

Endovascular Repair of a Pseudoaneurysm

After Multiple Open Repairs of Aortic Coarctation

Saleh A. Alnasser, MD
Kalyan C. Vunnamadala,
MD
Ourania A. Preventza, MD
Joseph S. Coselli, MD
Kim I. de la Cruz, MD

Successful surgical repair of aortic coarctation during childhood may have major late complications such as pseudoaneurysm formation. If left untreated, pseudoaneurysms put patients at risk for morbidity and death; if treated surgically, they are associated with complications. Endovascular aortic repair, an established safe alternative to open surgical repair, is associated with encouraging outcomes and fewer complications, and it is especially feasible for patients who have undergone multiple aortic surgeries. We report the case of a 41-year-old man who underwent endovascular repair of a pseudoaneurysm after previous surgical corrections of an aortic coarctation at 6 and 14 years of age. The pseudoaneurysm, involving the distal portion of an ascending-to-descending aortic 20-mm Dacron bypass graft, was successfully excluded with a thoracic stent-graft and sealed off with vascular plugs to prevent both blood flow into the pseudoaneurysm and type II endoleak. (*Tex Heart Inst J* 2020;47(2):149-151)

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From: Division of Cardiothoracic Surgery, Michael E. DeBakey Department of Surgery, Baylor College of Medicine; and Department of Cardiovascular Surgery, Texas Heart Institute; Houston, Texas 77030

Dr. Vunnamadala is now at St. Luke's Cardiothoracic Surgery Associates, St. Luke's Regional Heart & Vascular Center, Duluth, Minnesota

Address for reprints:
Saleh A. Alnasser, MD,
Thoracic Surgery Unit,
Surgery Department, King
Saud University Medical City,
12372 6864 Riyadh,
Saudi Arabia

E-mail:
sal.alnasser@gmail.com

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Surgical repair of primary aortic coarctation has proved effective, and it is usually done early after birth.¹ Surgical approaches include subclavian flap angioplasty, patch angioplasty, interpositional graft repair, and end-to-end anastomosis. Balloon angioplasty with stent placement may be a suitable option in children older than 3 months.^{1,2}

In the long term, surgical repair of aortic coarctation is associated with complications such as recurrent coarctation, anastomotic pseudoaneurysm formation, cerebrovascular disease, and hypertension.^{3,4} Using conservative interventional methods to treat recurrent pseudoaneurysms produces unpredictable results, and such methods greatly increase the risk of rupture.¹ Therefore, surgical reintervention in such cases is the best option. Yet, despite improvements in anesthesia and surgical care, conventional surgical reoperation on the descending thoracic aorta is associated with marked morbidity and risk of death; open repair of recurrent coarctation or anastomotic pseudoaneurysms presents even greater risks.

In general, endovascular repair is an effective treatment for pseudoaneurysms associated with several aortic pathologic conditions. In particular, it offers high-risk surgical patients who have undergone multiple aortic coarctation repairs a less invasive approach with potentially fewer complications. We report the case of an adult man who underwent endovascular repair of a pseudoaneurysm after previous surgical corrections of recurrent aortic coarctation.

Case Report

A 41-year-old man was admitted to our institution with a pseudoaneurysm at the site of a distal aortic anastomosis. The pseudoaneurysm had been identified on computed tomograms during follow-up monitoring by his physician. The patient's medical history included a bicuspid aortic valve, hypertension, hypothyroidism, hyperlipidemia, left ventricular hypertrophy, sleep apnea, and surgical repairs of aortic coarctation at 6 years of age and recurrent coarctation at 14 years of age. The first operation had involved placing a 10-mm Dacron graft from the distal aortic arch to the mid descending thoracic aorta through a left thoracotomy. The second operation had involved

Dr. Coselli is principal investigator for clinical trials conducted by Medtronic, Inc.; W.L. Gore & Associates; and Cook Medical, Inc.; spoke at a Medtronic-sponsored meeting; serves on a W.L. Gore advisory board; and consults for and receives royalties from Vascutek Ltd., a Terumo company. Dr. Preventza consults for Medtronic and W.L. Gore and had travel paid by Cook Medical.

placing a 20-mm Dacron bypass graft between the left subclavian artery and descending thoracic aorta. A few days after the second operation, bleeding at the graft anastomosis had necessitated repeat bypass grafting between the ascending aorta and the distal descending aorta. Despite these surgical interventions, the patient needed medication to control high blood pressure.

