Spontaneous Extracranial Internal Carotid Artery Aneurysm
A Case Report

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ABSTRACT

Extracranial internal carotid artery aneurysms are rare. They may result in thromboembolic phenomena but spontaneous rupture is rare. The clinical presentation may be an asymptomatic neck mass or there may be symptoms of upper aerodigestive tract compression. The diagnosis may be suspected on clinical examination but radiologic investigations play an important role in diagnosis as well as in assessing the risk of complications of surgical intervention. We present a case of a patient with an extracranial internal carotid artery aneurysm, along with a short review of the treatment options.

Keywords: Aneurysm, carotid, giant

Aneurisma Espontáneo de la Arteria Carótida Interna Extracraneal
Reporte de Caso

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RESUMEN

Los aneurismas de la arteria carótida interna extracraneal son raros. Pueden ocasionar fenómenos tromboembólicos pero la ruptura espontánea no es común. La manifestación clínica puede ser una masa asintomático en el cuello, o pueden presentarse síntomas de compresión de las vías aerodigestivas superiores. Pueden producirse indicios para el diagnóstico a partir de sospechas durante el examen clínico, pero las investigaciones radiológicas desempeñan un papel importante a la hora de diagnosticar, y evaluar el riesgo de complicaciones de la intervención quirúrgica. Presentamos un caso de un paciente con un aneurisma de la arteria carótida interna extracraneal, junto con una breve reseña de las opciones de tratamiento.

Palabras claves: Aneurisma, arteria carótida, extracraneal

INTRODUCTION

True extracranial internal carotid artery aneurysms are rare (1, 2). The causes include congenital factors, trauma (pseudoaneurysms), atherosclerosis, infections (mycotic), syphilis (luetic) and fibromuscular dysplasia (3). Upper cervical internal carotid artery aneurysms are associated with a high risk of ischaemic stroke but reports of spontaneous rupture are rare. These aneurysms may present as an asymptomatic neck mass, with aerodigestive compression or with neurological deficits. Diagnostic modalities are multiple but must include an assessment of the adequacy of the collateral cerebral circulation *via* the circle of Willis. The preferred method of treatment is surgical and while multiple options exist, the aim is to resect the aneurysm and repair the vessel while maintaining cerebral blood flow (1, 4–7). We report a case of extracranial internal carotid artery aneurysm treated at a tertiary healthcare institution and review the literature on the treatment of this rare condition.

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CASE REPORT

A 61-year old woman was referred to the Head and Neck Department with a five-month history of a slowly enlarging right neck mass. There was no associated pain or compressive symptoms and there was no hoarseness, odynophagia or dysphagia. She had no otologic symptoms other than intermittent right pulsatile tinnitus. She had no symptoms suggestive of cranial or peripheral neurologic deficits. She did not have any previous head and neck operations or other trauma to the area. She had a known history of hypertension and hyperlipidaemia and was maintained on nifedipine 10 mg twice daily, hydrochlorothiazide 12.5 mg daily, enalapril 5 mg daily, aspirin 81 mg daily and simvastatin 20 mg daily. She had smoked five cigarettes/day for over 40 years but had stopped two years ago. She gave no history of alcohol abuse.

Significant examination findings were confined to the neck where she had a pulsatile, expansile, non-tender neck mass extending from the retromandibular region of the right neck down to the level of the hyoid bone, which measured 5 x 4 cm in vertical and transverse diameters, respectively.

She was assessed as having either a carotid body tumour or a carotid aneurysm. Investigations included a Doppler sonogram done at the referring hospital, which revealed the "mass" to be a 4.13 x 5.1 x 3.57 cm aneurysm of the right internal carotid artery (ICA). The distal/superior extent of the internal carotid artery could not be assessed on ultrasound. Computed tomography (CT) angiography demonstrated tortuous aortic arch with tortuosity of the brachiocephalic trunk and the right and left common carotid arteries (Figs. 1, 2). The right carotid bifurcation was normal but the

Fig. 2: Computed tomography angiogram (3D volume rendering image) demonstrates the common carotid artery (A), pre-aneurysmal portion of the internal carotid artery (ICA) aneurysm (C) and compressed post aneurysm component of the ICA.

medial aspect of the aneurysm to enter the skull base. This efferent limb was deformed and compressed by the aneurysm with attenuated blood flow. Similar attenuated flow was demonstrated in the intracranial portion of the right ICA and the right anterior and middle cerebral arteries.

