

Original Article

DIFFERENT SURGICAL MODALITIES IN MANAGEMENT OF EXTRACRANIAL INTERNAL CAROTID ARTERY ANEURYSM

By

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Aim: The purpose of this study was to analyze the aetiology, the mode of presentation; surgical management of a series of extracranial internal carotid artery aneurysms (EICAA).

Patients & methods: This study includes 10 patients 8 men & 2 females with aneurysms involving the extracranial internal carotid artery presenting to Kasr El-Eini hospital during the period from January 2000 to December 2003.

Results: The etiology was trauma in 4 patients (40%), atherosclerosis in 4 patients (40%), Behcet's disease in 1(10%) patient & mycotic aneurysm in 1 patient (10%). As regards the management interposition grafting was applied in 8 (80%) of the 10 cases saphenous interposition graft was applied in 5 cases (50%) and in 3 (30%) cases polytetrafluoroethylene (PTFE) graft was used. Two cases were treated by ligation (20%). Clinical results showed minimal complications in two patients one with haematoma, & other with hypoglossal nerve affection. Follow up Duplex was done for 8 cases within the 2 years following surgery and proved no stenosis or occlusion in the repaired artery.

Conclusion: EICAA are rare and have variable causes. Safety and long-term reliability of appropriate surgical approach warrant broad surgical indications, because of the risk of embolization and rupture of these aneurysms.

Keywords: Post-Traumatic, Atherosclerosis, Behcet's disease, Mycotic aneurysm, ligation, interposition graft, Transient ischemic attacks.

INTRODUCTION

Extracranial internal carotid artery aneurysms (EICAA) are uncommon lesions with variable causes. Until 1925 they were usually unsuspected until the occurrence of local complications such as rupture or hemorrhage.⁽¹⁾ Few large⁽²⁻⁴⁾ series has been reported in the literature since first report of aneurysm ligation by sir Astley cooper in 1805,⁽⁵⁾ and so several aspects of this disease still need to be completely analyzed and discussed.

Aneurysms of the extracranial internal carotid artery are defined as localized increase in caliber of more than 50% as compared with the reference values, which are 0.55 ± 0.06 cm in men and 0.49 ± 0.07 in women at the level of the Internal carotid artery ICA.⁽⁶⁾ Although atherosclerosis is the main cause of stenotic lesions of the ICA, the causes of aneurysms are multiple and include

atherosclerosis and dysplastic, traumatic, and infectious lesions.⁽⁷⁾

These aneurysms are not restricted to the carotid bifurcation, which demands a simple surgical approach, but may extend along the whole ICA up to the site where it penetrates the petrous bone. The development of reconstructive surgery of ICA lesions now allows surgical treatment of all such lesions, even the most distal.⁽⁸⁾

In this series the aim was to analyze the aetiology, the mode of presentation, surgical management, different surgical modalities of ECICAA and early-term follow up of these cases and compare it with other studies

PATIENTS AND METHODS

This is a case series retrospective study of 10 patients 8

male & 2 females with aneurysms involving the extracranial internal carotid artery (ICA) presenting to Kasr El-Eini hospital during the period from January 2000 to December 2003. The criterion for inclusion in this study is at least 50% increase in the artery diameter, aneurysms of the carotid bifurcation were excluded.

Patients' data have been collected with particular attention to etiology, risk factors, clinical presentations, imaging investigations and surgical management. Clinical examination involved indirect laryngoscopy to assess the compression of the aneurysm into the pharyngeal wall.

Duplex was applied in all cases to evaluate the size and exact extension of the aneurysm and to examine the other carotid artery. Angiography was done in 4 cases (Fig. 1), computed tomography (CT) scanning with contrast was done in 2 patients, to help outline the aneurysm as it was extending to the base of the skull. Cervical Magnetic Resonance Angiography MRA was done for 1 case (bullet injury), as the patient is known to have allergy to the dye (Fig. 2).

CT brain was done for all cases that presented with stroke & transient ischemic attacks "TIAs" (4 cases) and a neurologist was consulted in all cases. Duplex of the saphenous vein was done for all cases to assess its availability for usage as a graft. General anesthesia was used in all 10 patients. Surgical exposure was done by cervical approach, for which interposition graft was applied in 8 cases, and ligation of the aneurysm was done in 2 cases.

Postoperative results were reviewed with clinical and neurological examination to assess the outcome of surgical interference. Follow up was based on clinical examination, duplex scanning done 3 & 6 months after surgery for patients with interposition graft.

RESULTS

During the study period 10 EICAA have undergone operations in 10 patients. Eight patients were males (80%) and two were females (20%), the mean age was 52.4 years (range 11-69).

The etiology was traumatic in 4 patients (40%), 3 patients (30%) due to blunt trauma and 1 patient (10%) due to bullet injury to the neck, atherosclerosis in 4 patients (40%), Behcet's disease in 1 patient (10%) and mycotic aneurysm in 1 patient (10%) Table 1.