After the patient's admission to our institution, computed tomograms revealed a 4.5-cm pseudoaneurysm at the distal portion of the ascending-to-descending aortic 20-mm Dacron bypass graft (Fig. 1). Although asymptomatic, the patient was counseled about the risk of rupture and opted to undergo endovascular stenting of the pseudoaneurysm.

At operation, a 6F sheath was inserted through the left common femoral artery, and a pigtail catheter was advanced into the transverse aortic arch to obtain thoracic aortograms. The pseudoaneurysm at the distal anastomosis of the 20-mm ascending-to-descending aortic graft was revealed; proximal to the anastomosis, a pouch led upward toward the left subclavian artery. The proximal descending thoracic aorta was almost occluded, but the previous 10-mm graft was patent down to the pouch. An inguinal incision was made, and a 22F sheath (W.L. Gore & Associates, Inc.) was advanced over a stiff wire into the right common femoral artery. Over a stiff Amplatz wire, a 26 × 26 × 145-mm Valiant™ thoracic stent-graft equipped with the Captivia™ delivery system (Medtronic, Inc.) was advanced through the 22F



Fig. 1 Preoperative 3-dimensional computed tomogram shows the pseudoaneurysm at the distal aortic graft anastomosis in the descending thoracic aorta.

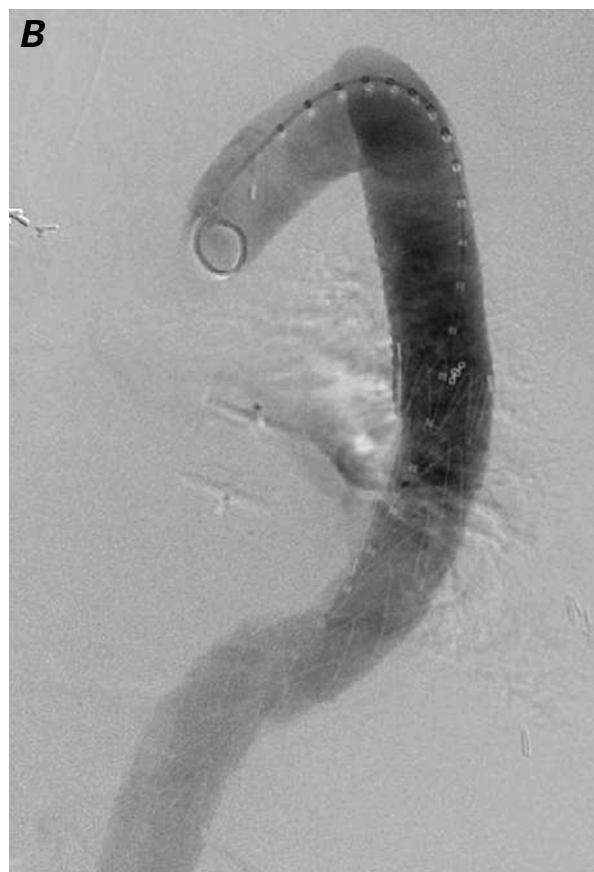


Fig. 2 Intraoperative aortograms show the pseudoaneurysm **A)** before and **B)** after endovascular stent exclusion.

sheath into the ascending-to-descending aortic graft, then into the mid descending thoracic aorta across the affected anastomosis, excluding the pseudoaneurysm. A 7F sheath inserted through the left common femoral artery was positioned in the proximal pouch between the 10-mm graft and the pseudoaneurysm. Through this sheath, two 12-mm Amplatzer™ vascular plugs (St. Jude Medical, an Abbott company) were placed where the 10-mm graft met the descending thoracic aorta in order to seal off and stop the flow of blood into the pseudoaneurysm and to prevent type II endoleak.