There was also a 0.4 cm saccular aneurysm arising at the a1/a2 junction of the left anterior cerebral artery (Fig. 2b).
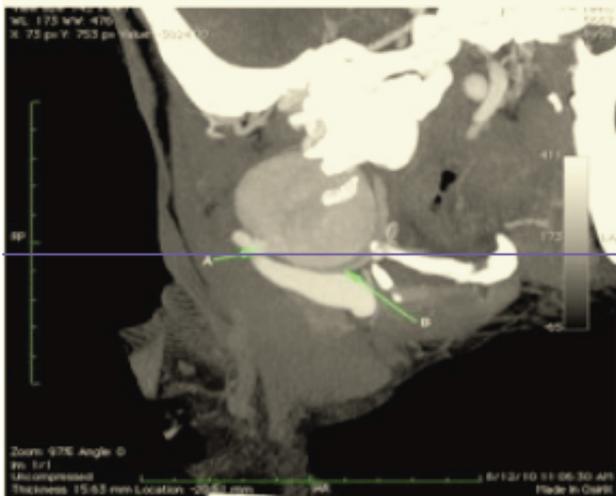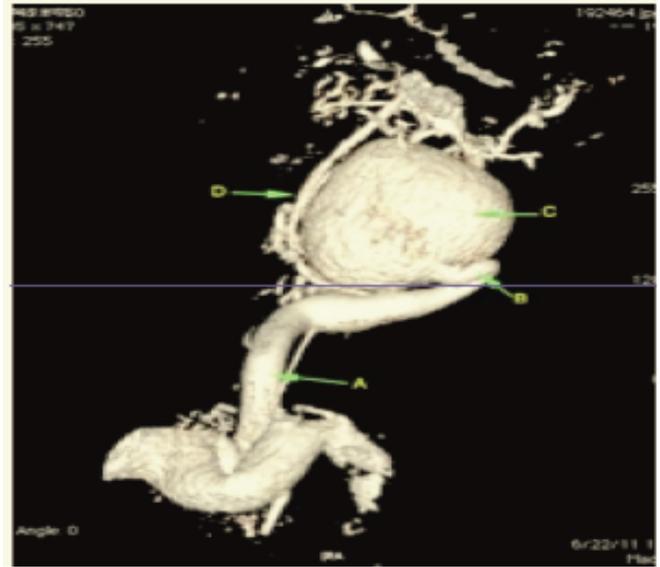

Fig. 1: Computed tomography angiogram (multiplanar reconstruction, posterior view) showing saccular aneurysm of the right internal carotid artery (ICA). The pre-aneurysmal portion of the ICA is labelled A. Note compressed distal internal carotid artery (B).
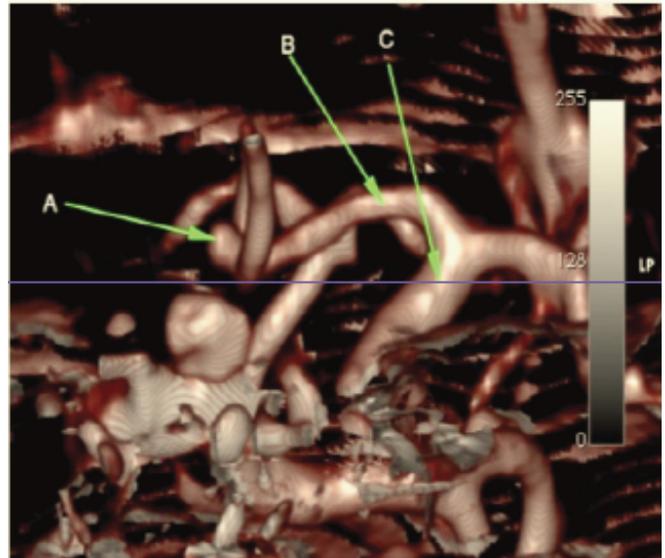

