Reconstruction of the MCA bifurcation after excision of a giant aneurysm

Technical note

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A patient with a giant aneurysm of the left middle cerebral artery (MCA) presented with a history of subarachnoid hemorrhage and ischemic symptoms. When the aneurysm was explored, its base was found to be very firm and atherosclerotic. Temporary clips were applied to the MCA, the aneurysm was excised, and the MCA bifurcation was reconstructed using microsurgical techniques. Good flow in the reconstructed MCA trunk was demonstrated by intracranial Doppler ultrasonography. A description of the operative procedure is presented.

KEY WORDS: aneurysm * giant aneurysm * middle cerebral artery * surgical vascular repair

The introduction of microsurgical techniques in the last two decades has markedly improved the surgical management of intracranial aneurysms. These technical advances have modified the treatment of difficult giant aneurysms when a direct approach toward restoration of a normal physiological anatomy is favored. This report describes the reconstruction of portions of two middle cerebral artery (MCA) branches to form one major MCA after excision of a giant aneurysm.

Case Report and Operative Technique

This 59-year-old right handed man presented with complaints of intermittent headache over the past few years. One week before his admission, he experienced the sudden onset of a severe headache which lasted for 6 days. During that time, he also suffered intermittent episodes of confusion and speech difficulty.

Examination. On admission, the patient was alert and well oriented. He had a mild expressive dysphasia but no behavioral disturbance. Cranial nerve function was intact. There were no motor or sensory deficits and no stiffness of the neck. Computerized tomography (CT) and magnetic resonance (MR) imaging revealed a 3.5-cm mass in the left insular region with evidence of frontal opercular infarction (Fig. 1). Cerebral angiography confirmed the presence of a partially thrombosed giant aneurysm at the left MCA bifurcation (Fig. 2 left). A relatively avascular area, visible within the left posterior frontal region, was consistent with the area of infarction demonstrated by CT and MR imaging.

Operation. A left frontotemporal craniotomy was performed on the 2nd hospital day. Electroencephalography with compressed spectral analysis (CSA-EEG) initially showed symmetrical power from both hemispheres, but then a symmetrical burst-suppression pattern was instituted with barbiturates. The somatosensory evoked potentials (SSEP) were also monitored intraoperatively.

The sylvian fissure was found to be stained with hemosiderin, confirming a previous hemorrhage. A broad-based partially thrombosed bilobulated giant aneurysm was found at the bifurcation of the left MCA. The two efferent vessels were incorporated in its wall. A small thrombus occluding the frontal branch could be visualized through the aneurysm wall. It was impossible to apply a clip to the aneurysm because of its large size, its broad atherosclerotic neck, and the incorporation of the efferent vessels in its wall (Fig. 3A). The aneurysm was trapped by placing temporary clips across the MCA and its branches. The aneurysm was deflated and straight Yasargil clips were placed to close the neck. However, a large atherosclerotic plaque prevented clip
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closure. The clip was removed, and a thromboendarterectomy was performed.

After this maneuver, the residual wall and the base of the aneurysm were very thin. Because there was not adequate wall tissue for primary closure, the arteriotomy was extended for about 5 mm along each of the two main branches of the MCA bifurcation (Fig. 3B), allowing approximation of the corresponding edge of the arteriotomy of both arteries to form one large extension of the MCA trunk. The incision was closed with a running suture of 10-0 nylon (Fig. 3C). This procedure extended the MCA bifurcation 15 mm dis-

tally (Fig. 3D). The temporary clips were removed, and intraoperative intracranial Doppler ultrasonography confirmed patency of the anastomosis. The MCA had been occluded for a total of 60 minutes.

The SSEP remained stable throughout the operation. After cessation of barbiturate administration, CSA-EEG demonstrated a symmetrical response from both hemispheres.

Postoperative Course. The postoperative course was unremarkable. The patient’s neurological examination was unchanged. Postoperative angiography revealed disappearance of the aneurysm and elongation of the MCA trunk (Fig. 2 right). The patient was discharged 8 days after surgery.

Discussion

Giant intracranial aneurysms, defined as greater than 2.5 cm in diameter, represent about 5% of all intracranial aneurysms and usually originate from the carotid artery. The MCA is less often involved, giving rise to between 5% and 16% of giant intracranial aneurysms. Sundt and Piepgras found that 13% of MCA aneurysms were giant in size. Although most giant aneurysms present with signs of a mass lesion, a significant proportion manifest themselves with a history of subarachnoid hemorrhage. Occasionally, they may present with ischemic symptoms related to distal emboli.

Treating giant aneurysms surgically is a challenge because of their large size and broad calcified neck, and because of the possibility of major arteries being incorporated within the aneurysm wall. Indirect procedures for treating giant aneurysms have often been advocated. Although commonly performed for difficult giant aneurysms, proximal ligation of major arteries is associated with significant risks. Approximately 20% of patients may not tolerate acute occlusion of one carotid

Fig. 1. Magnetic resonance image of the brain showing a giant middle cerebral artery aneurysm lying in the left insular region associated with “peritumoral” edema.

Fig. 2. Left carotid angiograms, lateral views. Left: Preoperative study showing the aneurysm (arrow) which is mainly thrombosed. Note the avascular area within the left posterior frontal region. Right: Postoperative study showing disappearance of the aneurysm. The main arterial trunks are well preserved.
artery. Roski, et al. noted that late complications developed in five (27.8%) of their 18 patients who underwent ligation of the internal carotid artery.

Microvascular bypass procedures associated with proximal ligation have been successful in most series. Unfortunately, ischemic complications have been reported even when the vascular bypasses were patent. Ferguson reported that preliminary bypass procedures allowed occlusion of the MCA trunk without permanent deficit in all of his cases. However, he warned that the procedure is risky and should never be performed without using a reversible tourniquet.

Although wrapping the aneurysm may decrease the risk of rebleeding, it does not protect from distal embolization and does not relieve the mass effect that is usually present. As with smaller aneurysms, the most effective surgical approach to giant aneurysms is obliteration of the neck while preserving the normal vascular anatomy. Aneurysms have been excised with end-to-end anastomosis. Sundt and Piepergras routinely performed temporary MCA trapping before proceeding to thromboendarterectomy of the aneurysm. When its neck is softened in this manner, the aneurysm is amenable to clipping. Many other surgeons have also reported favorable results with this approach.

Without deforming the ostium of the arteries or compromising their patency, it is not always possible to leave a portion of the aneurysm base for the application of a clip or for an aneurysmorrhaphy. Because the patient described here presented with a history of both subarachnoid hemorrhage and ischemic symptoms, excision of the aneurysm was particularly desirable. The procedure involved anastomosis of the corresponding vessel walls; this achieved the goal of aneurysm exclusion while maintaining the patency of the major vessels. This technique is presented as a viable option in the management of difficult giant aneurysms of the MCA.

References

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