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Minimally Invasive Video-Assisted Graft Replacement of a Descending Thoracic Aortic Aneurysm

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Y. Joseph Woo, MD, Henry Childers, MD

Division of Cardiothoracic Surgery, University of Pennsylvania, Philadelphia, Pennsylvania, USA

Dr. Woo

ABSTRACT

Standard surgical therapy of descending thoracic aortic aneurysms entails obligate extensive operative exposure that is associated with significant postoperative pain and morbidity. A 70-year-old patient with multiple significant comorbidities including severe chronic obstructive pulmonary disease (force expiratory volume at 1 second, 0.66 L) presented with a highly symptomatic, eccentric, descending thoracic aortic aneurysm. The patient underwent successful minimally invasive video-assisted graft repair of this aneurysm. This report represents the first known clinical application of this operative approach.

INTRODUCTION

Standard surgical therapy for aneurysmal disease of the descending thoracic aorta is associated with significant postoperative pain and morbidity from the extensive, traumatic nature of the operative approach. Patients with prohibitive comorbidities may be amenable to endovascular stent therapy; however, this option is extremely limited. Less invasive operative techniques are needed. A patient is described in whom a minimally invasive approach was taken to replace the descending thoracic aorta.

CASE REPORT

A 70-year-old woman presented with significant back pain. A computed tomographic scan of the chest revealed a 3.5-cm, medially-based, thrombus-filled, saccular aneurysm of the proximal descending thoracic aorta with what appeared to be a region of localized dissection (Figure 1). The patient's medical history is notable for longstanding hypertension, atrial fibrillation, diabetes, resected colon cancer, coronary artery disease, myocardial infarction, left ventricular dysfunction, and chronic obstructive pulmonary disease. Her forced expiratory volume at 1 second was 0.66 L or 39% of the predicted volume. Despite adequate blood pressure management, the patient had persistent moderate back pain. The referring team felt that the patient's significant comorbidities prohibited operative therapy. In this patient with preexisting significant cardiopulmonary dysfunction, a minimally invasive video-assisted approach was devised to attenuate postoperative pulmonary morbidity.

The patient underwent double-lumen endotracheal general anesthesia, placement of a pulmonary artery catheter, placement of a cerebrospinal fluid drainage catheter, and monitoring of lower extremity somatosensory evoked potential. The patient was placed in the left thoracotomy position, and the left common femoral artery and femoral vein were exposed for a planned partial cardiopulmonary bypass. A limited left lateral minithoracotomy was performed through a portion of the latissimus dorsi muscle, sparing the serratus anterior muscle. The fifth intercostal space was entered with minimal rib distraction and without rib division. Three additional small counterincisions were made for a proximal cross-clamp, a distal cross-clamp, and a video thoracoscope (Figure 2). The aneurysm was inspected (Figure 3), and proximal and distal aortic cross-clamp sites were then dissected under video guidance by using all incisions. The patient was systemically heparinized and cannulated via the previously exposed femoral vessels. Partial cardiopulmonary bypass was initiated, and the aorta was clamped above and below the saccular aneurysm. The aorta was incised (Figure 4), and a 24-mm polyethylene terephthalate (Dacron) graft was anastomosed proximally and distally (Figures 5 and 6). The graft was deaired as the distal cross-clamp was slowly removed. The proximal cross-clamp was removed, and the anastomoses were inspected and found to be hemostatic (Figure 7). The patient was weaned from cardiopulmonary bypass and decannulated. Thoracostomy tubes were brought out through the lower 2 counterincisions. The minithoracotomy and upper counterincision were reapproximated. The patient was hemodynamically stable throughout and experienced no changes in somatosensory evoked potentials. Total cross-clamp time was 61 minutes, and total bypass time was 83 minutes. Postoperatively, the patient was neurologically intact and hemodynamically stable. She was extubated to a nasal cannula at postoperative hour 15. Her remaining postoperative course was uneventful from a cardiopulmonary standpoint. She experienced a moderately delayed return of

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Address correspondence and reprint requests to: Y. Joseph Woo, MD, Assistant Professor of Surgery, Director, Minimally Invasive and Robotic Cardiac Surgery Program, Division of Cardiothoracic Surgery, University of Pennsylvania, Silverstein 6, 3400 Spruce St, Philadelphia, PA 19104, USA; 1-215-662-2956; fax: 1-215-349-5798 (e-mail: wooy@uphs.upenn.edu).

