Seventeen-year follow-up after ascending-to-infrarenal aorta bypass for recurrent coarctation in an adult

Daniel Pereda, MD,[a] Ramón Cartañá, MD,[b] Thoralf M. Sundt III, MD,[a] and **Carlos-A. Mestres, MD, PhD, FETCS,[b]** *Rochester, Minn; and Barcelona, Spain*

Anatomic repair of complex aortic coarctation is associated with significant mortality and morbidity, including paraplegia. Extra-anatomic bypass strategies have been developed to reduce these complications and allow the correction of any concomitant conditions during the same operation. We present the case of a woman with uncontrolled hypertension and preductal coarctation of the aorta diagnosed at age 22 who underwent an unsuccessful attempt at primary repair, followed by extra-anatomic bypass from the ascending-to-infrarenal aorta. The patient has remained normotensive, with no additional complications related to the disease or the procedure, during a follow-up of 17 years. (J Vasc Surg 2010;52:1362-4.)

Coarctation of the aorta is usually detected and corrected during infancy, with only a small proportion being diagnosed in adult life. Congenital aortic coarctation is the most frequent etiology. Coarctation of the thoracic aorta can also be acquired secondary to other conditions such as Takayasu arteritis or aortic injury. The most common treatment is anatomic repair through a left thoracotomy with primary end-to-end anastomosis, subclavian flap, or patch aortoplasty. Other options include extra-anatomic bypass grafting and, increasingly, catheter-based techniques. Primary repair has excellent long-term results in most cases, but residual coarctation (especially related with uncorrected arch hypoplasia) or recoarctation after repair have not been eliminated.

Complex aortic coarctations in adults are defined as those involving long segments of the thoracic aorta, those associated with arch abnormalities (ie, arch hypoplasia), and those with residual or recurrent coarctation or anastomotic pseudoaneurysms presenting after previous correction attempts. A significant number of these patients have associated comorbidities, particularly cardiac and vascular, that may require concomitant procedures at the time of repair and represent an increasing population at greater risk of death and major complications with anatomic correction. To minimize these risks, several extra-anatomic techniques have been developed during the last 30 years.

From Mayo Clinic, Division of Cardiovascular Surgery, Rochester[a]; and Hospital Clinic, Department of Cardiovascular Surgery, University of Barcelona, Barcelona.[b]

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Correspondence: Daniel Pereda, MD, Mayo Clinic, Department of Cardiovascular Surgery, 200 1st St, Rochester, MN 55905 (e-mail: pereda.daniel@mayo.edu).

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CASE REPORT

A 47-year-old woman was diagnosed with preductal coarctation of the aorta when she was 22 years old. Owing to severe, uncontrolled hypertension, she underwent left subclavian-to-descending thoracic aorta bypass with a 14-mm Dacron (DuPont, Wilmington, Del) graft in 1984, with clinical improvement. Progressive hypertension developed during follow-up that became uncontrollable, even with a multidrug medication regimen. She was hospitalized in August 1991 for an episode of acute renal failure that did not require dialysis. In September 1991, she was diagnosed with Graves-Basedow disease but despite successful treatment with carbimazole and radioiodine, hypertension did not improve.

The decision was made to proceed with a reoperation despite patency of her previous graft, which presented an obstruction to its inflow secondary to stenosis at the origin of the left subclavian artery in the distal arch (Fig). In November 1992, a 14-mm Gore-Tex bypass graft (W. L. Gore and Assoc, Phoenix, Ariz) was constructed from the ascending aorta to the infrarenal aorta through a combined midline sternotomy and xiphopubic laparotomy and without cardiopulmonary bypass. The graft was routed behind the inferior vena cava and through the diaphragm, into the retroperitoneal space, and anterior to the aorta.[1]

She had an uneventful recovery and experienced significant clinical improvement after the procedure. Since then, she has been followed-up yearly in our outpatient clinic. In June 1994, she underwent subtotal thyroidectomy. A vascular magnetic resonance image in May 2008 showed both grafts were widely patent (Fig). At her latest follow-up visit, in October 2009, she was normotensive on atenolol (50 mg twice daily) and continued with an active lifestyle.

