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Management of Extracranial Carotid Artery Aneurysms: 17 Years' Experience

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Objectives: a retrospective review of seventeen-year (1980–1996) experience of the management of extracranial carotid artery aneurysms.

Patients and methods: sixty-six aneurysms of extracranial carotid artery were seen in 63 patients. The diagnosis was confirmed by angiography in 51 patients and duplex ultrasonography in twelve. Twenty-eight (42%) patients had an atherosclerotic aneurysm, twenty-two (33%) had false aneurysms secondary to trauma, nine were congenital and seven were mycotic. All underwent aneurysm resection with saphenous-vein-graft interposition as the most common means of reconstruction.

Results: one death occurred due to septicaemia in a diabetic patient with a mycotic aneurysm, giving an operative mortality of 1.5%. One patient had an immediate hemiparesis after carotid artery ligation, and three had a hemiparesis within 48 hours of operation (6.1%). After a change in technique to avoid a residual carotid stump, no further neurological problems were encountered in the following 28 patients.

Conclusion: extracranial carotid aneurysms may be successfully managed with resection and reconstruction with autogenous saphenous vein. End-to-side anastomosis avoids a blind-ending stump which may be the source of emboli.

Key Words: Carotid artery; Aneurysm; Autogenous vein; Resection.

Introduction

Extracranial carotid artery aneurysms are uncommon. The largest reported series from a single institution, that of McCollum and associates at Baylor University, consisted of 37 aneurysms treated over a 21-year period. During the same period, approximately 8500 operations for arterial aneurysms of all types were performed at the same institution.¹ One hundred and sixteen cases of extracranial carotid artery aneurysms have been reported in the Chinese literature during the past 20 years.^{2–6} Extracranial carotid artery aneurysms may be increasing in incidence,^{7–9} and their treatment presents a challenge because of the risk of serious neurological events. We report our seventeen-year experience of managing extracranial carotid artery aneurysms at a single teaching hospital in China.

Patients and Methods

From January 1980 to December 1996, sixty-six aneurysms of extracranial carotid artery were seen in

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sixty-three patients. The mean age was 49 years (27–69 years) and 49 were men. All patients presented with a mass in the neck. The major clinical manifestations were transient ischaemic attack (TIA), Horner's syndrome, vascular bruit and thrill (Table 1). The diagnosis was confirmed by angiography in 51 and duplex ultrasonography in 12 patients (Fig. 1). Twenty-eight (42%) were due to atherosclerosis; twenty-two patients (33%) had false aneurysms of the carotid artery, which were secondary to blunt or penetrating trauma (no patient had undergone previous carotid surgery). Nine (14%) were congenital and seven (11%) were mycotic (five mycotic aneurysms were confirmed by bacteriology, and two cases were based on clinical findings). The majority (62%) were localised to the carotid bifurcation (Table 2).

Table 1. Clinical manifestations of extracranial carotid artery aneurysms.

Symptoms and signs	No. of patients
TIA	13 (21%)
Horner's syndrome	6 (10%)
Homolateral tinnitus	4 (6%)
Dysphasia	3 (5%)
Bruit	39 (62%)
Thrill	8 (13%)

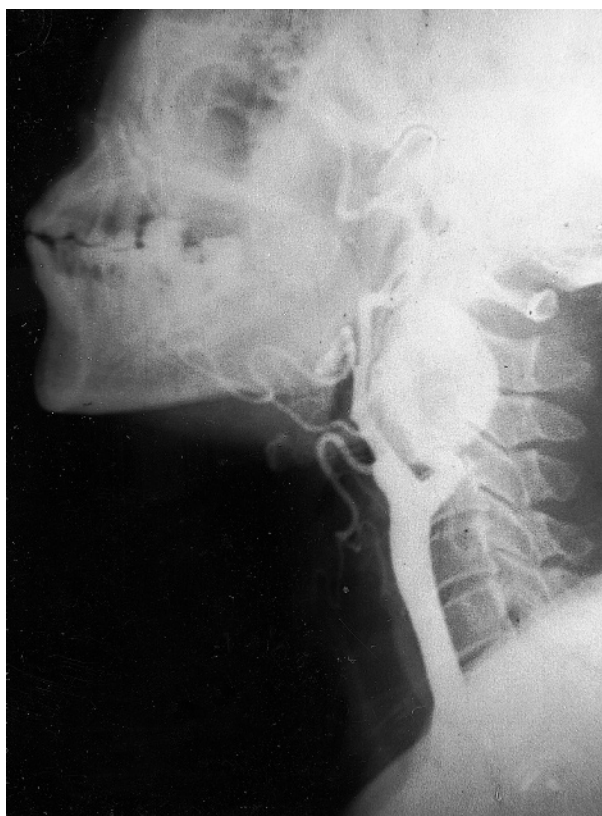


Fig. 1. Angiography showing an internal carotid artery aneurysm.