Fig. 2b: Computed tomography angiogram (3D volume rendering image) demonstrates an aneurysm (A) at the junction of a1 (B) and a2 of the left anterior cerebral artery ICA (B).

internal carotid was tortuous and led into a 4.7 cm saccular aneurysm arising 1.5 cm distal to the bifurcation. The afferent inflow into the aneurysm entered inferolaterally and the efferent limb exited inferomedially and coursed along the

The a2 segment of the right anterior cerebral artery demonstrated similar enhancement as its left counterpart suggesting contributed contralateral flow *via* a patent anterior com-

municating artery. The neurosurgeons opted to manage this aneurysm non-surgically.

After discussing the options with the patient and relatives, we decided to treat her carotid aneurysm surgically. Temporary balloon occlusion testing under fluoroscopic guidance was not available; however, the left common carotid artery angiogram demonstrated flow across the anterior communicating artery and the right anterior cerebral artery and its branches were outlined. The right middle cerebral artery was not demonstrated. The aorta was noted during this study to be ectatic and there was a suggestion of a dissection of the abdominal aorta. A CT aortic angiogram of the abdomen demonstrated a 3 cm fusiform infrarenal aortic aneurysm as well as a 1.3 cm saccular aneurysm of the right renal artery (Fig. 3).
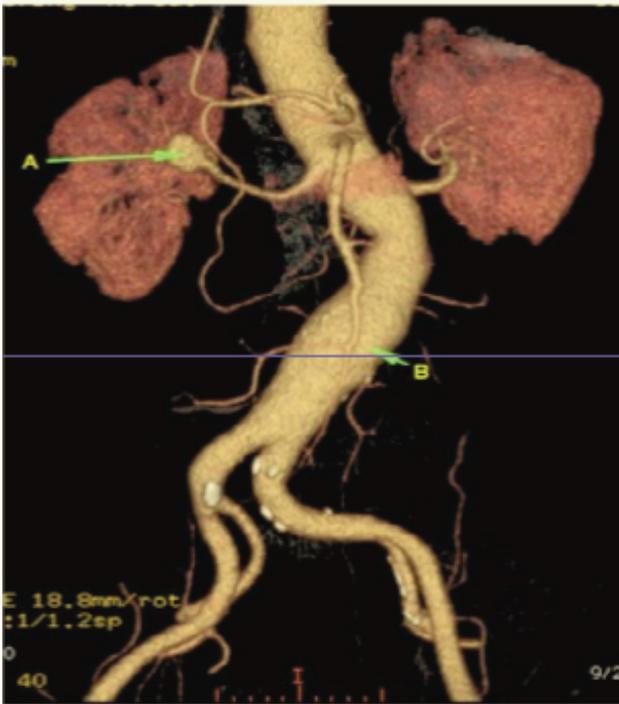

Fig. 3:   Computed tomography aortogram (3D volume rendering image) demonstrates a saccular aneurysm of the right renal artery (A) and a fusiform infrarenal aortic aneurysm (B).

Her preoperative blood investigations were normal including complete blood count, urea and electrolytes and prothrombin time (PT)/partial thromboplastin time (PTT). Her urinary vanillylmandelic acid (VMA) was also normal and her blood pressure was well controlled but a cardiology consult was requested and an electrocardiogram was normal with no ischaemic changes. She was assessed as low risk for adverse cardiac event intraoperatively.

