Cor-Knot automated fastener in distal anastomosis of total aortic arch replacement: a case report

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Abstract

A kyphotic gentleman with chronic obstructive pulmonary disease and Marfan syndrome whose history was significant for thoracoabdominal aortic replacement secondary contained rupture, presented with chest pain and an acute DeBakey type I aortic dissection. In this anatomically challenging total arch replacement, Cor-Knot fastener was employed without short-term or long-term complications.

Introduction

Acute DeBakey type I aortic dissections frequently present symptomatically at the time of dissection onset and have been associated with risks of aortic rupture, acute severe aortic regurgitation, and/or cardiac tamponade[1,2]. Classically, the treatment for an acute DeBakey type I aortic dissection is with an open surgical repair with an ascending aortic replacement, hemiarch replacement, zone 1 arch, zone 2 arch, and/or total arch replacement. The various approaches for this operation[3], are balanced with the severity of presentation, immediate mortality risk, facility resources, and surgeon preference. We herein present one of first reports of Cor-Knot automated fastener utilization in aortic arch surgery. Institutional Review Board approval was waived, and informed consent was obtained.

Case Presentation

A 37-year-old gentleman with a past medical history significant for chronic obstructive pulmonary disease (COPD), Marfan syndrome, and a previous open repair for a ruptured Crawford type I thoracoabdominal aortic aneurysm presented to a nearby emergency department with altered mental status and somnolence following cocaine use. He reported that for months he had syncopal episodes and dysphagia, with chronic chest and back pain, as well as shortness of breath. A computed tomographic angiography (CTA) demonstrated a DeBakey type I aortic dissection, with intact prior descending aortic replacement (**Figure 1**). On arrival to our institution, he was in sinus rhythm and on anti-impulse therapy. He was taken emergently for open aortic dissection repair. Through a median sternotomy, we cannulated centrally with epiaortic ultrasound and modified seldinger technique. Cannulae were placed and cardiopulmonary bypass initiated with systemic cooling towards 18°C for deep hypothermic circulatory arrest. The innominate artery was visualized, clamped cephalad, and transected at the level of the aorta for end-to-end anastomosis. Antegrade perfusion through the innominate artery was maintained as we completed the left common carotid, and left subclavian artery running anastomoses. Our distal aortic anastomosis was completed in Zone 3 of the aortic arch with a portion of the anastomosis to the dacron graft from the prior aortic repair.

In scenarios of normal anatomy, visualizing Zone 3 is frequently difficult via a median sternotomy. The kyphosis and extensive COPD in this patient made an already technically arduous situation virtually impossible with a conventional running aortic anastomotic approach. We placed interrupted 2-0 Ethibond plegetted valve sutures circumferentially (**Figure 2**). Once we were satisfied with our suture placement, we completed the anastomosis with the Cor-Knot automated fastener (**Figure 3**) over a 22 mm Hegar dilator to prevent aortic coarctation.

Body perfusion was resumed after 75 minutes, systemic rewarming was started, and the ascending aorta was transected at the sinotubular junction for proximal anastomosis as there was no root and/or valvular pathology. We subsequently completed the debranching anastomosis to the proximal aorta followed by atrial septal defect closure through the right atrium. Deairing was done through the left ventricular vent, the cross clamp was removed, rewarming was continued, the patient was decannulated from cardiopulmonary bypass (CPB), and the chest was closed. Cross clamp time was 197 minutes, and CPB time was 230 minutes.

Postoperatively, his course was complicated by prolonged intubation, tracheostomy, and bacterial pneumonia. His intensive care unit and total length of stay were 41 and 46 days, respectively. At one-month follow-up, he was mildly hypertensive at 135/80 mmHg with a heart rate of 99 beats per minute. Chest CTA at follow-up shows trifurcated debranching with Cor-Knot automated fastening of the distal aortic anastomosis (**Figure 4**). He had been decannulated from his tracheostomy and had progressively returned to his regular activities. He was scheduled for repeat CTA and follow-up to be done in one year.

