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Case Report

A short segment intracranial–intracranial jump graft bypass followed by proximal arterial occlusion for a distal MCA aneurysm

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Abstract

Background: To describe the use of a short segment cortical intracranial–intracranial (IC–IC) bypass for the treatment of a distal middle cerebral artery (MCA) aneurysm.

Case Description: A 54-year-old woman presented with a loss of consciousness followed by multiple seizures and was found to have a partially thrombosed distal MCA aneurysm. This possibly mycotic aneurysm was treated by creating a short segment jump graft between a normal cortical artery and a nearby cortical branch arising from the aneurysmal M3 arterial segment. The bypass allowed for subsequent occlusion of the aneurysmal vessel without ischemic consequence. At surgery, the anterior division of the superficial temporal artery (STA) was exposed and dissected. Intraoperative angiography was utilized to localize a cortical artery arising from the involved segment as well as a nearby cortical artery arising from a distinct, uninvolved MCA branch. A segment of the STA was harvested, and then 10-0 suture was utilized to anastomose this short segment, to both the involved and normal cortical arteries. This created a short jump graft allowing for subsequent sacrifice of the diseased artery. Following surgery, the patient immediately underwent coil embolization of the aneurysm back into the parent artery resulting in local vascular sacrifice. The remainder of the patient's hospital course was uneventful. She was discharged home in good condition.

Conclusions: We suggest that cortical IC–IC bypass followed by endovascular arterial sacrifice as performed in our case represents a simple and safe option for treating unclippable distal MCA aneurysms including mycotic lesions.

Key Words: Intracranial-intracranial bypass, middle cerebral artery, mycotic aneurysm

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INTRODUCTION

Mycotic intracranial aneurysms are typically associated with bacterial endocarditis, although other sources of systemic infection can also be responsible.[11,12,16] These lesions most commonly affect the distal middle cerebral artery (MCA) branches and represent a management challenge.[14,16,20] When surgical treatment is required, these lesions can be difficult to locate deep within the sylvian fissure, and may defy primary reconstruction because of their friable nature. In some cases, vascular sacrifice may be utilized, but this option risks ischemic injury to the brain irrigated by the involved arterial segment. We describe a rare case in which a short segment of the superficial temporal artery (STA) was harvested and used to create a jump graft between a normal cortical artery and a nearby cortical branch arising from the aneurysmal M3 arterial segment. The bypass allowed for subsequent safe occlusion of the aneurysmal vessel without ischemic consequence.

CASE REPORT

A 54-year-old woman presented with sudden-onset loss of consciousness followed by repeated generalized seizures. During ambulance transport, she was drowsy but able to protect her airway. On admission to the National Brain Aneurysm Center, she suffered another seizure. An intravenous anticonvulsant load was administered, and she was emergently intubated. Admission CT-scan revealed a hyperdense 2×3 cm^2 lesion involving the temporoparietal junction with an associated 7 mm high attenuation nidus at its anterior margin. This lesion was surrounded by vasogenic edema [Figure 1]. MRA demonstrated the presence of a 2 mm presumed mycotic aneurysm arising from a distal M3 branch of the right MCA. Cerebral angiogram confirmed the small, partially thrombosed aneurysm arising from a large posterior division M3 segment. The filling portion of the aneurysm measured $2 \times 2.2 \times 1.5$ mm^3 [Figure 2]. The involved arterial segment continued beyond the aneurysm to supply a significant portion of the nondominant posterior frontal and anterior parietal regions.