Two months after initial presentation to the department, she underwent surgery where, *via* a curvilinear right neck incision done under local anaesthesia, the right common carotid was clamped for 15 minutes with continuous clinical neurologic monitoring. She remained neurologically stable

and the clamps were removed and general anaesthesia was induced. The neck incision was extended, superior and inferior skin flaps were raised in the subplatysmal plane and control was obtained of the proximal common carotid artery and distal internal jugular vein. The artery was followed up to the bifurcation of the common carotid artery and proximal control was obtained of the external carotid artery (Fig. 4). A

Fig. 4:   Photograph showing right common carotid artery being isolated.

saccular aneurysm was seen in the internal carotid artery starting approximately 1 cm from the bifurcation, which measured 5 x 4 x 4 cm in the vertical, anteroposterior and transverse directions, respectively (Fig. 5). The distal intern-
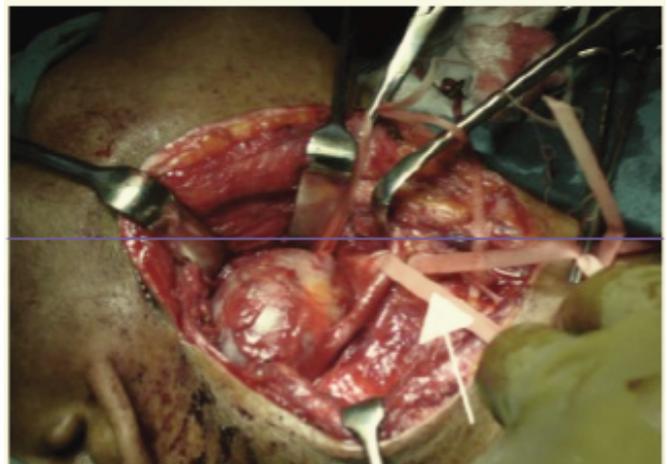

Fig. 5:   Photograph showing saccular aneurysm of the right internal carotid artery. Note the umbilical tape looped around the artery proximal and distal to the aneurysm (arrow).

al carotid artery was compressed and flattened over the lateral surface of the aneurysm with reduced arterial flow. The superior portion of the sac abutted onto the base of the skull but was easily dissected free. The hypoglossal nerve was identified and preserved.

The aneurysm was delivered and isolated between proximal and distal vascular clamps after administering 5000 units of heparin intravenously (Fig. 6). An aneurysmectomy was performed followed by an end-end anastomosis using 6/0 prolene suture (Fig. 7).
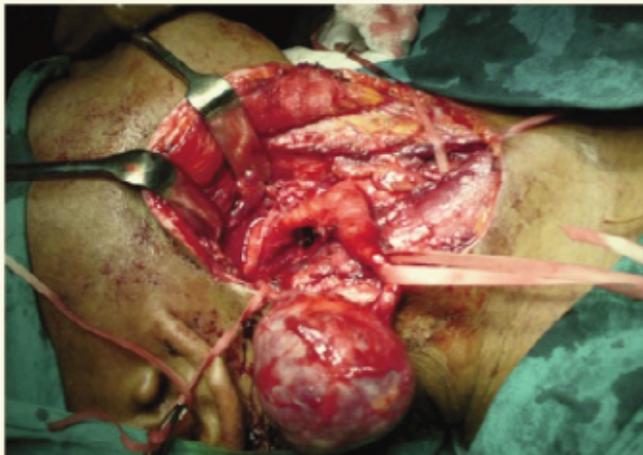
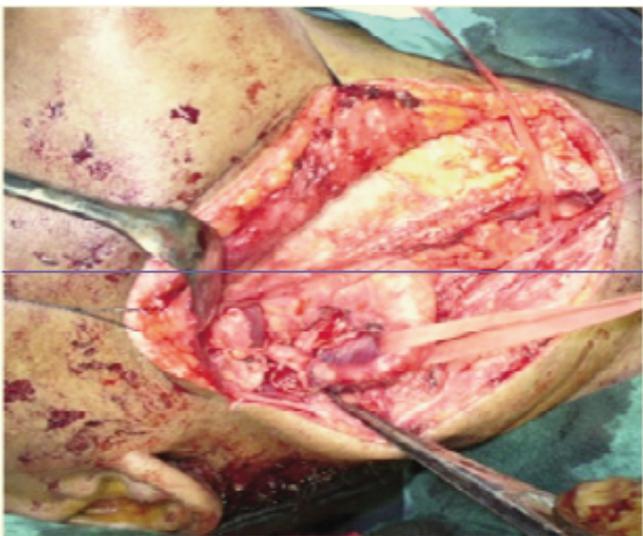Fig. 6:　Aneurysmal sac has been delivered and is ready for excision.