Discussion

Cor-Knot fastener is widely used in minimally invasive cardiac valve surgery, but its use in aortic arch surgery has not been reported. In a systematic review of Cor-Knot use in cardiac valve surgery, Jenkin et al. conclude that significant evidence exists to show that Cor-Knot use provides intraoperative advantages such as reduced intraoperative times and increased knot strength and consistency[4]. However, data is lacking as to whether these benefits translate to improved postoperative outcomes[5]. Cor-Knot use in sternotomy-based cardiac valve surgery was evaluated in a randomized clinical trial and was determined to have no significant impact on CPB or cross-clamp times but with an added financial cost[6]. In another prospective observational study, safety of Cor-Knot automated fastening in patients undergoing aortic valve replacement was comparable to that of patients with manually tied knots as demonstrated by similar 30-day mortality, stroke and transient ischemic attack rates, pacemaker implantation rates, and rate of aortic regurgitation[7]. These studies suggest Cor-Knot is efficacious in minimally invasive cardiac valve procedures where there is limited access and exposure, is safe particularly in aortic valve replacement procedures, but may not provide clinical benefit in sternotomy-based valve surgery. Cor-Knot automated fastener use in aortic arch surgery with limited visualization has not been studied or previously reported.

In this report, a patient with a personal history of connective tissue disease and a prior open descending aortic repair for rupture presented with the surgical emergency for ascending aortic pathology. We elected to perform an aortic dissection repair, total arch debranching, and zone 3 aortic anastomosis. Given limited exposure from a sternotomy approach, coupled patient specific characteristics including severe kyphosis and COPD, we performed a zone 3 aortic replacement utilizing interrupted pledgetted sutures and Cor-Knot fastener. We have employed this technique in a series of subsequent cases with excellent success. Potential pitfalls for this technique are iatrogenic coarctation, which can be combatted by performing the anastomosis over an appropriately sized Hegar dilator. While Cor-Knot utilization in minimally invasive cardiac surgery is well described, to our knowledge this is the first report describing its employment in open aortic surgery.

Contributions

Omar Sharaf: Drafting and approval of article

Tomas Martin: Drafting and approval of article

Eric Jeng: Critical revision and approval of article

Legends

Figure 1. Chest CTA with contrast showing preoperative acute DeBakey type I dissection. A) Ascending aortic dissection with true and false lumens visualized. Proximal ascending aorta with aneurysmal dilation

at 54.9 mm. B) Descending thoracic aortic dissection with true and false lumens identified. Previous thoracic aorta synthetic dacron graft visualized and intact.

Figure 2. Ethibond valve sutures placed circumferentially in the distal aortic anastomosis before Cor-Knot fastening.

Figure 3. Total aortic arch replacement with trifurcated graft technique and Cor-Knot automated fastener use in distal aortic anastomosis.

Figure 4. Chest CTA with contrast showing postoperative total aortic arch replacement with Cor-Knot automated fastening. A) Trifurcated graft anatomy displayed. B) Distal aortic anastomosis with Cor-Knot automated fastening.