Table 1: Etiolog of EICAA.

Etiology	No. Of cases	Percentage
Trauma	4	40%
Atherosclerosis	4	40%
Behcet's dis.	1	10%
Mycotic aneurysm	1	10%

From the 4 patients caused by trauma, 3 (30%) presented as swellings (aneurysms), [1 (10%) was a pseudoaneurysm and 2 (20%) were true aneurysms], and 1 patient (10%) presented with contralateral hemiparesis due to ischemic cerebrovascular accident. In the 4 patients due to atherosclerosis the presentation was by a pulsating swelling in the carotid triangle in one case (10%), 2 patients (20%) with contralateral transient ischemic attacks (TIA), and 1 patient (10%) with contralateral hemiparesis. In the case with Behcet's disease the patient presented with a pulsating swelling in the carotid triangle with urogenital ulcers and was referred from an internist after being suspected to be Behcet's disease. The patient with mycotic aneurysm was a 11 yrs old child that presented with a swelling in the carotid triangle, he was referred from the cancer institute, and suffered from lymphatic leukemia and was under chemotherapy Table 2.

Table 2: Modes of patient presentation.

Presentation	No. Of cases	Percentage
Swelling in carotid triangle	6	60%
Contralateral hemiparesis	2	20%
Contralateral hemispheric transient ischemic attacks (TIA)	2	20%

The relation between the etiology and the presentation of the patient is shown in Table 3.

The standard carotid approach anterior the sternomastoid muscle was used in all patients. All 10 cases were operated upon under general anesthesia; it was preferred on cervical block to avoid injury of the aneurysm. All procedures were performed under systemic heparinization. In 3 patients (30%) of the atherosclerotic cases Javit shunt were used prophylactically because of the presence of stenotic lesion of the contralateral internal carotid artery as was previously detected using arterial duplex on the internal carotid arteries. In 3 patients (30%) the wall of aneurysm was not removed because of adherence of the cranial nerves.

As regards the surgical; procedures used in the management, interposition grafting was applied in 8 (80%) of the 10 cases [saphenous interposition graft was applied in 5 cases (50%) (those are the cases in which venous duplex was done and showed the saphenous vein to be of suitable caliber), and in 3 cases (30%) Polytetrafluoroethylene (PTFE) graft 6 mm in diameter was used in which duplex showed the saphenous vein caliber was not suitable]. Two cases were treated by ligation (20%) one was a blunt trauma with the aneurysm reaching the base of the skull in a 19yrs old patient, with no neurological deficits postoperative, the other was a mycotic aneurysm in an 11 years old child with lymphocytic leukemia and under chemotherapy. In these two cases there was good

back bleeding. Figure 3A shows a patient presenting with a pulsating swelling in right carotid triangle, 3B shows the same patient postoperatively after 1 week.

During the immediate postoperative follow up period 2 patients (20%) developed haematoma, which completely resolved within 8 days. One patient (10%) had hypoglossal nerve affection, but that was relieved after a week.

Clinical follow up and neurological deficits was done for all patients. Follow up Duplex was done for all cases within the 2 years following surgery and proved no stenosis in the repaired artery.

Table 3: Relation of presentation to etiology.

	Trauma	Atherosclerosis	Behcet's dis.	Mycotic
Swelling	3	1	1	1
Contralateral hemiparesis	1	1	-	-
Contralateral TIAs	-	2	-	-



Fig 1. Angiography of left Carotid artery showing aneurysm of the internal carotid artery (White arrow).

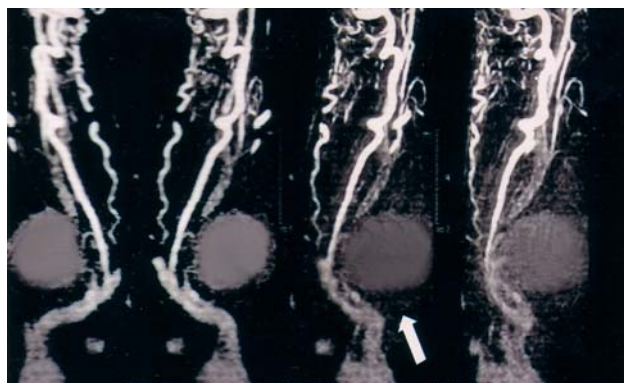


Fig 2. MRA of Right Carotid and Vertebrobasilar System. Showing aneurysm of internal carotid artery (white arrow).



Fig 3. A) Pulsating swelling in right carotid triangle. B) Postoperatively Patient pointing with left hand to site of operation.

