


Eur J Vasc Endovasc Surg 23, 462–464 (2002)

doi:10.1054/ejvs.2002.1631, available online at <http://www.idealibrary.com> on 

TECHNICAL NOTE

Penetrating Injuries to the Innominate Artery in Association with Abnormal Aortic Arch Anatomy

J. D. Woolgar*, J. V. Robbs, P. Rajaruthnum and G. S. Mohamed

Durban Metropolitan Vascular Service, University of Natal, Durban, South Africa

Key Words: Innominate artery; Injury; Anomalies.

Introduction

Penetrating trauma to the innominate artery is uncommon and even more unusual when associated with aberrant or unfamiliar anatomical variants as proximal clamping of a common innominate or carotid trunk may result in occlusion of almost all antegrade flow to the brain. We describe three patients that presented over a 4-year period with penetrating trauma of the proximal innominate associated with an abnormal origin of the left carotid artery and a variant of the aberrant right subclavian anomaly where both carotids originated from a common trunk.

Case Presentations

Case 1

A 19-year-old male patient presented to the casualty department having sustained a stab wound to the lower neck. On examination he was fully conscious but cold, hypotensive and bleeding actively from a 1.5 cm wound just above the sternal notch. A diagnosis of a major arterial haemorrhage was made and the patient was taken immediately to the operating room for an exploratory sternotomy.

On entering the chest massive haemorrhage was noted from a 1 cm laceration between what was believed to be the innominate artery bifurcation. After application of the clamp the defect was successfully repaired with interrupted sutures. Post operatively

the patient was hypothermic, acidotic and fully ventilated. He was subsequently transferred to the intensive care unit for further management. He remained comatose and died 2 days later. At post-mortem the aberrant nature of the vascular anatomy became clear: the right and left-carotid arteries arose from a common trunk with a retro-oesophageal right subclavian originating from the descending aorta distal to the left subclavian artery (the Lusorian anomaly) (Fig. 1). Death had occurred from extensive bilateral cerebral infarcts most likely as a direct result of dual carotid occlusion during repair of the injury.

Case 2

A 25-year-old male presented to hospital with a 1 cm stab wound in the supra-sternal notch. He was haemodynamically stable with a loud machinery murmur and a palpable thrill present over the praecordium and radiating to the base of the neck. A chest x-ray revealed a widened mediastinum and an angiogram demonstrated a large arterio-venous fistula between the origin of an anomalous innominate artery and the brachiocephalic vein (Fig. 2). Immediately as the chest cavity was entered, via a median sternotomy, torrential arterial and venous haemorrhage occurred. The venous bleeding was controlled by ligating the brachiocephalic vein on either side of the injury. A 1.5 cm laceration at the base of an aberrant innominate trunk was repaired under digital control using interrupted sutures buttressed with teflon pledgets. The patient made an uneventful recovery without any neurological events and discharged from hospital on the eighth post-operative day.

*Please address all correspondence to: J. Woolgar, Department of Surgery, University of Natal, Private Bag 7, Congella, Durban, 4013, South Africa.

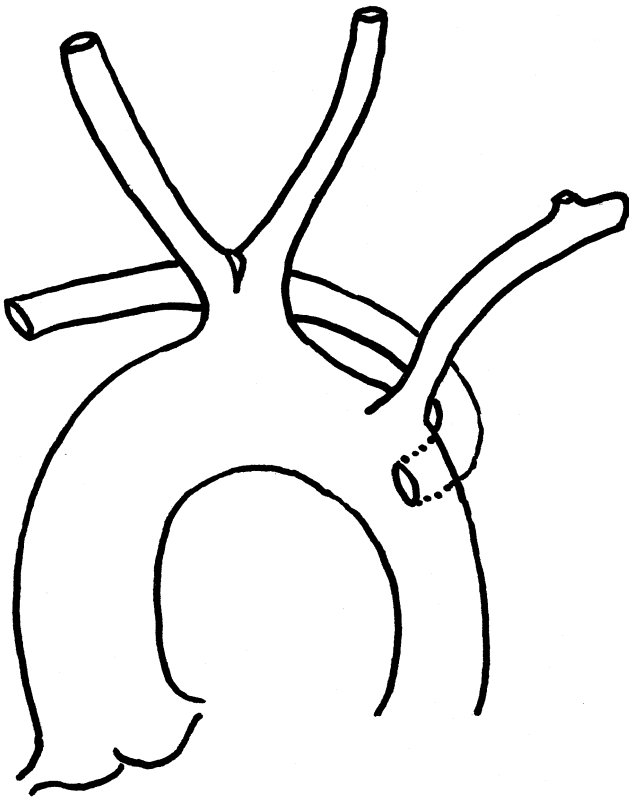


Fig. 1. Illustration showing the aberrant right subclavian anomaly and the site of injury in the common carotid trunk presenting in Case 1.

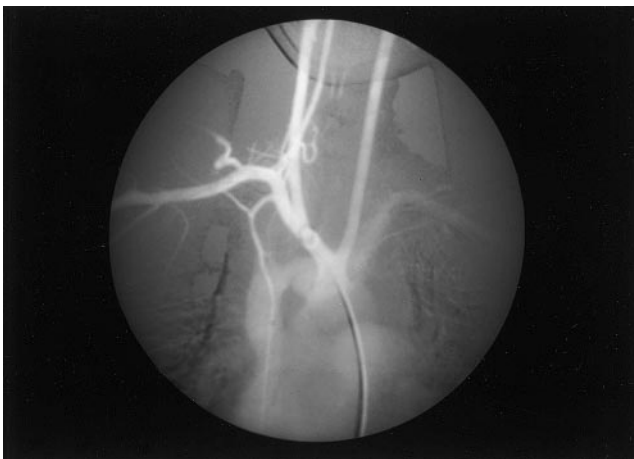


Fig. 2. Angiogram of the patient in Case 2 showing a large arteriovenous fistula between the proximal innominate artery and the brachiocephalic vein. Note the aberrant origin of the left carotid artery.

