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Review

Extracranial to intracranial bypass for the treatment of cerebral aneurysms in the pediatric population

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ABSTRACT

Cerebral aneurysms are rare in the pediatric population, making a definitive treatment algorithm difficult. Microsurgical clipping is the first choice for treatment but is not always feasible, while high recurrence rates and radiation exposure make endovascular options less favorable. Extracranial-intracranial (EC-IC) bypass, though not commonly performed in the pediatric aneurysm population, has been reported in a small number of studies to be both safe and effective for the management of cerebral aneurysms. The authors present the case of a child with a distal middle cerebral artery (MCA) aneurysm in eloquent territory, successfully treated with a superficial temporal artery (STA) to MCA bypass and trapping. A review of the current literature on pediatric EC-IC bypass in the treatment of intracranial aneurysms is presented.

1. Introduction

Cerebral aneurysms are rare in the pediatric population, estimated to be less than 5% of all aneurysms [1–3]. Pediatric aneurysms tend to differ from their adult counterparts across a multitude of factors, including morphology and location [4–6]. Middle cerebral artery (MCA) aneurysms in children are typically fusiform and a higher percentage present as giant when compared to adults [1,2,4,7,8]. A paucity of studies examine the long-term results of endovascular coiling in the pediatric population [9,10]. The relatively small number of pediatric aneurysms seen at a single institution further complicates the development of treatment algorithms.

Though a number of institutions have published their results with microsurgical clipping, fewer reports exist regarding the application of extracranial-intracranial (EC-IC) bypass in the pediatric cerebral aneurysm population [1,11–16]. The pediatric population presents several challenges when considering EC-IC bypass. Small vessel diameter, graft considerations such as size and long-term impact of graft harvest, future growth of the patient, and longer expected lifetimes must be considered when evaluating these unique patients. The authors present obliteration of an unruptured large, partially thrombosed, distal, eloquent territory MCA aneurysm with a superficial temporal artery (STA) to MCA bypass and trapping in a child. A review of all other reported patients with EC-IC bypass for cerebral aneurysm in the pediatric aneurysm population follows.

2. Case report

2.1. Presentation

A three-year-old boy with no significant past medical history experienced a ground level fall without associated loss of consciousness. He was witnessed having episodes of right facial twitching over the next week, lasting less than 10 seconds, and without eye deviation, shaking or jerking movements, loss of bowel or bladder continence, or ataxia. He initially presented to his primary medical physician who referred the patient to an outside hospital emergency department for imaging, given the concern for focal seizures. Non-contrast CT scan of the head demonstrated a left posterior frontal hyperdensity (Fig. 1). MRI as well as a CT angiogram were significant for a large, partially thrombosed MCA aneurysm with surrounding edema (Fig. 2). A 4-vessel cerebral angiogram was performed to rule out any associated arteriovenous malformation and better characterize the lesion (Fig. 3). The patient was transferred to our facility for a higher level of care and was neurologically intact on arrival. Initial blood cultures, cerebrospinal fluid examinations and echocardiogram were unremarkable. The patient was kept on broad-spectrum antibiotics given the concern for a mycotic aneurysm, which were discontinued after multiple negative blood cultures. A

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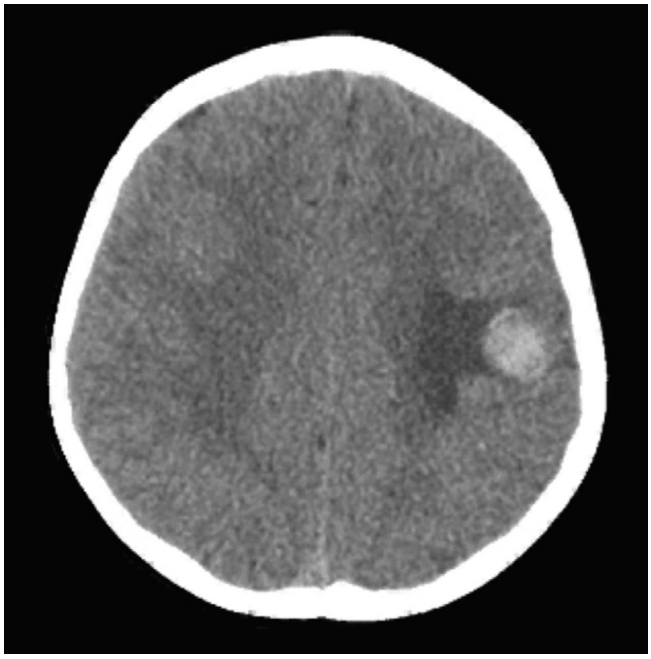

Fig. 1. Non-contrast axial CT head scan showing a left fronto-parietal hyperdensity with surrounding hypodensity in the white matter concerning for a hemorrhage with surrounding edema.

multidisciplinary cerebrovascular team concluded that given the patient's presentation, the concern for rupture, the associated edema and the negative infectious work up, the aneurysm should be treated in an urgent fashion. Based on the large size of the aneurysm in comparison to the size of the parent artery, it was unlikely that the parent artery could be reconstructed with an open or endovascular approach. Given the patient's symptoms and the location of the aneurysm, vessel sacrifice was considered but not favored due to the eloquent location, making even a small stroke potentially disabling. Careful review of the imaging localized the parietal branch

