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Dehiscence of a Valved Conduit in the Ascending Aorta following Low-Velocity Blunt Chest Trauma: Case Report

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ABSTRACT

We report a case of a 56-year old man presenting with dehiscence of a valved conduit in the ascending aorta following low-velocity blunt thoracic trauma. The patient had a history of a Bentall procedure in 1994. Two weeks before referral to our hospital, the patient fell during a bicycle ride and hit the handlebars of the bicycle with his chest. During the days following the accident, the patient developed progressively worsening fatigue, shortness of breath, and intolerance for even minor physical effort. The presence of an enlarged ascending aorta surrounding the implanted valved graft was confirmed, and the patient was referred to our department for surgical repair, after which the patient had an uneventful recovery and was discharged home on postoperative day 12.

INTRODUCTION

Disruption of the thoracic aorta following blunt thoracic trauma is a catastrophic injury commonly leading to death. Most described cases involve rupture of the native aorta caused by high-velocity motor vehicle accidents [Symbas 1998]. We report a case of a 56-year old man presenting with dehiscence of a valved conduit in the ascending aorta following low-velocity blunt thoracic trauma.

The presentation, investigation, and treatment of blunt traumatic aortic rupture are well described and commonly accepted in the literature [Symbas 1998]. Several case reports describe the occurrence of aortic rupture [Symbas 1998], aortic dissection [Mimasaka 2003], and acute aortic valve regurgitation [Charles 1977] due to blunt chest trauma. Traumatic aortic rupture is a known mechanism of immediate death in high-velocity motor vehicle accidents. An incidence of aortic rupture up to 21% has been described in autopsies of car occupants who died in fatal traffic accidents [Richens 2003]. However, it was shown that even low-severity impacts can cause traumatic aortic lesions [Trachiotis 1996, Answini 2001, Richens 2003].

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CASE REPORT

A 56-year old man was referred to our hospital for semi-urgent operative treatment. The patient had a history of a Bentall procedure in 1994 (Carbomedics Composid valved conduit, 29 mm), after the detection of an ascending aortic aneurysm. There were no postoperative complications, infectious problems, or endocarditis after this procedure. The patient soon resumed both professional and recreational activities. Further medical history of the patient revealed mild asthmatic disease, mild hypercholesterolemia, and an operative repair of a bilateral inguinal hernia.

Two weeks before referral to our hospital, the patient fell during a bicycle ride. He recalls that during the fall, he hit the handlebars of the bicycle with his chest. The man experienced mainly pain at the level of the sternum and left hemithorax. But since no other symptoms occurred, he returned home. During the days following the accident, the patient developed progressive fatigue and shortness of breath, with an intolerance for even minor exertion. These symptoms worsened progressively.

Clinical investigation showed diffuse contusions over the chest. Dyspnea and slight tachypnea were present. Auscultation revealed the presence of a strong diastolic murmur. At the most recent cardiologic check-up (6 months prior to the accident), this murmur was not present. At that time, echocardiography showed no abnormalities at the level of the conduit.

A standard chest X-ray revealed a slightly enlarged upper mediastinal shadow, but interpretation was difficult because of the history of the Bentall procedure. An electrocardiogram showed no abnormalities. Transthoracic echocardiography showed the image of an enlarged ascending aorta (up to 8 cm), with a flow pattern leaving the ascending aorta at the level of the distal anastomosis, entering the old aneurysmatic space, and regurgitating into the left ventricle through a massive paravalvular leak. The patient's file noted that at the time of the Bentall procedure in 1994, an inclusion graft technique was used, involving closure of the remaining diseased aorta around the graft.

The transthoracic echocardiographic findings were confirmed by transesophageal echocardiography. Additionally, magnetic resonance imaging was performed, and results confirmed the presence of an enlarged ascending aorta surrounding the implanted valved graft (Figure 1). No hemodynamic instability was noted. The patient was referred to our department for surgical repair.

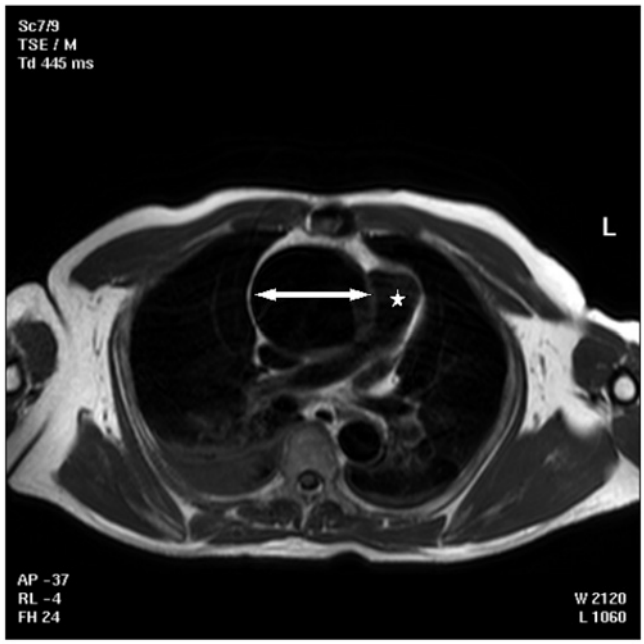

Figure 1. Magnetic resonance image of the large ascending aortic aneurysm (bounded by the arrows). The asterisk marks the main pulmonary artery.