Fig. 7:　Aneurysm has been excised and primary end-end anastomosis performed of the internal carotid artery.

Clamping time was 28 minutes. Haemostasis was achieved after an estimated blood loss of 380 millilitres and the wound was closed in layers after placement of a hae-movac drain. Bleeding from the right anterior jugular vein complicated her early postoperative course, for which she required re-exploration under general anaesthesia. She had no postoperative neurologic deficits and she was discharged on the 3rd postoperative day; she was neurologically stable at her last visit four months after her operation. No postoperative angiography was done due to financial constraints. Histologic evaluation of the aneurysm showed portions of a muscular artery exhibiting sub-endothelial fibrosis and focal lipid deposits within the media associated with fibrosis and dystrophic calcification. The features were of an athero-sclerotic aneurysm.

DISCUSSION

True extracranial internal carotid artery aneurysms are rare with the largest series reported by El-Sabrout and Cooley comprising 67 patients over a 35-year period (5). Other series report an average of one case per year (1). The common causes include atherosclerosis, trauma, syphilis, bacterial infections (mycotic) and fibromuscular dysplasia (2, 8). The commonest symptom is a neck mass but patients may also present with aerodigestive tract compression and neural deficits. Neural deficits may be the results of direct compression such as of the vagus, hypoglossal or glossopharyngeal nerves or a Horner's syndrome due to compression of the cervical sympathetic nerves. However, some patients may develop transient ischaemic attacks or hemiplegia due to thrombotic or embolic stroke. Rupture and bleeding are rarely seen unless the result of ill-advised aspiration of the lesion.

The diagnosis may be established by Doppler ultrasound, which has the advantage of being relatively inexpensive, non-invasive and does not expose the patient to ionizing radiation. Conventional digital subtraction angiography remains the "gold standard" but has been largely supplanted by CT angiography, which may provide extravascular anatomical details which may be utilized to plan the surgical approach. Magnetic resonance angiography (MRA) is a useful diagnostic tool as well, which avoids exposure to ionizing radiation and iodinated contrast.

Investigations may also be geared toward determining the adequacy of the cerebral circulation. These include the Matas test with external digital compression of the carotid artery with neurologic monitoring. This may be combined with MRA for enhanced accuracy (9). Conventional angiography with temporary balloon occlusion is an invasive option that has reasonable accuracy although 10–25% of those who passed this test still had cerebrovascular accident with carotid artery ligation. The accuracy of this study can be improved by combining it with Xenon CT, cerebral perfusion CT scan, MRI, single photon emission CT (SPECT) or positron emission tomography [PET] (10–12). Ninety per cent of patients who have cerebral blood flow of less than 30 mls/100 gm/hour will have cerebrovascular accidents after carotid artery ligation (13). Single photon emission CT is another option for assessing the adequacy of the collateral circulation. These investigations are not available at our institution. Direct clamping of the common carotid artery with clinical neurologic monitoring was therefore performed.

The recommended treatment is surgical or endovascular interventions with conservative treatment reserved for patients who are poor surgical candidates or who refuse surgery (1, 4–7). The goal of any surgical intervention is to eliminate the risk of thromboembolic complications and/or rupture of the aneurysm. Surgical options include ligation of the internal carotid artery. The most common surgical option is excision of the aneurysmal sac and arterial repair. Small

aneurysms may be excised and the resultant defect closed primarily with sutures or repaired with a vein patch graft. Alternatively, the artery may be repaired by end-end anastomosis which is usually facilitated by the tortuosity of the artery in the elderly patients. Where tension-free anastomosis is impossible, an interposition graft of saphenous vein, PTFE or Dacron may be utilized. Alternatively, the proximal end of the external carotid artery may be transposed and anastomosed to the distal internal carotid artery.