A thorough medical evaluation disclosed no evidence of fever, and the white blood cell count and tagged white blood cell exam were unremarkable. Her erythrocyte sedimentation rate was within the normal limit, but her C-reactive protein was elevated. Cardiology consult, chest, and abdominal CT-scan were all noncontributory. It was felt that this lesion most likely represented a mycotic aneurysm, and after combined consultations with the neurovascular and infectious disease services, a decision was made to proceed with treatment of the aneurysm. Careful study and evaluation of the aneurysm outflow revealed important supply to the nondominant motor cortex. Thus, simple sacrifice of the involved arterial segment seemed ill-advised. In addition, it was unclear how straightforward it would be to locate the aneurysm within the sylvian fissure or whether the involved segment could be primarily repaired once identified. Due to the poor caliber of the posterior division STA, a traditional extracranial–intracranial (EC–IC) bypass was not feasible. Therefore, we decided to perform an IC–IC short jump graft bypass in preparation for endovascular sacrifice of the parent vessel related to the aneurysmal segment.

At surgery, the anterior division of the STA was exposed and dissected over an adequate length, and a generous craniotomy was performed. Intraoperative angiography was utilized to localize a cortical artery arising from the involved segment as well as a nearby cortical artery arising from a distinct, uninvolved MCA branch. A segment of the STA was harvested, and then 10-0 suture was utilized to anastomose this short segment to both the involved and normal cortical arteries, both as end-to-side grafts [Figure 3]. This created a short jump graft allowing for subsequent sacrifice of the diseased artery. Intraoperative angiogram after completion of the bypass demonstrated patency of the jump graft [Figure 4].

Following surgery, the patient was taken directly to the

Figure 1: Admission axial CT showing 3 × 2 cm^2 region of evolving low attenuation within the deep white matter of the right temporoparietal junction, at the posterior margin of the sylvian fissure, containing a 7 mm high attenuation nidus anteriorly

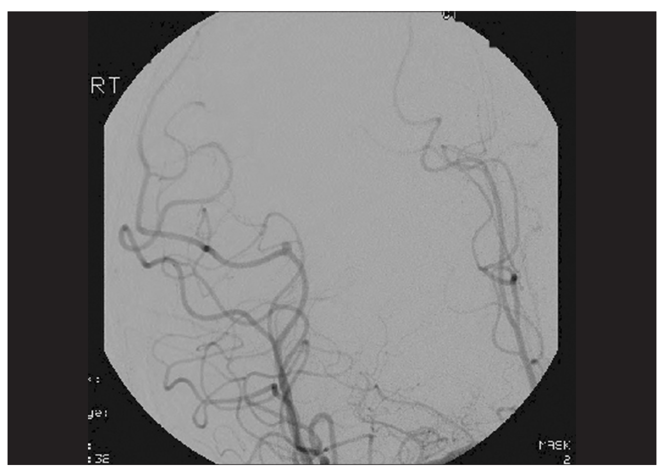

Figure 2: Angiography showing a peripheral right middle cerebral artery aneurysm arising from a peri-sylvian branch of the posterior division in the mid M3 deep sylvian segment

biplane-suite for coil embolization of the parent right MCA-M3 posterior division at the level of the aneurysm [Figure 5]. Postoperatively, the patient remained neurologically stable, and the remainder of her hospital course was unexceptional. She was discharged home in good condition.

DISCUSSION

Mycotic aneurysms may affect any intracranial artery, although the distal MCA territory is the most common location involved.[3,6,14,17,20] They can present as either a single isolated lesion or can be multiple and when ruptured, the erosive arteritis normally presents with an intracranial hemorrhage, with or without subarachnoid extension.[8,11,12,14,20] Although fungal aneurysms tend to occur more proximally involving the larger basal arteries, bacterial lesions are more commonly located along the distal MCA branches.[5,9,19] In cases of endocarditis, when an unruptured mycotic aneurysm is identified the combined mortality rate approximates 30%, but this number increases to 50% if the aneurysm ruptures.[2] Overall, the reported mortality for infective aneurysms ranges from 40% to 80% in most series.[4,20,21]

