VA.

Anastomosis via the temporobasal approach is complicated by the depth and narrowness of the surgical field, and because of the danger of retraction damage to the temporal lobe and the risk of injury to the vein of Labbe we used the posterior transpetrosal approach. Because it is close to the cortex, the P2 segment can be approached easily even during the acute stage of SAH. Its perpendicular course upward in the surgical field makes the P2 segment ideal for the placement of an anastomosis.

Because trapping is an option for treating giant BA trunk aneurysms, only limited experience has been reported in the literature. Even if a few perforating arteries are sacrificed, an ischemic insult can be confined to a small region of the medial ventral pons if there is a single large PCoA and the superior cerebellar artery and AICA are separated. The choice between proximal ligation and trapping should be based on whether there are any critical branches and/or perforating vessels originating from the segment to be trapped. Although relatively good outcomes have been reported, in our case trapping was not performed because several perforating arteries originated at the BA at the distal portion of the AICA.

Some patients with dissecting mid-BA aneurysms had been treated using the stent-supported technique. Nevertheless, although stent-assisted endovascular treatment was successful, there was recurrent bleeding, indicating that, because of the porosity of currently available stents, they may be insufficient for the induction of intraluminal thrombosis. Placement alone may fail to prevent bleeding, and postoperative anticoagulation therapy may be inadequate to prevent occlusion of the stent-treated vessel.

Conclusions

Although we found that occlusion of the BA with an RA graft was effective in our case and prevented subsequent hemorrhage, follow up is necessary after any intervention. In patients with postoperative neuroimaging evidence of progressive dissection, saccular aneurysm dilation, or inadequate thrombus formation in the pseudolumen, additional treatment is necessary to prevent rebleeding.

References

Dissecting basilar artery aneurysm

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