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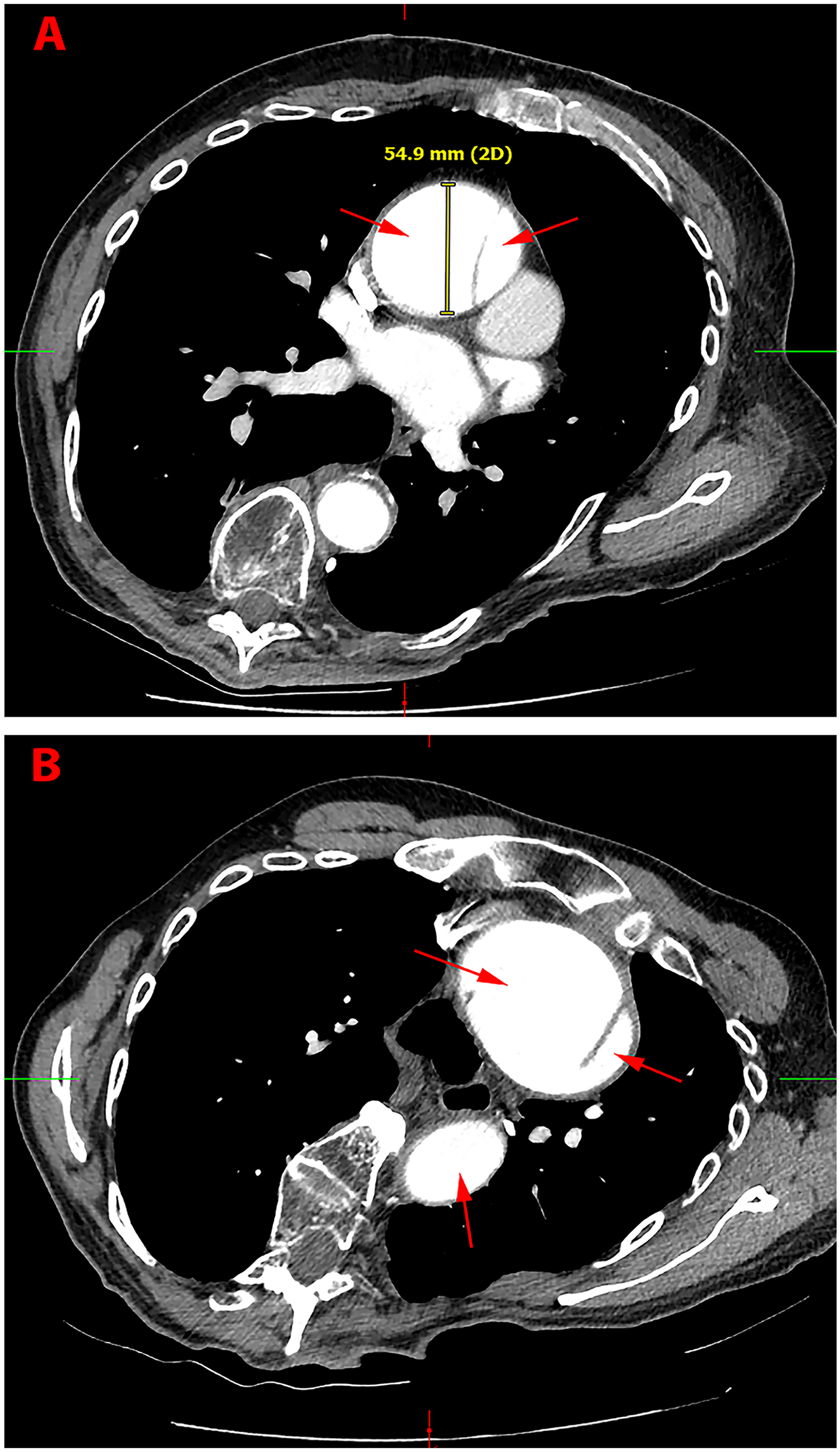
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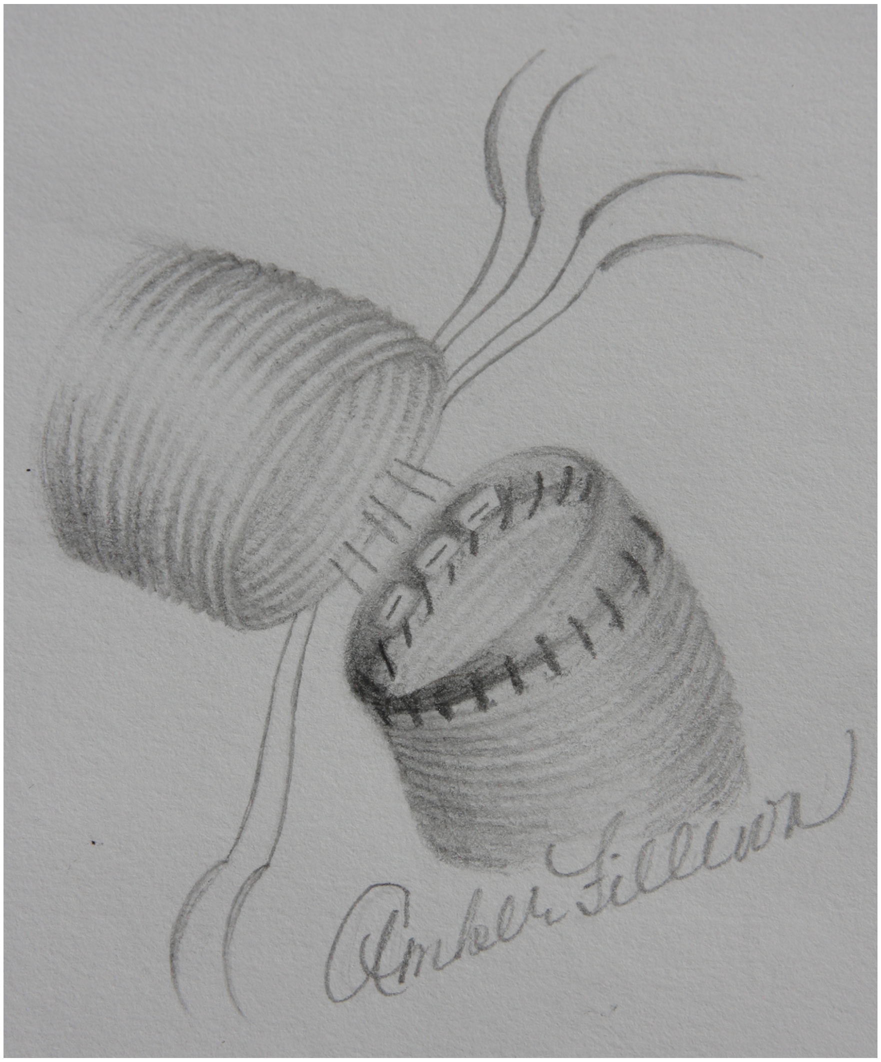