Case 3

A 21-year-old male patient had sustained a low velocity gunshot wound to the neck. The patient was

fully conscious and stable. A single entrance wound was noted in the suprasternal notch, all upper limb pulses were present and no bruits or abnormal sounds were audible. Chest x-ray demonstrated a widened mediastinum and a bullet lying in the right posterior chest wall. Angiography revealed a small pseudoaneurysm involving an anomalous innominate trunk from which the left common carotid originated. Through a median sternotomy the brachiocephalic vein was divided. Two small through and through perforations approximately 5 mm diameter were noted on the anterior surface of the innominate trunk at the origin of the left common carotid artery were sutured. Postoperatively he made an uneventful recovery without any neurological deficits.

Discussion

Penetrating injuries to the innominate artery are rare. Unlike extremity vascular trauma where much experience has been derived from the large military series, present knowledge of innominate injuries is largely based on civilian practice. Indeed, Rich *et al.* reported only three innominate injuries out of 1000 cases of vascular trauma from the Vietnam Vascular Registry.¹ In civilian series, it has been reported that these lesions account for 0.0% to 3.2% of all arterial trauma.³

The anomaly where the left common carotid artery originates from the proximal innominate has been reported to occur in 11–27% of the population.^{2,3} Current knowledge regarding the management of such patients is based on the experience from several cases only, all sustaining blunt trauma.^{3–6} The variant of the Lusorian anomaly (Case 1) where both carotid arteries are derived from a common trunk in association with an aberrant right subclavian is distinctly rare.⁷ The management of patients with penetrating trauma to such abnormal trunks and common origins has yet to be defined. In the stable patient chest x-ray and an aortic arch angiogram are usually the only imaging required.⁸ Unstable patients require immediate surgery without preoperative imaging. Small stab lacerations of the innominate, aorta or proximal great vessels can be effectively repaired by digital control and simple interrupted mattress suture of the laceration without the use of shunts, heparinisation or cardiopulmonary bypass.^{3,8,9} Clamping the proximal innominate artery at its origin in the presence of an aberrant left carotid interrupts flow in three of the four major arteries to the brain with potentially devastating results. In the bleeding patient where bypass may not be immediately available, temporary cardiac inflow occlusion as described by Vosloo *et al.*, may prove

useful.¹⁰ Alternatively, a permanent Y-bypass utilising a bifurcated Dacron or PTFE graft extending from the ascending aorta to the distal innominate stump and left common carotid after which the injured proximal common trunk is clamped and repaired.^{3,8} The use of a Javid shunt as outlined by Roberts *et al.*,⁶ from the aorta to the right carotid may also be a feasible solution.

Experience with endovascular therapy for these lesions is largely limited to patients with blunt injuries presenting with false aneurysms of the innominate artery.¹¹ Reubben⁵ and associates successfully excluded a traumatic pseudoaneurysm of the innominate associated with an abnormal left carotid origin using an endovascular stent-graft. However, the patient required a preliminary open procedure to transfer the left common carotid onto to the left subclavian artery. Although, the minimally invasive nature of this therapy is attractive, the long term results of placing endovascular stents in the innominate arteries of young trauma patients are not known.

References

- 1 RICH NM, BAUGH JH, HUGHES CW. Acute arterial injuries in Vietnam: 1000 cases. *J Trauma* 1970; **10**: 359–368.
- 2 LIECHTY JD, SHIELDS TW, ANSON BJ. Variations pertaining to the aortic arches and their branches, with comments on surgically important types. *Bull Northwest Univ Med School* 1957; **31**: 136–143.
- 3 GRAHAM JM, FELICIANO DV, MATTOX KL, BEALL AC. Innominate vascular injury. *J Trauma* 1982; **22**: 647–655.
- 4 VILLEGAS-CABELLO O, COOLEY DA. Aneurysm of the innominate artery with aberrant origin of the left carotid artery. *Tex Heart Inst J* 1996; **23**: 298–300.
- 5 REUBBEN A, MERLO M, VERRI A *et al.* Combined surgical and endovascular treatment of a traumatic pseudoaneurysm of the brachiocephalic trunk with anatomical anomaly. *J Cardiovasc Surg* 1997; **38**: 173–176.
- 6 ROBERTS CS, SADOFF JD, WHITE DR. Innominate arterial rupture distal to anomalous origin of left carotid artery. *Ann Thorac Surg* 2000; **69**: 1263–1264.
- 7 STONE WM, BREWSTER DC, MONCURE AC *et al.* Aberrant right subclavian artery: varied presentations and management options. *J Vasc Surg* 1990; **11**: 812–817.
- 8 ROBBS JV. Penetrating trauma to the inlet and outlet regions of the chest. In WESTABY S, ODELL JA, eds. *Cardiothoracic trauma*. New York: Arnold, 1999: 183–195.
- 9 FULTON JO, DE GROOT MK, von OPPELL UO. Stab wounds of the innominate artery. *Ann Thorac Surg* 1996; **61**: 851–853.
- 10 VOSLOO SM, REICHART BA. Inflow occlusion in the surgical management of a penetrating aortic arch injury: case report. *J Trauma* 1990; **30**: 514–515, 853.
- 11 CHANDLER TA, FISHWICK G, BELL PR. Endovascular repair of a traumatic innominate artery aneurysm. *Eur J Vasc Endovasc Surg* 1999; **18**: 80–82.

Accepted 4 March 2002