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Case Report

5 Birds with 1 stone – multiple aneurysms treated with a single craniotomy

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Abstract

A 57 year old female presenting with a subarachnoid haemorrhage was found to have multiple aneurysms. She underwent a single left sided pterional craniotomy and clipping of 5 aneurysms including 2 distal anterior cerebral artery aneurysms typically not accessed via this approach. Post-operative angiogram showed successful clipping of all aneurysms and no evidence of infarction or vasospasm. The patient made a full recovery with a GCS of 15/15 and a mRS of 2. This case shows the utility of the pterional approach in reaching the distal anterior cerebral artery as well as the role of microsurgical clipping of multiple aneurysms in the endovascular era.

Keywords: Subarachnoid haemorrhage, anterior cerebral artery aneurysm, Mirror aneurysms, pterional craniotomy, Neurofibromatosis 1

INTRODUCTION

Multiple intracranial aneurysms are reported to be present in 15%–35% of patients with subarachnoid haemorrhage (SAH) from a ruptured aneurysm.(1) We present a case of a patient presenting with SAH from a ruptured intracerebral aneurysm and found to have multiple intracranial aneurysms. All aneurysms were successfully clipped through a single craniotomy.

CASE DESCRIPTION

A 57-year-old female with a history of hypertension presented to her regional hospital with a sudden onset severe headache. Of note on family history is that her daughter as well as her grandchild from that same daughter have been diagnosed with Neurofibromatosis 1 (NF1). On examination she has no clinical manifestations of the condition. She had no history of cigarette smoking or alcohol use. Her Glasgow Coma Score (GCS) on presentation was 15/15 with no focal neurological deficit. A non-contrast computed tomography (CT) Brain showed a SAH in a typical aneurysmal pattern with blood in the interhemispheric fissure and the right sylvian fissure. Based on this she underwent a CT angiogram of the brain which showed a left middle cerebral artery (MCA) aneurysm and an anterior communicating artery (ACoA) aneurysm. She was subsequently transferred to our neurosurgical service. On arrival she was assessed as having a World Federation of Neurological Surgery (WFNS) Grade 1 – This is a good grade patient with a GCS of 15 with no focal deficit and generally has a good prognosis if rerupture is avoided. She was started on the aneurysm protocol which includes nimodipine, fluid therapy, stool softeners and seizure prophylaxis as well as monitoring of electrolyte levels while awaiting the 14-day vasospastic period. She was discussed with our referral endovascular service, but this service was unavailable at the time. On day 6 she had a sudden deterioration requiring intubation and admission to ICU. An urgent CT brain as well as a repeat CT angiogram was done which showed no evidence of rebleeding, hydrocephalus or vasospasm and the deterioration was assumed to be secondary to a seizure. Her GCS rapidly improved and she was extubated. The CT angiogram now identified an additional 2 aneurysms not previously detected on the initial angiogram, 2 mirror aneurysms of the distal anterior cerebral artery aneurysms (DACA) (Fig 1). Based on the pattern of subarachnoid haemorrhage initially seen, the most likely aneurysm to have bled could be one of the DACA aneurysms or the ACoA aneurysm. She was scheduled for surgery on day 15, the first available elective list following the vasospastic period.

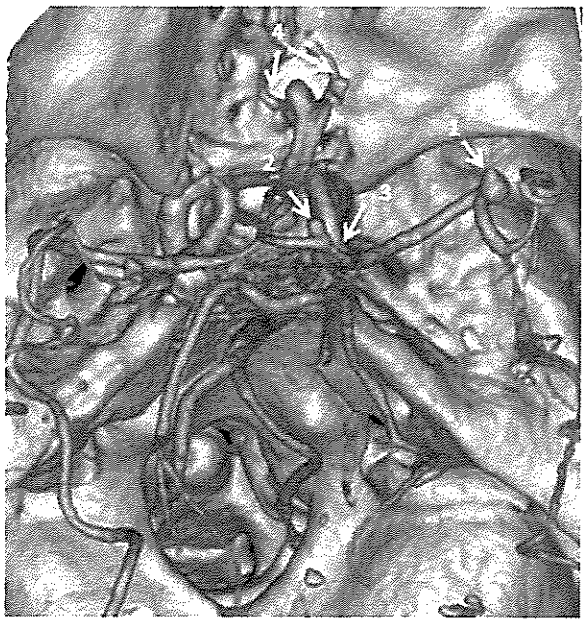

Figure 1. Preoperative CT Angiogram (volumetric rendered reconstruction) shows multiple intracranial saccular aneurysms (white arrows) at the following locations:

1. Right MCA (genu / M1-M2 junction)
2. Right ACA (A1 segment)
3. Left PCom Aneurysm (not detected on preop angio)
4. Distal right ACA (two aneurysms)

ACA: Anterior Cerebral Artery, MCA: Middle Cerebral Artery, PCom: Posterior Communicating Artery