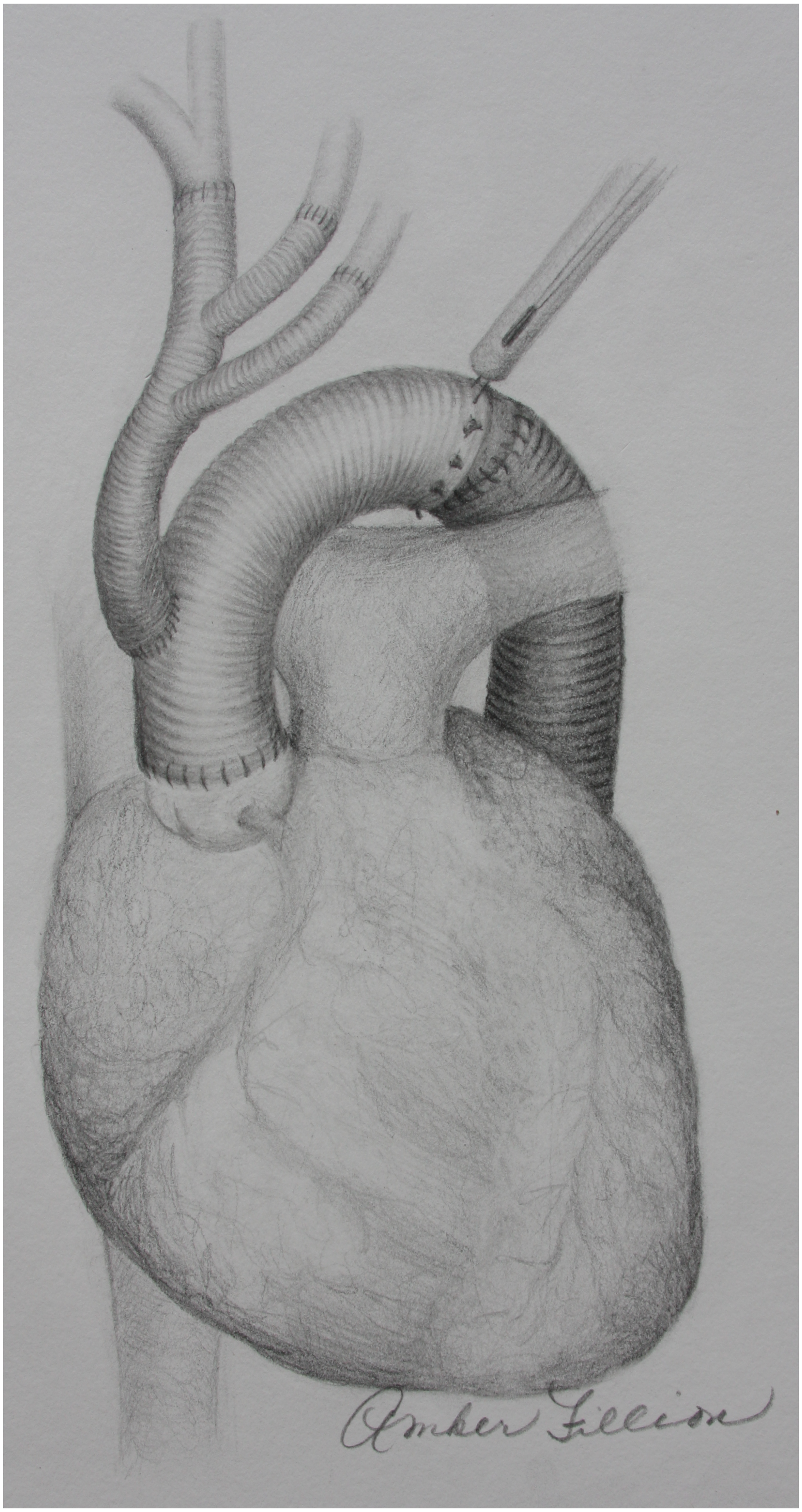
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