The management of these mycotic intracranial aneurysms is highly controversial and depends on multiple factors. Some authors suggest treating unruptured aneurysms with antibiotics and sequential cerebral angiograms.[2,7,13,15] In patients treated with antibiotics alone, previous reports have demonstrated a decrease in the size and eventual lesion resolution in 30–50% of cases.[2,7,15] However, in 10–30% of these patients, the aneurysm will continue to grow or form a *de novo* lesion.[2,15] Endovascular treatment which often requires vascular sacrifice is normally reserved for ruptured lesions and carries a risk of ischemic injury to the affected vascular territory.[3,16,20]

Available surgical options for treating these lesions include direct clipping, wrapping, proximal occlusion, trapping, distal revascularization, excision with end-to-end re-anastomosis, or some combination of the above.[11,12] Under such circumstances, creative options have been devised for intracranial arterial vascular reconstruction by others in the past, particularly for lesions involving the anterior and posterior cerebral arteries.[10,18,22] Yokoh *et al*. reported the performance of a variety of short segment intracranial–intracranial jump graft bypasses for the anterior circulation.[23] Ausman *et al*. described microvascular re-implantation, anastomosis, grafting, and reconstruction of the distal MCA vascular territory.[1] Our report highlights the utility of a particularly straightforward option, a short jump graft performed entirely on the cortical surface, to allow for proximal occlusion of an intracranial vascular segment.

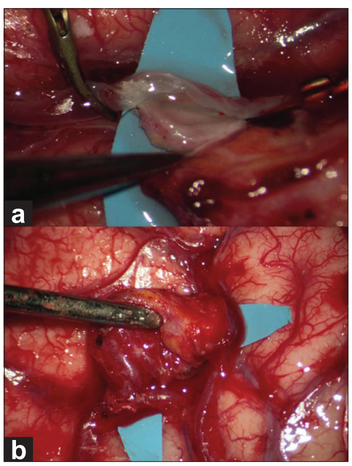

Figure 3: (a) Intraoperative photomicrographs demonstrating the first anastomosis, partially completed, and (b) the completed short jump graft

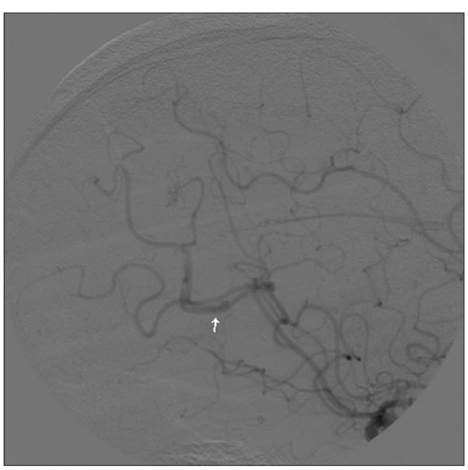

Figure 4: Intraoperative angiographic image confirming the patency of a jump graft (arrow) extending between two right middle cerebral artery branches

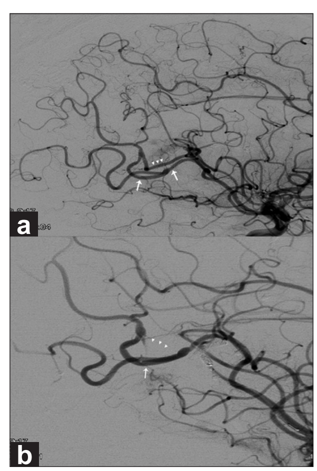

Figure 5: (a) Pre-embolization angiogram demonstrating the patent short jump graft between MCA branches (arrow) and (b) postembolization imaging showing the sacrifice of the aneurysmal distal MCA segment (arrowhead) with preservation of distal flow via the short jump graft

CONCLUSION

Ruptured and unruptured mycotic aneurysms are potentially lethal intracranial lesions. Management of such aneurysms is complex, and the best outcomes will generally be achieved in experienced centers that can offer endovascular support as well as complex surgical treatments including revascularization techniques. We suggest that cortical IC–IC bypass followed by endovascular arterial sacrifice as performed in our case represents a simple and safe option in this setting.

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