Surgical treatment remains high risk with notable complications including transient ischaemic attacks (8%), cerebrovascular accidents (4–4.5%), cranial nerve injury (glossopharyngeal, vagus and hypoglossal, 20.8–44%) and death [0% in elective cases, 50% in emergency cases] (8, 14).

Shunts may be utilized in order to reduce the period of cerebral hypoxia which may result in a lower risk of cerebrovascular accidents (1). In the index patient, having established adequate collateral circulation, we were able to resect the aneurysm and do an end-end anastomosis without central nervous system complication and without using a shunt.

Endovascular techniques involve the use of various devices introduced into the aneurysm within the lumen of the vessel under radiologic guidance. The main goal is to exclude the aneurysm from the circulation with subsequent thrombosis within the sac while maintaining intra-arterial blood flow. The role of endovascular techniques in the treatment of extracranial ICA aneurysms is not yet established but is utilized in intracranial ICA aneurysms. Complications include arterial injuries at the injection site but embolic stroke has been reported (4).

REFERENCES

1. Bakoyiannis CN, Georgopoulos SE, Tsekouras NS, Klonaris CN, Skrapari IC, Papalambros EL et al. Surgical management of extracranial internal carotid aneurysms by cervical approach. A N Z J Surg 2006; **76:** 612–17.
2. Nair R, Robbs JV, Naidoo NG. Spontaneous carotid artery aneurysms. Br J Surg 2000; **87:** 186–90.
3. McCann RL. Basic data related to peripheral artery aneurysms. Ann Vasc Surg 1990; **4:** 411–14.
4. Bergeron P, Khanoyan P, Meunier JP, Graziani JN, Gay J. Long-term results of endovascular exclusion of extracranial internal carotid artery aneurysms and dissecting aneurysm. J Interv Cardiol 2004; **17:** 245–52.
5. El-Sabrout R, Cooley DA. Extracranial carotid artery aneurysms: Texas Heart Institute experience. J Vasc Surg 2000; **31:** 702–12.
6. May J, White GH, Waugh R, Brennan J. Endoluminal repair of internal carotid artery aneurysm: a feasible but hazardous procedure. J Vasc Surg 1997; **26:** 1055–60.
7. Pasternak J, Popovic V, Vukobratov V, Horvat Z, Pfau J, Obradovic J. [Surgical treatment of a giant extracranial internal carotid artery aneurysm–a case report]. Med Pregl 2007; **60:** 187–90.
8. Faggioli GL, Freyrie A, Stella A, Pedrini L, Gargiulo M, Tarantini S et al. Extracranial internal carotid artery aneurysms: results of a surgical series with long-term follow-up. J Vasc Surg 1996; **23:** 587–94.
9. Hori M, Okubo T, Aoki S, Ishigame K, Araki T, Nukui H. The magnetic resonance Matas test: feasibility and comparison with the conventional intraarterial balloon test occlusion with SPECT perfusion imaging. J Magn Reson Imaging 2005; **21:** 709–14.
10. Chen HJ, Chen HY. Use of Tc-99m HMPAO brain SPECT to evaluate cerebral collateral circulation during Matas test. Clin Nucl Med 1995; **20:** 346–51.
11. Katano H, Nagai H, Mase M, Banno T. Measurement of regional cerebral blood flow with H2(15)O positron emission tomography during Matas test. Report of three cases. Acta Neurochir (Wien) 1995; **135:** 70–7.
12. Overbeck B, Rosanowski F, Grunwald F, Bockish A, von Itter C, Biersack HJ et al. [HMPAO-SPECT during carotid artery compression (Matas test) in the evaluation of cervical tumor surgery with potential carotid involvement]. Laryngorhinootologie 1991; **70:** 422–5.
13. Witt JP, Yonas H, Jungreis C. Cerebral blood flow response pattern during balloon test occlusion of the internal carotid artery. AJNR Am J Neuroradiol 1994; **15:** 847–56.
14. Rosset E, Albertini JN, Magnan PE, Ede B, Thomassin JM, Branchereau A. Surgical treatment of extracranial internal carotid artery aneurysms. J Vasc Surg 2000; **31:** 713–23.