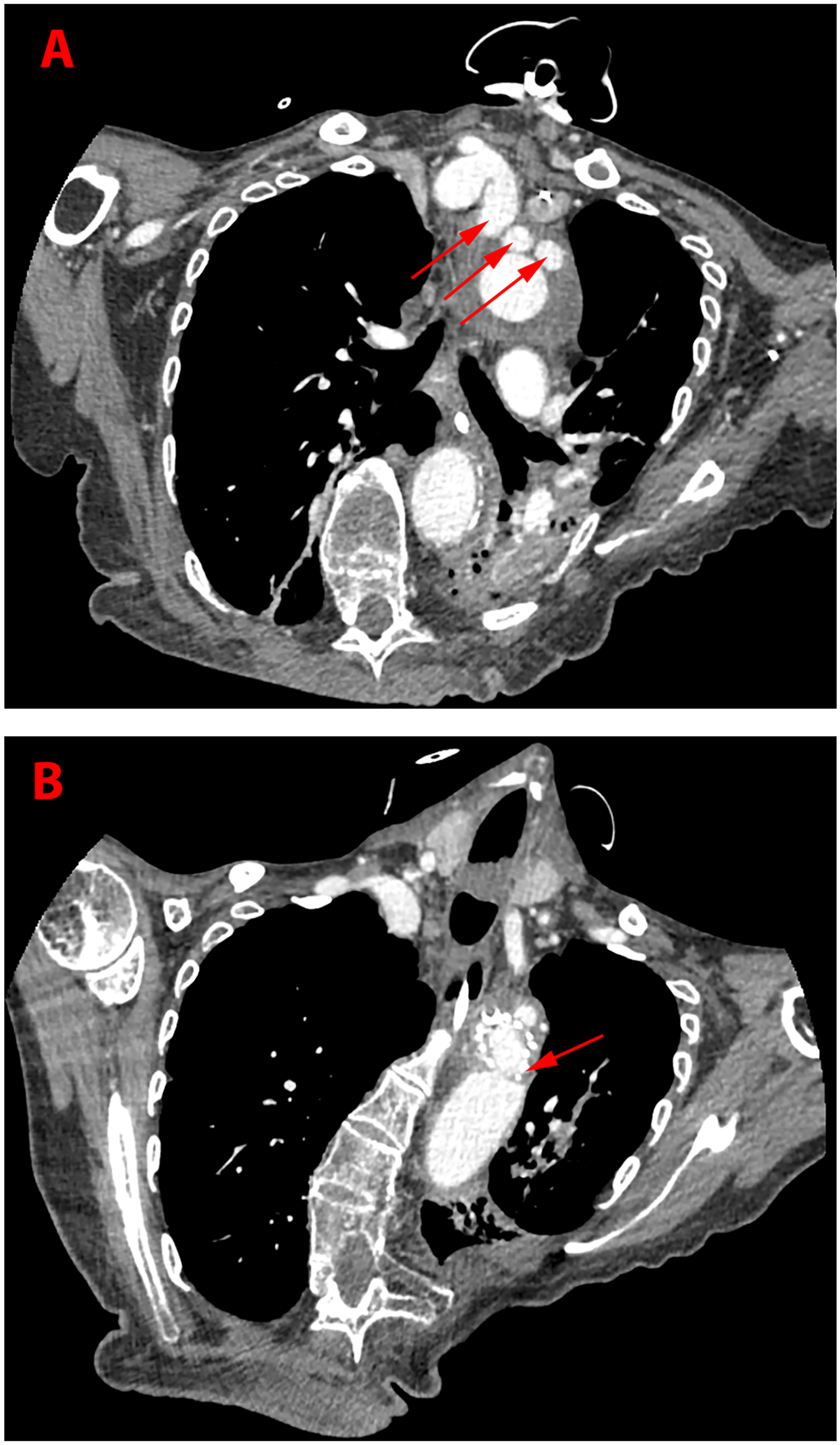
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