

Eur J Vasc Endovasc Surg 17, 84–86 (1999)
Article No. ejvs.1998.0574

CASE REPORT

Traumatic Rupture of the Aortic Arch Treated by Stent Grafting

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Introduction

Trauma to the thoracic aorta occurs most frequently as a consequence of blunt injury as a result of deceleration or crushing. Seventy–90% of patients die before reaching hospital, and of those treated only 60% survive.¹ The aortic adventitia or mediastinal interstitium may allow an unstable haematoma to form following transection of the aorta, although this is liable to rupture with catastrophic consequences. Smaller aortic tears may result in the development of a pseudoaneurysm which may persist undetected for months or even years.²

The treatment of acute aortic disruptions has traditionally been surgical, with a significant risk of paraplegia in those that survive.³ Stent grafts are being used increasingly to treat a number of vascular conditions, including those traumatic in origin.⁴ We describe the case of an 18-year-old male suffering multiple trauma in a road traffic accident, who developed a false aneurysm of the aortic arch. In view of the severity of his injuries, surgery was considered inadvisable, and the aortic disruption was treated successfully by insertion of a covered stent to exclude the false aneurysm.

Case Report

An 18-year-old male was transferred from a local hospital following a road traffic accident. He had sustained injuries to his head, chest and abdomen and had fractures of his pelvis and right femur. He was hypovolemic, with a blood pressure of 140/70 mmHg

but a pulse rate of 140, and his oxygen saturation was 70%. Chest radiography demonstrated bilateral haemopneumothoraces, for which bilateral chest drains were inserted. Computed tomography (CT) of the chest confirmed these together with a mediastinal haematoma in the aortico-pulmonary region. The Glasgow Coma Scale was 10 deteriorating rapidly to 5. A head CT scan revealed bilateral frontal pole contusions with a larger right frontal intracerebral haematoma, and fractures of the left mandible and right orbit. He had a ruptured spleen which was removed at laparotomy.

The mediastinal haematoma was investigated by transoesophageal echocardiography which revealed no abnormality, though views were suboptimal. A further contrast enhanced helical CT scan confirmed the lung contusions, pneumomediastinum and mediastinal haematoma, and demonstrated a small collection adjacent to the aortic arch immediately distal to the origin of the left subclavian artery. An arch aortogram confirmed a saccular aneurysm of the aortic isthmus which was considered to represent a partial aortic rupture (Fig. 1). Because of the coexisting pulmonary and cerebral injuries, open surgery to repair the aortic isthmus was felt to carry a significant mortality or risk of spinal cord damage. Endovascular repair of the false aneurysm was considered the treatment of choice.

Under general anaesthetic, the right common iliac artery was exposed and controlled through a retroperitoneal approach. A short length of 8 mm diameter woven polyester graft was sutured end-to-side to an arteriotomy in the common iliac artery for use as a conduit. The false aneurysm was occluded by insertion of a 22 mm × 70 mm Vanguard endovascular aortic graft (Meadox, Boston Scientific Corporation, New Jersey, U.S.A.). This was placed with its covered central

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Fig. 1. Arch aortogram confirming a false aneurysm of the aortic isthmus.

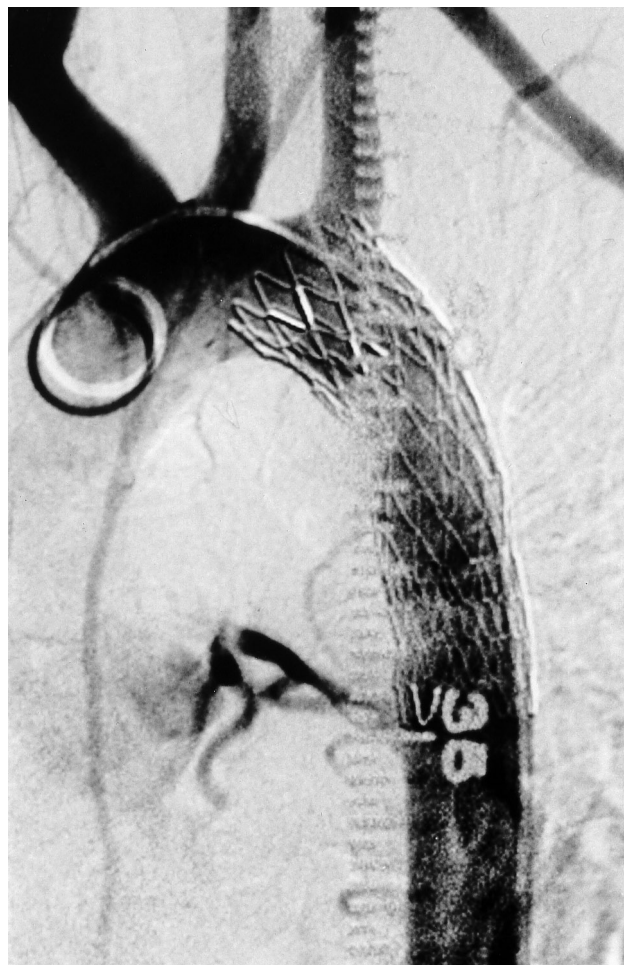


Fig. 2. Completion aortogram showing the covered stent *in situ* with total exclusion of the false aneurysm.

portion lying across the neck of the false aneurysm, and with the proximal uncovered portion overlapping the origin of the left subclavian artery. The final radiographic appearance was satisfactory (Fig. 2). The right and left arm blood pressures were identical following the procedure.

The patient also underwent intramedullary nailing for the fractured femur, and the mandibular fracture was plated. He made an uneventful recovery from his head injury and he was discharged 7 days after the endovascular stent was inserted on aspirin and beta-blockers. A follow-up CT at 6 weeks has shown no evidence of an endoleak, and the blood pressure in both arms remains the same.

Discussion

Endoluminal stenting has been used to treat thoracic aortic atherosclerotic^{5,7} and traumatic dissecting

aneurysms,^{6,7} atherosclerotic fusiform aneurysms,⁷ anastomotic leaks,⁵ iatrogenic aortopulmonary fistula,⁸ and aortic rupture following malignant infiltration.⁹ Vascular injuries resulting in peripheral arteriovenous fistulas or peripheral arterial false aneurysms have also been successfully stented.¹⁰⁻¹² This technique has only rarely been applied to traumatic ruptures of the aortic arch.^{5,7}

Open surgery to repair aortic arch rupture carries a risk of mortality and paraplegia. Aortic cross-clamping results in proximal hypertension which could predispose to further intracerebral haemorrhage in the case of a head-injured patient. These risks may be reduced if a minimally invasive endoluminal approach is employed. The technique of using a synthetic graft as a conduit for access to the iliac arteries made endoluminal stenting feasible in this case, as the introducer sheath was designed for stenting infra-renal aneurysms, and was therefore too short to reach the arch from the femoral artery.

Endoluminal stenting is the optimal procedure in patients with traumatic aortic arch ruptures who are medically unfit, where the alternative is major open surgery. However, long-term reports of stent-graft insertion are not yet available, and potential deleterious effects include stent disruption, graft-stent separation at their sutured join, embolisation or occlusion of adjacent arteries, and graft material disintegration, the latter particularly as the graft is very much thinner than that currently used for open arterial bypass surgery. Though the removal of stent grafts has been reported as being a hazardous procedure,⁶ an ideal compromise in aortic rupture may be the initial use of stent-grafting while concomitant injuries are treated, with a view to later definitive open repair in the haemodynamically stabilised patient.

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Accepted 10 February 1998