

Superficial temporal artery — middle cerebral artery bypass for internal carotid artery petrous aneurysm: A case report

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Abstract

A 13 years old boy presented with persistent ear bleed following a blow to the head. The boy was found to have a bleeding congenital aneurysm of the Petrous part of the internal carotid artery. He underwent a bypass surgery for the aneurysm and a successful Superficial Temporal Artery to Middle Cerebral Artery bypass was made.

Keywords: Carotid Artery Diseases/surgery, Carotid Artery, Internal/ surgery, Cerebral Revascularization, Intracranial Aneurysm/ surgery, Male, Cerebral Angiography.

Introduction

Congenital Internal Carotid Artery (ICA) aneurysms usually go unnoticed until they start to bleed or manifest with neurological symptoms like nasal or aural bleed,¹⁻³ facial nerve palsy or eye signs.⁴ These bleeding episodes are usually followed by trauma or they may result from as trivial an insult as a sneeze.⁵ Multiple approaches are available for the treatment of these aneurysms. These include endovascular repair, stenting or ballooning. For inoperable aneurysms, ligation and bypass procedures are done; either by mobilizing an external artery or by using a free venous graft.^{4,6}

Case Report

We present the case of a 13 years old school going boy who was referred to us with six days history of episodic right ear bleed in May 2014. The boy had sustained a mild blow to his right ear, seven days back while playing with his peers. He had profound ear bleed for which he was admitted in the nearest hospital. The patient was referred to the ENT specialist for recurrent bleed as no obvious cause for the bleed could be found. An MR Angiography (Figure-1 and 2) was performed which showed an aneurysmal dilation of the right petrous ICA extending into the middle ear cavity with absent bony wall between the carotid canal and the middle ear. However, the rest of



Figure-1: Pre-operative MR Angiogram Showing the aneurysm (Arrow) on the Right side (Coronal view).

the ICA was normal including the circle of Willis. He was eventually referred to the department of vascular surgery at Combined Military Hospital Rawalpindi for definitive management.

The patient on presentation was vitally stable. On examination, no wound was found in the neck and the external auditory meatus was packed, with no active bleed. His contrast enhanced MRI brain showed acute haemorrhage in the middle ear and the mastoid with aneurysmal dilation of the petrous part of the ICA. His brain MR venography was normal.

After base-line work up, the case was discussed with the neurosurgeons, plastic surgeons and the anaesthetist. The patient was planned and prepared for surgery, the next day. The patient was positioned supine with his ipsilateral shoulder raised and head turned at 30°. To reduce venous distension, he was propped up to 15°. The patient's neck was explored and the ICA was identified and slung. Supraclinoidal part of the carotid artery was exposed by pterional craniotomy. A curvilinear incision was made from zygomatic arch, 1cm in front of tragus, finishing near the midline. The pericranium above the superior temporal line was reflected anteriorly. The

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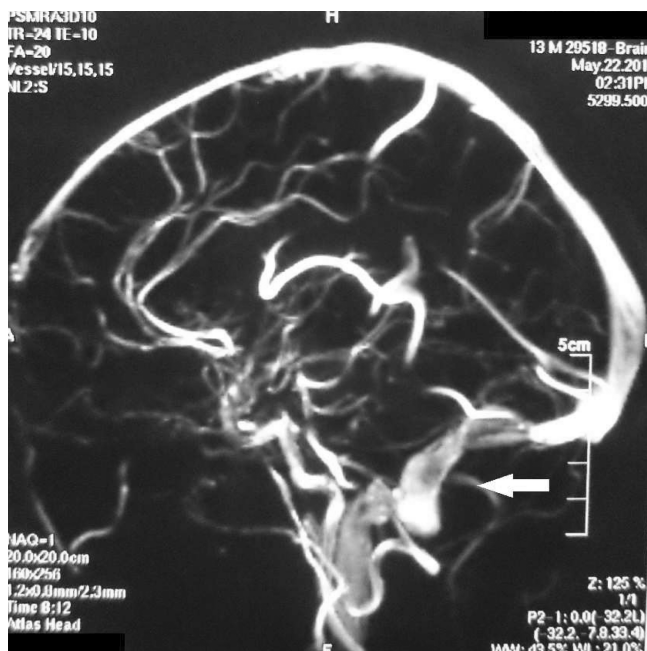


Figure-2: Pre-operative MR Angiogram Showing the aneurysm (Arrow) on the Right side (Sagittal view).

Superficial Temporal Artery (STA) on the right side was harvested and mobilized. Temporal branch of the Middle Cerebral Artery (MCA) was identified in the sylvial fissure, 6 cm above the external auditory meatus and was mobilized. An end to side anastomosis between the STA and the MCA was made. The ICA was then ligated in the neck first and then in the supraclinoid region. The patency of the anastomosis was checked per-operatively with a hand held Doppler. The wounds and the craniotomy were then closed in layers.