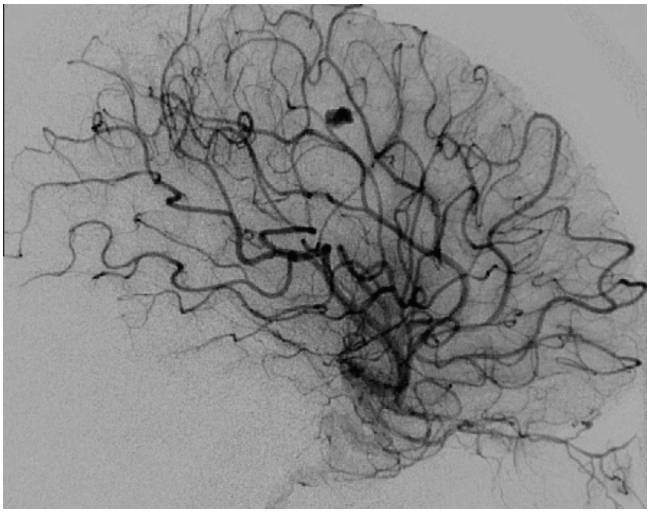

Fig. 3. Catheter digital subtraction angiogram shows a left internal carotid artery injection which confirms the CT angiogram and MRI findings. A distal middle cerebral artery aneurysm is demonstrated without any associated arteriovenous malformation and no other aneurysms identified.

of the STA travelling over the aneurysm. Therefore, we recommended a surgical trapping with STA-MCA bypass. Additionally, this strategy allowed for surgical excision of the aneurysm in order to have a pathologic evaluation performed.

2.2. Surgery

The patient was intubated and sedated in standard fashion. The patient was positioned and the lesion was localized using intraoperative navigation in order to minimize the size of the exposure. The parietal branch of the STA was dopplered and marked out. An incision was made directly over the STA and it was circumferentially dissected, mobilized and left in continuity. An approximately 4 cm craniotomy was then opened deep to the STA. A large partially thrombosed aneurysm was encountered upon

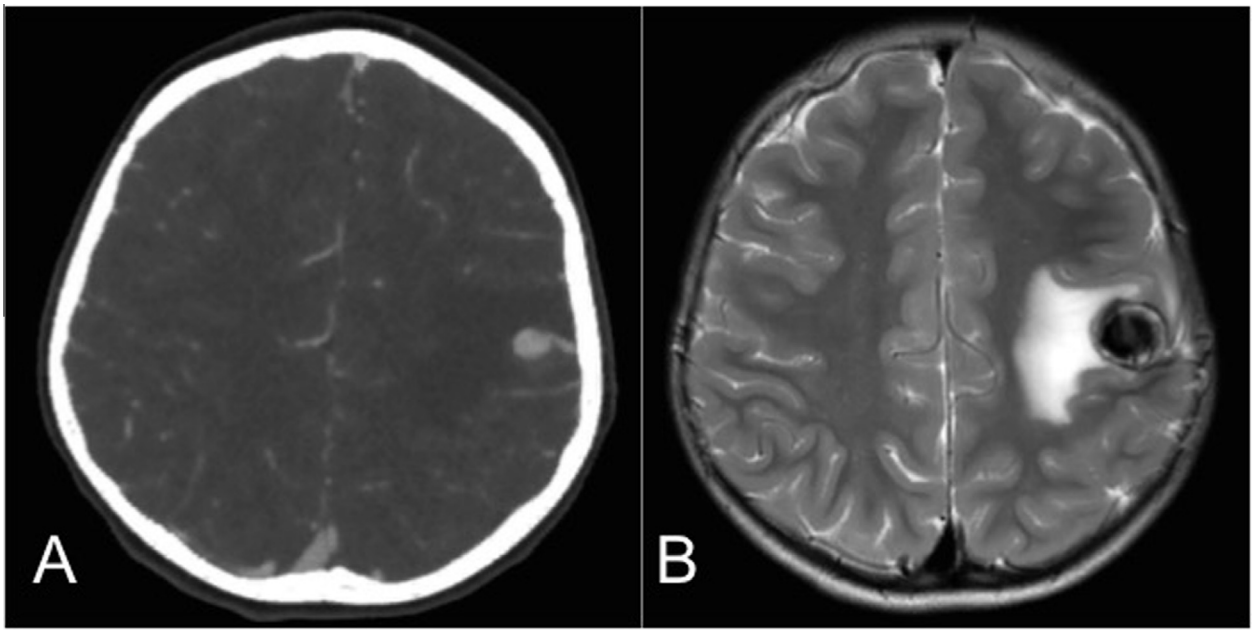

Fig. 2. (A) Axial CT angiogram illustrates a vascular lesion, most likely an aneurysm, of the distal middle cerebral artery. (B) T2-weighted axial MRI shows a hypointense region, larger than the aneurysm appreciated on CT angiogram. This is most consistent with a large, partially thrombosed aneurysm in the peri-rolandic region.