Completion aortograms revealed complete exclusion of the pseudoaneurysm by the Valiant graft (Fig. 2). Before the patient was discharged from the hospital on postoperative day 4, computed tomographic angiograms showed exclusion of the pseudoaneurysm by the endovascular stent, no endoleak, good occlusion of the smaller bypass graft by the Amplatzer vascular plugs, and no contrast enhancement indicative of thrombosis (Fig. 3). Five years after endovascular exclusion of his pseudoaneurysm, the patient remained well and needed no additional aortic interventions.

Discussion

Surgical repair of congenital aortic coarctation during infancy or childhood can be complicated by recurrent stenosis and pseudoaneurysm formation. In the long term, up to 32% of patients develop anastomotic pseudoaneurysms,^{5,6} which are associated with a rupture-related mortality rate of 7%.¹ The incidence of



Fig. 3 Postoperative 3-dimensional computed tomogram shows good stent placement and pseudoaneurysm exclusion.

aneurysm formation is approximately 17% after subclavian flap angioplasty, 14% after patch aortoplasty, 6% after tube-graft repair, and 3% after end-to-end anastomosis.⁶

Endovascular management of pseudoaneurysm formation is a less invasive and apparently safe alternative to repeat open repair. One group concluded after a review of its single-center experience that, for patients with a pseudoaneurysm alone, stent-graft implantation is the preferred approach to repair.² Another group's analysis of its small experience with endovascular repair of late postsurgical pseudoaneurysm after coarctation repair revealed a technical success rate of 100% and only one death and one case of paraplegia.⁷

On the basis of available data and this case report, we consider endovascular repair of a pseudoaneurysm arising after coarctation repair to be a safer, less invasive alternative to surgery for patients who have undergone previous aortic repairs. Close follow-up evaluation is mandatory, however, to monitor the status of the repair and to detect any potential complications, especially endoleak.

References

1. Cohen M, Fuster V, Steele PM, Driscoll D, McGoon DC. Coarctation of the aorta. Long-term follow-up and prediction of outcome after surgical correction. *Circulation* 1989;80(4):840-5.
2. Preventza O, Wheatley GH 3rd, Williams J, Hughes K, Ramaiah VG, Rodriguez-Lopez JA, Diethrich EB. Endovascular approaches for complex forms of recurrent aortic coarctation. *J Endovasc Ther* 2006;13(3):400-5.
3. Webb G. Treatment of coarctation and late complications in the adult. *Semin Thorac Cardiovasc Surg* 2005;17(2):139-42.
4. Bouchart F, Dubar A, Tabley A, Litzler PY, Haas-Hubscher C, Redonnet M, et al. Coarctation of the aorta in adults: surgical results and long-term follow-up. *Ann Thorac Surg* 2000;70(5):1483-9.
5. Knyshov GV, Sitar LL, Glagola MD, Atamanyuk MY. Aortic aneurysms at the site of the repair of coarctation of the aorta: a review of 48 patients. *Ann Thorac Surg* 1996;61(3):935-9.
6. von Kodolitsch Y, Aydin MA, Koschyk DH, Loose R, Schalwat I, Karck M, et al. Predictors of aneurysmal formation after surgical correction of aortic coarctation. *J Am Coll Cardiol* 2002;39(4):617-24.
7. Midulla M, Dehaene A, Godart F, Lions C, Decoene C, Serge W, et al. TEVAR in patients with late complications of aortic coarctation repair. *J Endovasc Ther* 2008;15(5):552-7.