All patients subsequently underwent surgery. The carotid occlusion tolerance test (Mata's test) was performed before operation in all cases, the minimal tolerance time required being 20 minutes. Patients who were not able to tolerate this had repeated compression for increasing lengths of time, until they were able to tolerate carotid compression for 20 minutes. This could take up to two weeks in some patients. No patient suffered any adverse consequences from this. General anaesthesia was used in all patients. Aneurysm resection with saphenous-vein-graft interposition was used as reported by Feng in 1981² (Fig. 2) and Wang in 1987.⁵

Table 2. Location of extracranial carotid artery aneurysms in 63 patients.

Location	No. of aneurysms
Carotid bifurcation	41 (62%)
Internal carotid artery	13 (20%)
Common carotid artery	10 (15%)
External carotid artery	2 (3%)
Total	66 (100%)

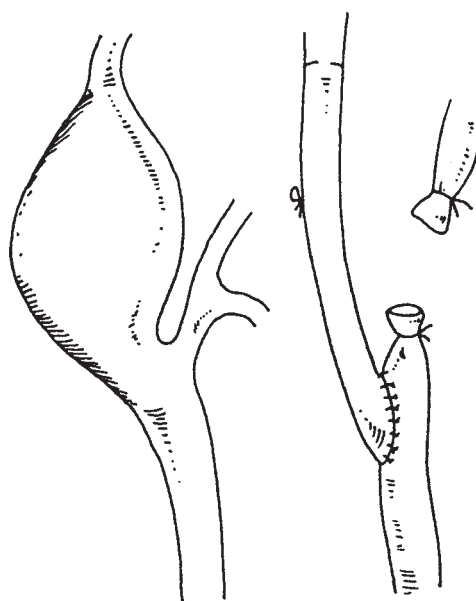


Fig. 2. Aneurysm resection with saphenous-vein-graft interposition, leaving a carotid stump.

Results

Forty-six aneurysms were resected with saphenous-vein-graft interposition. Seven aneurysms were completely resected with end-to-end anastomosis. Five aneurysms were resected with proximal and distal ligation of the internal carotid artery. The surgical procedures are summarised in Table 3. One operative death was due to septicaemia in a diabetic patient who had a mycotic aneurysm. The operative mortality was 1.5%. One patient with a ruptured false aneurysm had a hemiparesis after carotid artery ligation. Hemiparesis occurred between 24 and 48 hours post-operatively in three patients who had made a good initial recovery after carotid aneurysm resection with saphenous-vein-graft interposition. All these grafts were patent as confirmed by re-exploration in one and duplex scan in two cases. The operative morbidity was 6%. The hemiparesis in these three patients was

Table 3. Surgical procedures for extracranial carotid artery aneurysms.

Operation	No. of aneurysms
Aneurysm resection with saphenous-vein-graft interposition	46 (70%)
Aneurysm resection with end-to-end anastomosis	7 (11%)
Carotid artery ligation	5 (8%)
Endoaneurysmorrhaphy with Dacron wrapping	4 (6%)
Aneurysm resection with patch	1 (2%)
External carotid aneurysm resection	3 (5%)

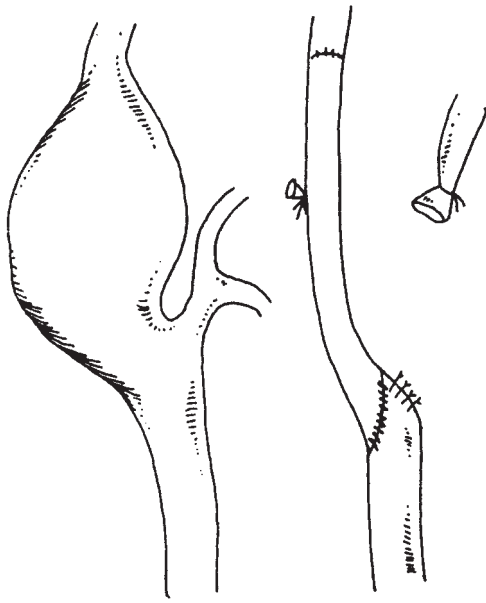


Fig. 3. Aneurysm resection with saphenous-vein-graft interposition, no carotid stump.

caused by ischaemic cerebral infarction, confirmed by CT scan. All patients made a good recovery and returned to work. Following a modification in technique, the following 28 cases proceeded uneventfully. The early patients in this series had a distal blind end of the common carotid stump which probably acted as a source for emboli (Fig. 2). The reason for leaving a stump was to allow an end-to-side anastomosis to be performed proximally using a side-biting clamp in order to minimise the length of cerebral ischaemia. The later patients had end-to-side anastomoses with resection of the carotid stump, so avoiding any source for emboli (Fig. 3). The mean time for an end-to-end anastomosis between distal internal carotid artery and saphenous vein was 9.5 ± 3.2 minutes, which represented the total cerebral ischaemic time.

