Endovascular Treatment for Pseudoaneurysms After the Surgical Repair of Aortic Coarctation

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Abstract

In this report, we describe the case of a 28-year-old male who presented to our hospital with shortness of breath and sudden, severe central chest pain that radiated across his chest and back. The patient had a history of coarctation of the aorta (CoA) repair using Dacron patch aortoplasty at the age of 10 years, and he had been lost to clinical follow-up. A chest X-ray (CXR) revealed the widening of the upper mediastinum. He underwent emergency CT angiography, which demonstrated extensive mediastinal hematoma and contrast leaking from a 4x12 cm complex pseudoaneurysm of the proximal thoracic descending aorta. After the heart-team meeting, the transcatheter approach was deemed more feasible and safer than a surgical approach. The patient was taken to cardiac catheterization laboratory and, under general anaesthesia, we successfully implanted a tapered (28 mm - 26 mm) x 150 mm Valiant Thoracic Stent Graft with the Captivia Delivery System (Medtronic Vascular, Santa Rosa, CA). In this case, we demonstrated the feasibility and safety of using a stent graft to treat late surgical complications after CoA repair, which are not uncommon.

Categories: Cardiac/Thoracic/Vascular Surgery, Cardiology
Keywords: aortic pseudoaneurysm, aortic coarctation, endovascular, aortic stenting, transcatheter repair, endograft implantation

Introduction

Coarctation of the aorta (CoA) is the sixth most common congenital heart disease (CHD), accounting for 4-8% of all CHD. It occurs in four out of 1,000 live births and has a male predominance [1]. Surgical repair of CoA has been the standard treatment in infants and adolescents to prevent either the early or late consequences of obstruction, proximal hypertension, and distal hypoperfusion [2]. Several surgical techniques for CoA repair have been applied traditionally, which include resection with end-to-end anastomosis, extended end-to-end anastomosis, prosthetic patch aortoplasty, subclavian artery flap aortoplasty, interposition tube graft, and extra-anatomical aortic bypass [2]. Currently, adults presenting late are generally treated with balloon-expandable stents, with excellent immediate and long-term outcomes [1,3]. Irrespective of the kind of surgical technique used initially, late post-repair complications are not uncommon, and often occur decades later. Such complications include hypertension, re-CoA, and aneurysm/pseudoaneurysm formation. Hence, it is important that patients are kept under lifetime surveillance, which includes regular cross-sectional imaging, blood pressure monitoring, and risk factor modification. Many patients have
been discharged or lost to follow-up before its importance was appreciated. Some patients may present with a symptomatic or apparently incidental but serious complication years after the first repair. Although any surgical technique can lead to late pseudoaneurysm formation at the anastomotic site (around 10% of cases overall), longer-term follow-up suggests that there is a particular problem with patch aortoplasty. Incidence of late pseudoaneurysm associated with this technique may reach as high as 38%, although lower figures have also been recorded, and our current understanding might have been affected by the large number of patients who are no longer under follow-up. The average time to aneurysm formation has been reported to be up to 12 years after the initial repair, with a progressive increase in prevalence over time. As such, we can anticipate a growing problem in the future. Emergency presentation is not uncommon (with rupture being associated with 7% mortality), as in the complex case we present in this report [2].

Case Presentation

A 28-year-old man, with a history of CoA repair using Dacron patch aortoplasty at the age of 10 years, presented with shortness of breath and sudden, severe central chest pain that radiated across his chest and back. The patient had been lost to clinical follow-up over the last 15 years. He was conscious, hypotensive (90/60 mmHg on both arms), and in distress with tachycardia (120 BPM) and relatively weak pedal pulses with cold distal extremities. A chest X-ray (CXR) demonstrated the widening of the upper mediastinum (Figure 1).
FIGURE 1: Chest X-ray revealing wide mediastinum (red arrows)