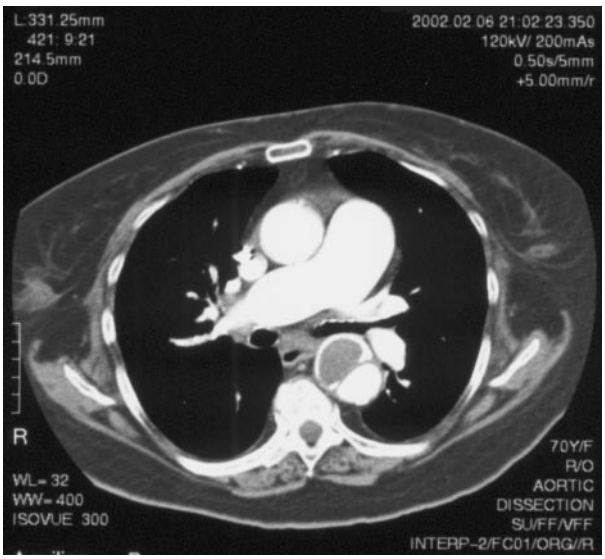

Figure 1. Contrast computed tomography scan of descending thoracic aorta demonstrating a medial saccular aneurysm versus a localized type B dissection.

normal gastrointestinal function, presumably due to her recent colectomy for carcinoma, and was subsequently discharged to home in excellent condition. At the 4-month follow-up, the patient was pain free, had assumed baseline physical activity, and had returned to her volunteer work.

DISCUSSION

The natural history of descending thoracic aortic aneurysms has been well characterized [Juvonen 1997, Griepp 1999]. Nonoperative observational management of aneurysms carries a known risk of rupture. In a large contemporary study of nonoperative management, several characteristics were found

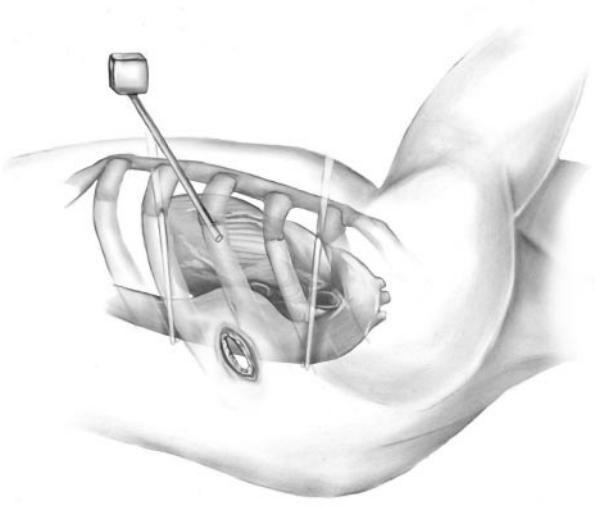

Figure 2. Representation of minimally invasive exposure of proximal descending thoracic aorta.

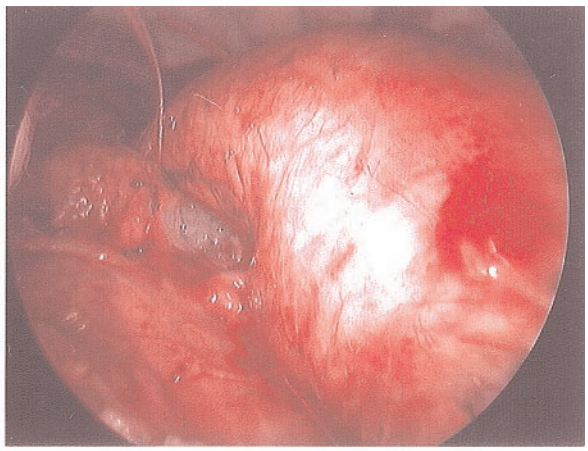

Figure 3. Intraoperative photograph of the saccular aneurysm of the small descending thoracic aorta.

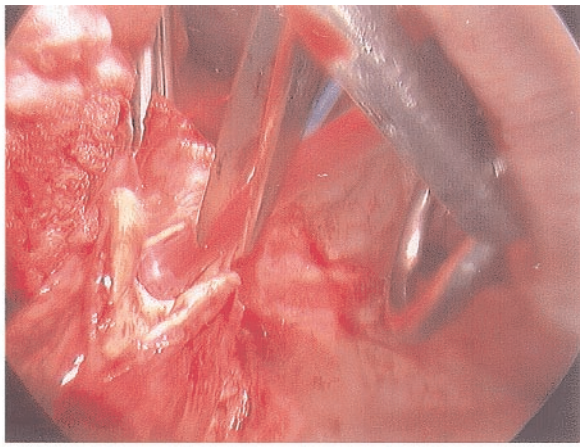

Figure 4. Aneurysm incised.