SURGICAL TECHNIQUE

An extended left pterional craniotomy was used to clip all aneurysms with a single craniotomy (Fig 2). Most aneurysms are usually accessible with this approach; however, distal ACA aneurysms typically require a different approach (typically the anterior interhemispheric approach). The patient was strapped to the bed to allow tilting of the bed if required. Neuronavigation was used to assist in localising the distal ACA aneurysms. A left sided incision was made anterior to the tragus, behind the hairline to the contralateral midpupillary line. The craniotomy was completed, and the sphenoid bone and orbital roof drilled down. The dura was opened and the sylvian fissure was dissected. On identifying the internal carotid artery and posterior communicating artery aneurysm was discovered that was not noted on the preoperative angiogram and was clipped (Fig 4a). The MCA was then followed, and the aneurysm was identified and clipped (Fig 4b). The first part of the ACA was then followed and the anterior communicating artery aneurysm was identified and clipped (Fig 4c). The trajectory was then adjusted and a new subfrontal interhemispheric corridor was used to identify the distal anterior cerebral arteries, these were followed until the larger right sided aneurysm was identified and clipped. Intraoperative rupture was encountered at this point but was easily controlled

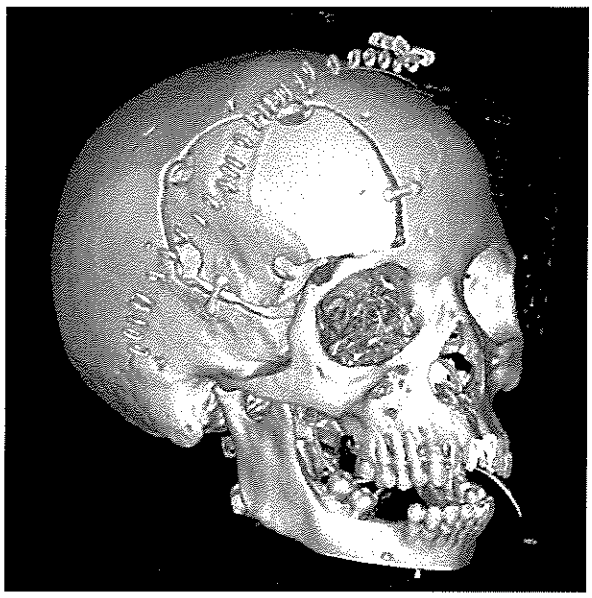

Figure 2. Postoperative volume rendered reconstruction shows right extended pterional craniotomy used for neurosurgical access

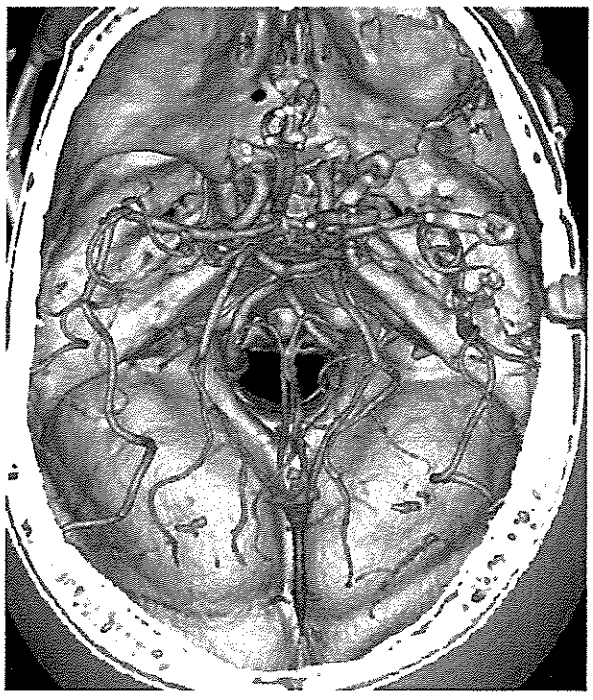

Figure 3. Postoperative CT angiogram (volume rendered reconstruction) shows multifocal aneurysmal clips in situ on the left, with no residual aneurysmal filling

with proximal control and clip repositioning. The slightly smaller mirror left DACA aneurysm was also successfully clipped (Fig 4d). Hypertension was induced to ensure that haemostasis had been achieved and closure was done in the