He underwent emergency CT angiography, which demonstrated extensive mediastinal hematoma and contrast leaking from a 4x12 cm complex pseudoaneurysm of the proximal thoracic descending aorta (Figure 2).
The intimal disruption started about 2 cm distal to the origin of the left subclavian artery (LSCA), which was probably the site of the patch repair. The aortic diameter just prior to the disruption was 2.5 cm, and the normal distal thoracic aortic diameter was 2 cm. Of note, there was compression to the distal aorta by the pseudoaneurysm, leading to significant narrowing, which explained the weak distal pulses and cold extremities. After the heart-team discussion, the decision was made to proceed with transcatheter endograft implantation. The transcatheter approach was deemed more feasible and safer than a surgical one, especially in the presence of a good landing zone for endograft placement (away from the LSCA) (Figure 3).
FIGURE 3: A sketch representing the CT angiography findings

The sketch shows intimal flap at the site of disruption (red arrow), large pseudoaneurysm (blue arrow), and aortic true lumen compression (green arrow). We usually do such sketches to plan our approach (roadmap).

CT: computed tomography

The patient was taken to cardiac catheterization laboratory and, under general anesthesia, we implanted a tapered (28 mm - 26 mm) x 150 mm Valiant Thoracic Stent Graft with the Captivia Delivery System (Medtronic Vascular, Santa Rosa, CA). The endograft was implanted.
成功地完全排除了假性动脉瘤并获得了远端良好的血流（图4）。

图4: 主动脉造影检查结果
A: 主动脉造影显示主动脉内膜撕裂和大型复杂假性动脉瘤（黄色箭头）。B: 主动脉造影显示成功的血管内移植物支架植入，无证据表明有内漏和左颈总动脉通畅。

访问点（右股动脉）成功地被两个Perclose ProGlide™设备（Abbott Laboratories, Abbott Park, IL）封堵。患者恢复良好，三天后出院。随访CT血管造影显示支架腔的广泛通畅，无内漏。

讨论

CoA的外科修复一般与良好的长期生存有关，25年生存率接近90%。然而，晚期并发症仍然很常见[4]。 redo开放手术对于晚期手术并发症是具有挑战性的，并且与显著的死亡率和发病率相关（包括对喉返神经的损伤、截瘫和出血）。晚期假性动脉瘤并不罕见，不应被忽视，因为即使在小的假性动脉瘤中也会被描述为破裂[4]。Knyshov等人已经报告了这些假性动脉瘤破裂率为100% [5]。

最近，血管内方法正在被逐步采用，特别是在 redo开放手术相关的并发症时。尽管所报道的系列较小，但它们显示出了非常令人鼓舞的结果。报告和研究已经证明了该技术的成功率高达100% [6]。然而，这些年轻患者的中期数据对于血管腔内支架的性能是稀缺的。技术困难包括假性动脉瘤的延展区的远端固定、动脉入径的尺寸、以及小的动脉弓。潜在并发症类似于用于重新-CoA的球囊成形术或支架放置引起的主动脉损伤和访问部位并发症[2]。内漏可能由于支架腔过紧或支架腔中的血流引起。
the aortic wall, especially in cases of challenging anatomy [6]. Another devastating complication that can occur in up to 10% of cases after stent-graft implantation (especially for long grafts of >20 cm) is spinal cord ischemia, leading to paraparesis or paraplegia. Proper evaluation and sizing are crucial to avoid such complications [7]. In our case, there was a good proximal (away from the LSCA) and distal landing zone and a relatively short complex lesion, which enabled us to implant the graft stent successfully without jailing the LSCA and causing damage to the spinal artery.

**Conclusions**

Pseudoaneurysm after the surgical repair of CoA is likely to be a serious problem in the future. Redo open surgery for late surgical complications is challenging and associated with significant mortality and morbidity. Endovascular treatment is a viable alternative to surgical reoperation due to its lower morbidity and mortality. However, more data from long-term monitoring are needed to determine their effectiveness and to detect late complications.

**Additional Information**

**Disclosures**

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