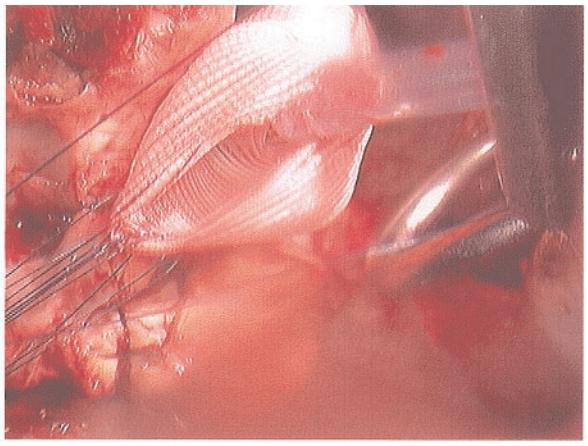

Figure 5. Parachute anastomosis.

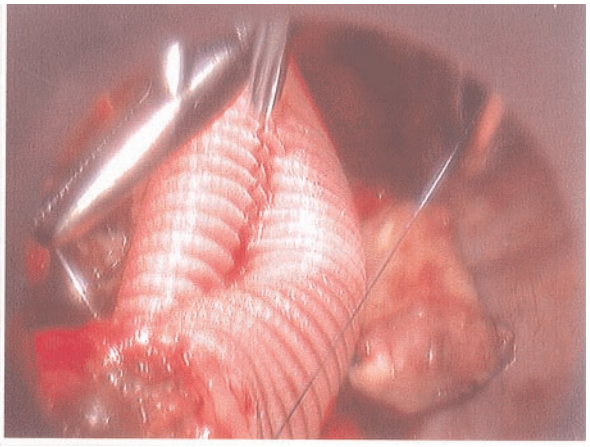

Figure 6. Completed anastomosis.

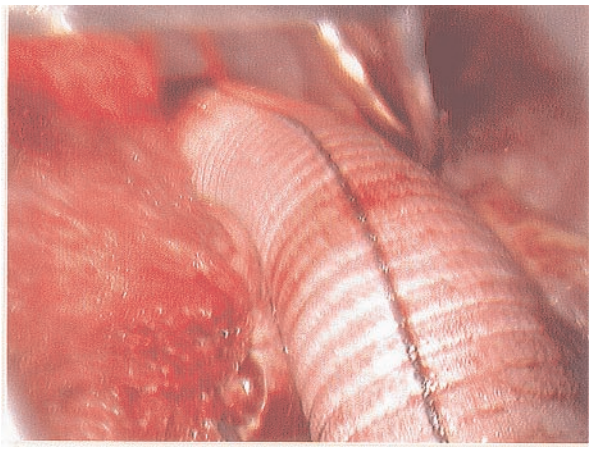

Figure 7. Graft replacement of the proximal descending thoracic aorta.

to correlate highly with rupture. These factors included chronic obstructive pulmonary disease, persistent pain, and presence of dissection, all of which were present in the patient described in this report [Griepp 1999]. Operative indications for descending thoracic aortic aneurysms have been well studied [Coady 1997], and operative techniques have become relatively standardized, with adjuncts such as cerebrospinal fluid drainage and distal aortic perfusion becoming commonplace [Estrera 2001]. Unfortunately, the requisite exposure for visualization, dissection, cannulation, clamping, and graft placement entails a large posterolateral thoracotomy, division of multiple muscles, and wide distraction of the ribs with associated rib notching, resection, or costal margin division. These painful procedures often yield respiratory dysfunction and prolonged ventilatory support requirements, particularly in patients with limited preoperative pulmonary reserve. Patients with pulmonary and other organ system comorbidities may be better addressed with endovascular stent therapy [Dake 1994, Mitchell 1999, Rachel 2002]. However, the widespread applicability of stent therapy is impaired by limited availability, very specific anatomic criteria, a requisite time delay for customized production, and, most recently, regulatory restrictions. In high-risk patients who are not candidates for endovascular stent therapy, an alternative to the standard operative approach is clearly needed. The use in sheep of a deployed sutureless aortic device that is minimally invasive has been described [Zegdi 1999]. To our knowledge, our study represents the first clinical report of a minimally invasive video thoracoscopic approach to the replacement of the descending thoracic aorta. This operation was performed safely in a technically feasible manner and likely decreased postoperative pain, prevented respiratory dysfunction, and contributed to early extubation and rapid patient recovery.

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