The boy was nursed in the intensive care unit post-operatively where he had a smooth post-operative recovery with no demonstrable neurological deficit and was subsequently discharged on the 5th post-operative day.

Discussion

This was the first case of this deformity encountered in our hospital. To the best of our knowledge no other such case has been reported from the country. ICA aneurysms are extremely rare. Their prevalence is 2.3% in adults without risk factors, increasing with age. The risk of spontaneous rupture ranges from 1.9% to 0.7% per year.⁷ They can either be intra-cranial or extra-cranial. About a third of intracranial lesions are asymptomatic at diagnosis.⁸ However they can present with hearing loss, tinnitus, symptoms of cranial nerve compression, subarachnoid

haemorrhage, thromboembolic ischaemic symptoms, bilateral carotid-cavernous fistulae, seizures or life threatening haemorrhage.⁸

Intra-cavernous ICA aneurysms represent 3 to 5% of all intracranial aneurysms and account for 14% of all ICA aneurysms. They can be classified as giant (>2.5 cm in diameter), large (1.0 to 2.5 cm in diameter) or small (<1.0 cm in diameter) aneurysm. They can also be classified on the basis of their shapes as being saccular or fusiform.⁸ Our patient had a giant, fusiform aneurysm. The etiologies for the development of these aneurysms are traumatic, mycotic or congenital. Inflammation and infection of the middle ear cavity may also lead to erosion of the bony cavities, weakening of the vessel's wall and eventually aneurysms.⁴ The patient in discussion did not have any history of ear infection in the preceding period and the bleeding was precipitated by trauma to the ear.

Surgical clipping is the "Gold Standard" for the treatment of giant aneurysms.⁶ Other treatment options include conservative management, endovascular ICA balloon occlusion, endovascular coil embolization, stenting and flow diverting procedures.⁸ Non-surgical/endovascular techniques are more frequently used for asymptomatic, intra-petrous aneurysms owing to their difficult surgical approach. Surgical interventions are however indicated for giant aneurysms not amenable to clipping or endovascular treatments, as in our case. Similarly those lacking a discrete neck or the presence of calcification or atheromatous plaques within the wall of the ICA or aneurysm itself require surgical intervention.⁹ Our hospital did not have facilities for endovascular coiling of the aneurysm.

Balloon occlusion test is used to assess the cerebral blood flow before ICA ligation, the collateral blood flow to the cerebral hemispheres and the subsequent risk of developing ischaemic stroke. Those who maintain a cerebral blood flow of >30 ml/100 g/min after ICA occlusion have little risk of developing ischaemic stroke and bypass procedures are not required in these patients.⁸⁻¹⁰ However, we did not have balloon occlusion tests facilities available in our institution.

The cerebral vascularity can be preserved with a high flow interpositional bypass using petrous to supraclinoid ICA bypass, superficial temporal artery to middle cerebral artery bypass, superficial temporal artery to middle cerebral artery bypass with saphenous graft, superficial temporal artery to superior cerebellar artery bypass, long saphenous bypass, in situ bypass or primary reanastomosis. These allow for a high flow conduit for bypass and are associated with very few long term

complications, which makes them very suitable for young patients. However, long grafts have a risk of kinking, thrombosis of perforating arteries after parent artery ligation and eventually vascular compromise.¹¹

Patency in Intracranial - Extra cranial bypass is excellent, with reported failures rates of 2.3% per year after the first year post surgery.¹² Long term complications include transient ischaemic attacks, stroke and subarachnoid haemorrhage.¹³ The long term risk of ischaemic defect is 0.8% per year and that of developing sub arachnoid haemorrhage is 0.4% per year.¹⁴

Recently, possibility of Middle Meningeal Artery-to-petrous ICA bypass has been studied in cadavers.¹⁵ Also latest flow diversion stents have been introduced. Two commercially available flow diverters, the Pipeline Embolization Device (PED) and the SILK flow diverter (SFD) have been tested with promising results. They have been successfully used in the treatment of giant fusiform aneurysms.¹⁶

ICA aneurysm bypass surgery has come a long way since it was first performed by Conley in 1953.¹⁷ Many new treatment modalities have been described since then. Owing to its rarity and varying presenting symptoms, a high index of suspicion is required.

Conclusion

Congenital internal carotid artery aneurysms are very rare. They can present with a wide variety of symptoms, from very obscure to grossly obvious. Although, this boy had an unusual presentation, he underwent a successful STA-MCA Bypass. This involved a multidisciplinary approach, appropriate use of preoperative imaging and surgical techniques.

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