DISCUSSION

Residual or recurrent coarctation after primary correction has been a vexing problem since the early days of cardiac surgery. Its prevention and management have improved over time due to a better understanding of the disease and the development and refinement of better

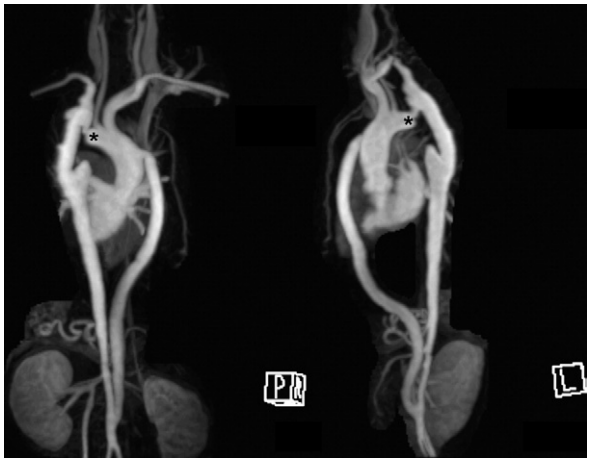

Fig. Magnetic resonance study 17 years after reoperation shows the interruption of the descending aorta involving the origin of the left subclavian artery (*) as well as the patency of both conduits: the previous left subclavian-to-descending aorta bypass and the ascending-to-infrarenal aortic bypass.

repair techniques. Nonetheless, it still occurs in a significant number of patients. Currently, its incidence may be increasing due to earlier repair and better recognition because of more available diagnostic techniques.[2]

Anatomic repair of complex aortic coarctation or recoarctation in adults is a major surgical challenge, with mortality reported of up to 7%.[3,4] Other major risks are bleeding (damage to collaterals), lung injury (adhesions), chylothorax, injury to the recurrent laryngeal and phrenic nerves, and late aneurysm formation, especially after graft aortoplasty. Paraplegia deserves special mention. It is much more frequent in adults than in pediatric patients, with a reported incidence of about 2.6%.[5] Risk factors for this include older age, higher dependence on collateral flow, hypotension during and after the operation, coexistence of atherosclerotic disease, longer segments of the thoracic aorta excluded between the clamps during repair, and the necessity of left subclavian artery clamping.

Another relevant aspect of adults with uncorrected or recurrent aortic coarctation is the high prevalence of other cardiovascular conditions requiring surgical repair, especially on the aortic valve, the ascending aorta, and coronary artery disease. It is associated with a bicuspid aortic valve in about 60% of patients. A significant degree of valvular stenosis or regurgitation will develop over time in 63% of patients with coarctation, and 20% may eventually require valve replacement. A dilated ascending aorta has been reported in up to 28% of these patients.[6]

Several alternatives have been proposed to avoid the complications of anatomic repair in these patients. Of special interest is the strategy of bypassing the coarctation extra-anatomically. This avoids the risk of working in a scarred and fragile zone that is often calcified and simplifies the repair of associated cardiac conditions. This can be accomplished by directing blood through a graft from anywhere above to anywhere beyond the level of coarctation. Especially versatile as an inflow source is the ascending aorta,[7] although the aortic arch or left subclavian artery can be used. The descending thoracic aorta, the abdominal (supraceliac or infrarenal) aorta, and the iliac or femoral vessels are possible distal anastomosis sites.

Depending on the strategy chosen, these procedures can be completed through a median sternotomy, right or left thoracotomy, or by combining two separate incisions (median sternotomy and laparotomy or left thoracotomy). Extracorporeal circulation is usually used,[8] although off-pump techniques have been reported.[9,10] Currently, the most widespread extra-anatomic technique is the ascending-to-descending bypass and the posterior pericardial approach to the descending thoracic aorta, first performed in 1979.[11,12]

Extra-anatomic correction series show minimal morbidity and mortality rates, with good long-term results, consistent improvement in hypertension, and a low rate of paraplegia. Deep hypothermia and circulatory arrest is avoided in most cases and extracorporeal circulation in some. Damage to collaterals, lungs, and recurrent laryngeal and phrenic nerves is also reduced. This strategy allows the concomitant correction of any simultaneous cardiac conditions, frequently through the same incision. Although graft-related complications are possible, no large clinical series have reported graft infection or thrombosis, pseudoaneurysm formation, erosion of adjacent structures, or fistulization.[8-10]

Percutaneous catheter-based techniques have been applied for treatment of primary and recurrent aortic coarctation, apparently with good results, but scarce information is available on its application in adults.

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