The follow-up ranged from 6 months to 15 years. Six patients were lost to follow-up. Two patients died of myocardial infarction and one died of liver cancer. The other patients are alive and well.

Discussion

Extracranial carotid artery aneurysms are rare, with reports on the incidence varying between centres.^{1,8,9} One-hundred and sixteen cases of carotid aneurysm have been reported in Chinese literature.²⁻⁶ In comparison with the total number of peripheral aneurysms reported during the same period, the incidence of

carotid aneurysm would seem to be higher in China than in the West.

The treatment of extracranial carotid aneurysms has evolved with time. The primary objective is the prevention of permanent neurological deficits which arise from embolisation of the contents. Sir Astley Cooper reported the first successful treatment for an aneurysm of the extracranial carotid artery by ligation in 1808.¹⁰ Unfortunately, simple ligation is associated with a high incidence of neurological sequelae (up to 30–40%) and has been abandoned in favour of resection and reconstruction.^{3,9} Several recent reports in the English literature have attested to the success of this method.^{5,7,9}

Hypothermia and shunting have both been used, either separately or in combination, to reduce the risk of cerebral ischaemia during carotid artery cross-clamping. However, these measures may be associated with prolonged operating time, increased blood loss, dysfunction of blood coagulation, cardiac arrhythmia and embolism or thrombosis. We used normothermia and no shunt as recommended by Wang.⁵ Patients should be able to tolerate carotid compression for 20 minutes without neurological problems pre-operatively, and the systemic blood pressure was elevated pharmacologically during carotid cross-clamping.

The three patients who suffered hemiparesis after making an initially normal recovery probably suffered emboli from the carotid stump (Fig. 2). The stump of an occluded internal carotid artery can act as a source of emboli for further cerebral embolic ischaemia as described by Barnett *et al.*¹² We therefore modified our technique of saphenous-vein-graft interposition with resection of the carotid stump. No further neurological problems were encountered with this operation, which has become our technique of choice.

References

- 1 McCOLLUM CH, WHEELER WG, NOON GP, DEBAKEY ME. Aneurysm of the extracranial carotid artery. Twenty-one years' experience. *Am J Surg* 1979; **137**: 196–200.
- 2 FENG YX, SHI Q. Surgical treatment of aneurysm of the extracranial carotid artery. *Chin J Surg* 1981; **19**: 32–35.
- 3 TENG BR, SHENG ZR. Anaesthesia for operation of aneurysm of the extracranial carotid artery. *Chin J Surg* 1982; **20**: 482–484.
- 4 WANG JJ, SONG XL, ZHANG JJ, ZANG GS. Clinical characteristics and surgical treatment of aneurysm of the carotid artery. *Chin Prac J Surg* 1985; **5**: 303–304.
- 5 WANG ZG, WU QH, PU LP *et al.* Carotid reconstruction without hypothermia and shunt (report of 21 consecutive cases). *Proc CAMS and PUMC* 1987; **2**: 33–35.
- 6 XIN SJ, DUAN ZQ, ZHANG Q. Surgical treatment of extracranial aneurysm of the carotid artery. *Chin Prac J Surg* 1997; **17**: 361–363.

- 7 MOREAU P, ALBAT B, THEVENET A. Surgical treatment of extracranial internal carotid artery aneurysm. *Ann Vasc Surg* 1994; **8**: 409–416.
- 8 SCHECHTER DG. Cervical carotid aneurysms. *New York State Journal of Medicine* 1979; **79**: 892.
- 9 LIAPIS CD, GUGULAKIS A, MISIAKOS E *et al.* Surgical treatment of extracranial carotid aneurysms. *Int Angiol* 1994; **13**: 290–295.
- 10 COPPER A. Account of the first successful operation performed on the common carotid artery for aneurysm in the year of 1808 with post mortem examination in the year 1821. *Guys Hosp Rep* 1836; **1**: 53.
- 11 LEECH PJ, MILLER JD, FITCH W, BARKER J. Cerebral blood flow, internal carotid artery pressure, and the EEG as a guide to the safety of carotid ligation. *J Neurol Neurosurg Psychiatry* 1974; **37**: 854–862.
- 12 BARNETT HJ, PEERLESS SJ, KAUFMANN JCE. “Stump” on internal carotid artery – A source for further cerebral embolic ischaemia. *Stroke* 1978; **9**: 448–456.

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