Anastomosis of the anterior temporal artery to a secondary trunk of the middle cerebral artery for treatment of a giant M₁ segment aneurysm

Case report

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The clinical course, operative technique, and angiographic outcome are reported for a patient with a giant intracranial aneurysm of the proximal middle cerebral artery (MCA) who presented with symptoms of ischemia. Treatment of the aneurysm required bypassing the involved MCA bifurcation, but the patient lacked a suitable donor superficial temporal artery. The involved arterial segment was therefore bypassed with a side-to-side anastomosis of the anterior temporal artery to one of the secondary trunks of the MCA. This bypass eliminated the need to harvest a vein graft and re-established flow using in situ intracranial vessels of similar diameter, minimal arterial dissection, and only one suture line.

KEY WORDS • vascular anastomosis • extracranial-intracranial bypass • aneurysm • middle cerebral artery

The extracranial-intracranial bypass (EC-IC) bypass procedure has evolved considerably since its inception.

Prior to the reports of The EC/IC Bypass Study Group in 1985, enthusiasm for the technique led to its widespread use for the treatment of intracranial occlusive disease. Cerebral revascularization is still used for a smaller set of indications that includes the treatment of giant intracranial aneurysms.

To a great extent, the success of cerebral revascularization depends on the availability of a suitable donor vessel. In patients who require cerebral revascularization but who lack an adequate superficial temporal artery, a variety of other donor vessels can be used, including the middle meningeal artery and the occipital artery. Venous interposition grafts have been employed most frequently. Vein grafts for cerebral revascularization have the advantages of being able to carry greater acute blood flow volumes and of having a greater length than other donor vessels. However, revascularization using vein grafts has the disadvantages of requiring an extra vessel to be harvested and the need to perform two anastomoses. In addition, vein graft bypasses have a decreased long-term patency rate and may be associated with increased morbidity.

Most current forms of EC-IC bypass carry crucial blood flow to the hemisphere through the subcutaneous tissues. This situation poses the theoretical risk, particularly in young active patients, of cerebral ischemia being caused by minor facial trauma that injures the bypass vessel. We sought to develop a technique of cerebral revascularization that would minimize the disadvantages of vein interposition grafts in patients without a suitable extracranial donor vessel.

Case Report

A previously athletic 17-year-old girl presented with sudden weakness of the right arm, leg, and side of the face.

Examination. On neurological examination, the patient was unable to walk due to a 3/5 right hemiparesis that affected the arm and leg equally. She had hyperactive deep tendon reflexes and no significant sensory deficit. Magnetic resonance imaging (Fig. 1) demonstrated a partially thrombosed giant aneurysm of the left middle cerebral artery (MCA). Cerebral angiography (Fig. 2) demonstrated 99% stenosis of the MCA.
that affected 2 cm of the M1 segment, beginning 1 cm distal to the anterior temporal branch. Therapeutic occlusion of the MCA was considered because the lesion had already caused a high-grade stenosis; however, it was possible that lenticulostriate branches originating from the affected segment might still supply viable tissue. Furthermore, the uninvolved portion of the artery between the anterior temporal branch and the aneurysm would normally give rise to significant lenticulostriate branches. Acute occlusion of the MCA was therefore rejected as a therapeutic option.

The patient was given anticoagulation therapy with heparin, and was followed closely for 3 weeks but showed no significant neurological improvement. A computerized tomography scan obtained 2 weeks after presentation confirmed the presence of a calcified aneurysm and a small infarction near the posterior limb of the internal capsule.

Operation. At surgery, the aneurysm, which circumferentially involved the M1 segment and the MCA bifurcation, was found to enlarge and distort the origin of the major secondary branches. The aneurysm wall was heavily calcified and gave rise to several small lenticulostriate branches, the patency of which could not be determined. Resection of the aneurysm was considered unwise because of persistent flow through its lumen and the possible supply of the lenticulostriate branches through its fundus. The distal portion of the anterior temporal artery curved around the aneurysm, passing through the lateral sylvian fissure adjacent to the secondary MCA trunks. This artery was used as a donor vessel for a side-to-side anastomosis with one of the secondary MCA trunks. The anastomosis was performed in a routine manner with 10-0 nylon suture. The side-to-side configuration was chosen in order to preserve flow through the anterior temporal artery, which normally supplies the temporal lobe (Fig. 3). Heparin therapy was discontinued at the completion of the procedure.

Postoperative Course. The patient made an uneventful postoperative recovery. A follow-up angiogram (Fig. 4) demonstrated patency of the anastomosis, fill-
Anterior temporal artery to MCA branch anastomosis

Fig. 4. Postoperative left carotid angiograms. Left: Lateral view demonstrating robust filling of the middle cerebral artery (MCA) candelabra. Right: Anteroposterior view demonstrating occlusion of the previously stenotic M1 segment, hypertrophy of the anterior temporal artery (arrow), and increased perfusion of the secondary MCA trunks (arrowhead).

...ing of the MCA secondary trunks that had failed to fill preoperatively, spontaneous occlusion of the M1 segment, and enlargement of the donor anterior temporal artery. During the next several days, the patient’s hemiparesis improved and she was discharged home. At a 1-month follow-up examination, she had only minimal detectable weakness, was walking without assistance, and had begun to resume athletic activities.

Discussion

The diameter of the anterior temporal artery is similar to that of the other secondary trunks of the MCA.16 The anterior temporal artery arises as an early branch in 51% of specimens; the tempopolar artery is a smaller branch with a proximal origin in 90% of specimens.16 Approximately 80% of MCA aneurysms arise at the bifurcation/trifurcation, while only 12% arise from the proximal M1 segment.17 Of 60 MCA aneurysms treated at Barrow Neurological Institute since 1987, nine (15%) arose from the M1 segment (unpublished data). Thus, the majority of MCA aneurysms appear to arise distal to the potential donor arteries.

After a period of cerebral ischemia, blood flow is restored to affected brain tissue by vasodilatation of anastomotic branches.10,11 This process can take several weeks when the MCA is acutely occluded and, if adequate flow is not restored, infarction occurs.1 Cerebral revascularization has therefore been used to treat unclippable and giant intracranial aneurysms when acute occlusion of the parent artery is contemplated.10,11,14,15

Cerebral revascularization in the treatment of intracranial aneurysms has previously been achieved by using extracranial donor arteries. In this case, an in situ vessel (the anterior temporal artery) was used to augment collateral flow to the hemisphere. A side-to-side anastomosis allowed the donor vessel to continue supplying its normal territory. Most aneurysms of the MCA do not require cerebral revascularization; however, when cerebral revascularization is necessary, the anterior temporal artery or the tempopolar artery may serve as a suitable donor vessel in selected cases.

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References


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