The patient was placed on cardiopulmonary bypass through the left groin, and the chest was opened though resternotomy. An important aneurysmatic dilatation of the aortic root was present, with the wall of the aneurysm being the old aneurysmatic wall. Venting was placed through the right upper pulmonary vein, and a cannula for continuous retrograde blood cardioplegia was introduced in the coronary sinus.

After clamping and opening the aorta we saw an important dehiscence of the distal suture line (the suture line of the distal part of the graft with the aorta) (Figure 2A). At the base of the valved tube graft, we noticed a large gap between the valve sewing cuff and the aortic annulus (Figure 2B). These lesions appeared to be relatively recent, because there was only minimal scar formation at all levels. The insertion of the left coronary artery into the graft was still intact, but the right coronary artery was partially pulled out of the graft.

The entire valved conduit was excised together with all of the remaining aortic wall tissue. The coronary artery orifices were prepared for reimplantation. A new valved conduit (St. Jude Medical valved conduit, size 29 mm) was implanted. Because of severe calcification the left coronary artery origin was not suitable for direct reimplantation in the graft. Therefore, a small piece of saphenous vein was interposed between the left coronary artery and the Dacron conduit. The right coronary artery was reimplanted to the conduit directly.

The patient had an uneventful recovery and was discharged home on postoperative day 12. All tissue and graft samples taken from the operative field were cultured to exclude low-grade or occult subclinical infection, but all cultures remained sterile. Transthoracic echocardiography performed 1 week postoperatively revealed normal function of the implant.

DISCUSSION

Rupture of the thoracic aorta by blunt trauma is a well-recognized injury. Most frequently, it is a lethal injury to the native aorta following high-velocity accidents or falls. We described a case of a nonlethal dehiscence of a valved conduit in the ascending aorta following a low-velocity trauma.

There remains considerable uncertainty regarding the pathogenic mechanism of aortic rupture following blunt trauma. Many hypotheses have been proposed over the years, such as sudden stretching of the aorta, shearing due to deceleration loads, sudden rise in blood pressure, water-hammer effect, and entrapment of the aorta between the anterior tho-

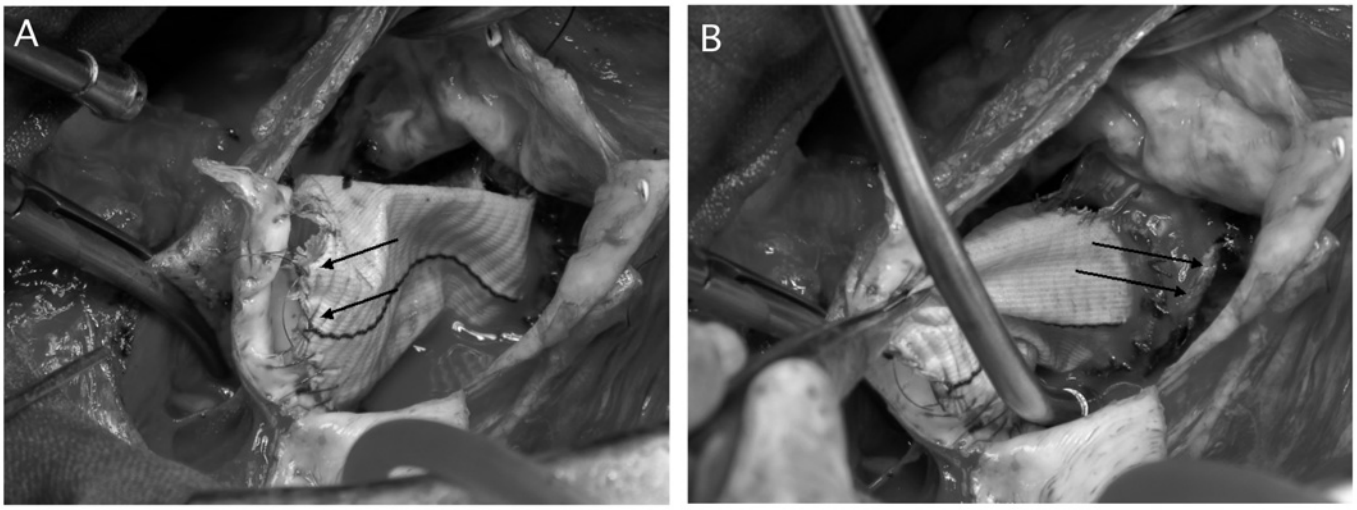

Figure 2. A, Dehiscence of the distal suture line (arrows). B, Large paravalvular leak due to dehiscence of the valve sewing cuff out of the aortic annulus (arrows).

racic bony structures and the vertebral column [Richens 2002]. Current thinking proposes that the injury results from a combination of mechanisms including shear, torsion, and stretching, compounded by hydrostatic forces [Richens 2002]. Obviously, all these forces can act on a previously implanted valved graft as well. To the best of our knowledge, there has been only one paper reporting a similar but fatal case [Ursell 1998].

In this particular case, the progressively worsening symptoms in the days after the accident together with the intraoperative findings suggest a causal relation between the fall and the sudden deterioration of the implanted graft. Low-grade or occult infection was excluded (all explanted tissue and graft cultures remained sterile). The inclusion graft technique that was used in this patient in 1994 (constructing a blood-tight closure of the residual aneurysm wall over the composite graft) has been abandoned because of complications of coronary artery dehiscence. It seems, however, that in this patient the inclusion technique was life saving. The case illustrates possible complications following (even minor) chest trauma in patients with a history of surgery at the level of the aortic valve and ascending aorta. As in injuries to the native thoracic aorta by blunt trauma, a high level of suspicion is required for timely diagnosis and treatment.

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