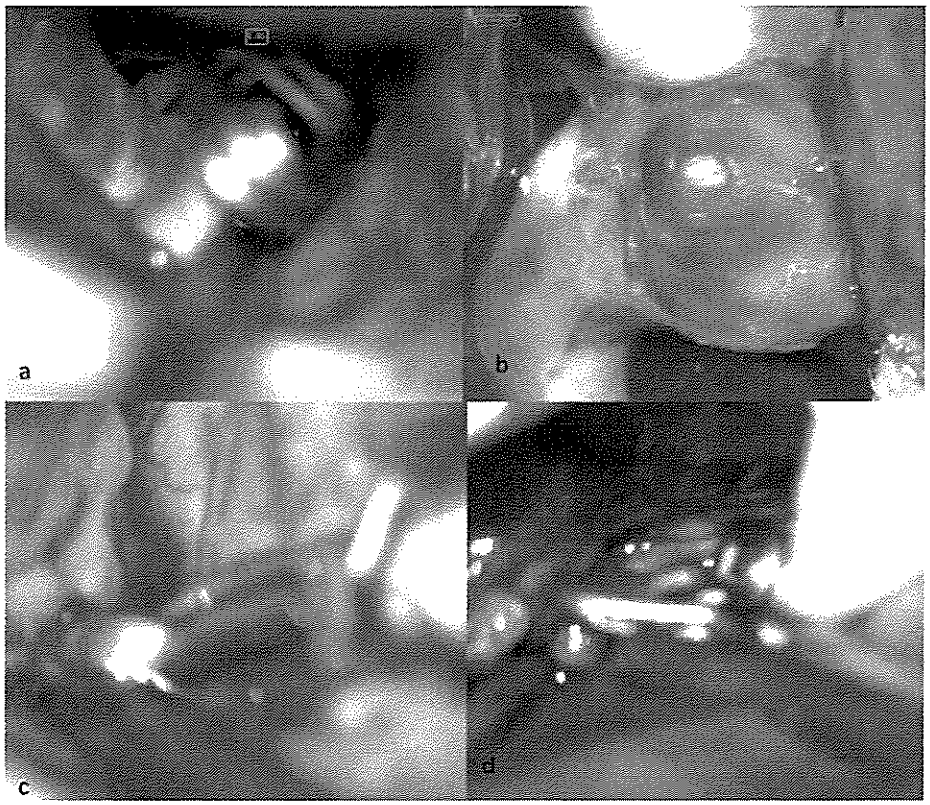

Figure 4. Intraoperative microscopic pictures. a) left PCom aneurysm, b) left MCA aneurysm, c) left ACom aneurysm, d) mirror DACA aneurysms
ACom: Anterior Communicating artery, DACA: Distal Anterior Cerebral artery, MCA: Middle Cerebral Artery, PCom: Posterior Communicating artery

standard fashion. The patient was initially kept intubated for concern of postoperative seizures but was extubated on the first postoperative day. She was initially confused but improved to a GCS of 15/15 and had no focal neurological deficit and a modified Rankin Score of 2.

DISCUSSION

Significant risk factors for multiple intracranial aneurysm include smoking, female gender and hypertension.(2) Neurofibromatosis type 1 is an autosomal dominant neurocutaneous disease caused by a mutation in the neurofibromin gene on chromosome 17q11.2. It has been suggested that this condition is associated with an increased risk of intracranial aneurysms.(3) The basis of this has been several case reports of intracranial aneurysms in NF1 patients. This association has, however, been confirmed by a series of MRI's done in patients with NF1 finding significantly more incidental aneurysms compared to a control population.(3)

Treating all aneurysms in one stage is advocated as induced hypertension to treat vasospasm post operatively may risk rupture of the unsecured aneurysms.(4)four with mass effect, and five were asymptomatic. These 38 patients harbored 101 aneurysms, 79 of which were treated with GDCs, 14 by surgical clipping, and eight were left untreated. Of the GDC-treated lesions, a complete endovascular occlusion was achieved in 55 aneurysms (70% In patients with SAH that have multiple aneurysms there are a number of factors to determine the site of rupture including the location of the blood, focal spasm and the size and shape of the aneurysm.(1) The site cannot always be determined with 100% accuracy and if all aneurysms are not treated in a single stage there is a risk of leaving the ruptured aneurysm unsecured.

Endovascular management is a feasible option in the treatment of multiple aneurysms, especially if all lesions are not accessible via a single craniotomy. It is also noted that clipping multiple aneurysms in the presence of SAH can be difficult due to cerebral oedema and hydrocephalus which can reduce the space needed to access all aneurysms.

However endovascular services are limited in our setting and it has been shown that microsurgical clipping of aneurysms is a more cost-effective procedure which is an important consideration in developing countries.

A case series by Dunn (6) describes an approach using two ipsilateral craniotomies, a pterional as well as an interhemispheric approach, with a single incision to address

multiple intracranial aneurysms in similar locations to the current case. In our case we opted for a single extended pterional approach which allowed access to the distal ACA aneurysms in addition to the other aneurysms normally accessible with a pterional approach.

CONCLUSION

This case of multiple aneurysms highlights the role of microsurgical clipping in the endovascular era. It also shows the utility of the extended pterional approach in reaching the distal anterior cerebral arteries. The patient's descendants having clinical neurofibromatosis, a condition known to be associated with aneurysms, which suggests variable penetrance of this condition.

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