DISCUSSION

Aneurysms of the EICAA are uncommon; the incidence in the literature is reported in the range of 0.1% to 2% of all carotid artery procedures.⁽⁹⁾ EICAA were reported to be 0.4% to 1% of all arterial aneurysms⁽¹⁰⁾ or 4% of peripheral aneurysms.⁽¹¹⁾

In this series; and in the absence of further data on at least 50% increase of the artery diameter was used as an indication for surgical intervention.

In the current study the male/ female ratio was 4:1, in comparison to other large series and collected experiences that showed a range from 2:1 to 1:2: these figures are different from the 5:1 and 30:1 ratios reported for aortic aneurysms and peripheral aneurysms, respectively.⁽¹²⁾

The reports in the literature refer to a variety of causes for EICAA. In this study the etiology was trauma in 4 patients (40%), atherosclerosis in 4 patients (40%), Behcet's disease in 1 patient (10%) and mycotic aneurysm in 1 patient (10%). The incidence of atherosclerosis as an etiological factor is extremely variable and accounts for 9.5% to 83% of cases.^(3,4,9,13-15) Another major and increasingly frequent cause of carotid aneurysms is trauma.⁽¹⁶⁻¹⁸⁾

Most of the patients in this study presented by a swelling in the carotid triangle 6 cases (60%). Two patients (20%) presented with contralateral ischemic hemiparesis. Two patients (22.2%) following trauma presented with contralateral (TIAs).

The presentation by a swelling vary according to the location, size and etiology, this was evident by the variability in different studies ranging from 79.2% in a series⁽¹⁹⁾ to 13 % in another (20). In the study by Oliver et al. (1997) 40 % of the cases presented by hemispheric stroke and 20 % presented by hemispheric TIA. Similar results were reported by other series.^(15,21)

Duplex ultrasound scanning is the most simple investigation, but this may fail if the lesion is located high, especially if the patient has a short neck. Duplex is used also to assess the other carotid artery for stenotic lesions. Arteriography most often provides the diagnosis of the lesion, specifies the localization, and detects any associated stenosis, or wall irregularities. Enhanced CT scanning allows analysis of the aneurysm anatomy and extension. The two-dimensional magnetic resonance inflow angiography technique with reconstruction yields a good opacification of the ICA, but the lesion may be underestimated in case of partially or completely thrombosed aneurysm.⁽²²⁾

Surgical treatment is believed to be necessary for all

EICAA by most authors,^(2,19) because of the high rate of neurological symptoms 33%-45% in collected series.^(3,15) Nonoperative treatment is associated with a risk of stroke as high as 50%.⁽³⁾ On the contrary, rupture is a very rare complication of EICAA.^(11,15)

All patients were anaesthetized using general anesthesia, as local or cervical block was considered not to be feasible due to the disturbed anatomy for fear of aneurysm rupture. Surgical management was undertaken by interposition grafting in 8 of the 10 cases 80% and artery ligation in 2 case 20%. Saphenous interposition graft was applied in 5 cases 50% and Gortex graft in 3 cases 30%. In this study, carotid shunt was used in three cases as there was a significant stenosis in the contralateral carotid artery as was revealed by preoperative duplex. The cervical approach is not feasible if the aneurysm extends beyond the entrance of the carotid canal. This limitation compelled us to perform ligation in one traumatic case in the presence of good back bleeding this has been reported by other authors using this approach exclusively.^(9,23) Ligation of the aneurysm was also done in another case of mycotic aneurysm this was performed due to friability of the wall and coagulopathy, similar management was also attempted by others.⁽²⁴⁾

In the ongoing study during the immediate postoperative follow up period 2 patient (20%) developed haematoma, which completely resolved within 8 days. One patient (10%) had hypoglossal nerve affection, but that was relieved after a week. Unlike previous authors⁽²⁵⁻²⁷⁾ in this study no major postoperative swallowing problems occurred and we did not perform gastrostomy in any patient. To minimize the risk of swallowing complications we leave the wall of the aneurysm was left in place if it is too adherent to the cranial nerves as done in 3 of our cases (30%).

Some cases of endoluminal treatment of high ICA aneurysms have been reported, but the scarcity of the publications and, particularly, the absence of long-term results do not allow an objective evaluation of this technique.⁽²⁸⁻³⁰⁾

Current surgical studies⁽³¹⁾ indicate that reconstruction is advisable over ligation with a death rate of 2% versus 20% and a stroke rate of 8% versus 25%. In the current study, there were no deaths or strokes after revascularization or ligation may be due to the young age of the two patients in which the carotid artery was ligated.

The good short- and middle-term results of this series support the use of surgical therapy for aneurysms of the EICA.

In conclusion safety and long-term reliability of

appropriate surgical approach warrant broad surgical indications, because of the risk of embolization and rupture of these aneurysms.

Carotid shunting is used when there is contralateral stenotic lesion. The resection of the wall of the aneurysm depends on the adherence of the wall of the aneurysm to the surrounding structures, to avoid injury to the cranial nerves and pharynx.

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