Caveat Emptor
Self-Expanding Stents in the Management of Arch Coarctation in the Adult

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Coarctation of the aorta, a narrowing or occlusion of the aorta, occurs generally in the region of the ligamentum arteriosum and represents 5% to 8% of all congenital heart lesions. Although most often diagnosed in infancy, a small proportion present in adolescence or adulthood during evaluation for a heart murmur, reduced peripheral pulses, or therapy-resistant hypertension. It represents one of the first congenital lesions to be successfully addressed surgically1 and has a 7-decade long history as a therapeutic treatment. However, even after successful repair, survival is reduced when compared with the general population if repair takes place later in life (>5 years of age).2 Repair is nonetheless advocated in the older patient to reduce the cardiovascular event risk and improve survival.3 Several surgical approaches have evolved during the years, with percutaneous treatment options only becoming available in the 1980s, first with balloon angioplasty and balloon expandable stent implantation in the late 1990s.4,5 Although clinical acceptance of percutaneous approaches was initially slow, improved techniques, operator experience, and balloon and stent technology have resulted in an enhanced clinical acceptance with improved safety profiles and success rates, although not without controversy.6 There remains a scarcity, however, of long-term follow-up studies after endovascular repair in regards to the development of aneurysm formation, recurrent obstruction, and general cardiovascular mortality and morbidity.

See Article by Kische et al

In this issue of Circulation: Cardiovascular Interventions, Kische et al7 from Berlin and Oldenberg Germany present a series of 52 adult patients (mean age, ≈36 years) with unoperated coarctation of the aorta treated by an endovascular repair with a novel self-expanding uncovered nitinol stent, with ≈47 (12–84) months of follow-up. Patients thought to be at risk of vascular rupture, that is, those with tubular hypoplasia were excluded in favor of covered stents. Considerable time and effort were invested by the authors in a detailed review of arch imaging (computed tomographic scan) before each procedure, a critical element in understanding and planning the intervention, a lesson which should not be lost on any interventionist performing an endovascular arch repair regardless of device. The diameter of the stent was 10% to 15% larger than the proximal landing zone (usually that segment of vessel near the ostium of the left subclavian artery) and stent length extended well beyond the stenotic lesion. Eight patients with a near atretic lesion required balloon dilation before stenting and all patients after stenting had the lesion dilated with a noncompliant balloon. Invasively measured coarctation gradients fell acutely from ≈55 to 3 mm Hg (P<0.001) and minimal lesion diameters increased from ≈4.6 to 18.6 mm (P<0.001). All patients were home within a few days (mean, 3.5 days). During follow-up, there was 1 noncardiovascular death and CT imaging noted the absence of stent collapse or migration and stability in the achieved lesion diameters (≈18 mm). Importantly, 30 patients, just over half the cohort had discontinuation of their antihypertensive medications and in just over a quarter, drug use dropped to ≈1 drug per patient (P<0.001).

These results are commendable, and the demonstration of efficacy in the use of a self-expanding implant with a low entry profile (10 Fr) is encouraging. However, can we do better? Abolishing the gradient at the level of the coarctation is important, although the authors stopped progressive balloon dilations if the gradient was <10 mm Hg, possibly leaving a waist in the stent. Covered stents would be routinely fully dilated because of the added security of the covering in regards to wall trauma. Leaving a gradient is not particularly acceptable (although the residual gradients observed in this study were in the 3 mm Hg range). As such, procedural safety must always be balanced against efficacy; it is possible to do a safe procedure in the absence of efficacy; this does not necessarily help the patient. Only just over half of patients were taken off antihypertensive medications in this study. This falls into a mid-range when compared with other studies of coarctation stenting (56%–88%).5,8–13

As this study demonstrated, complications today are uncommon and meticulous attention to detail will continue to keep rates low. We do not support a standard dose of heparin and default to a weight-based heparin load followed by activated clotting time monitoring, and we do not use the brachial artery for a second arterial access because a randomized angioplasty trial has identified brachial access with the highest rate of complications versus radial with the lowest and femoral arterial next.14 In this regard, there is no need for an access >6 Fr and likely 5 Fr would suffice, diminishing the merits of a brachial access as a routine. However, we fully support the enhanced
safety of the dual access for imaging in this procedure. Despite meticulous attention to detail, one patient had a ruptured aorta, which was missed in the laboratory and returned for a covered stent. This near fatal complication could have been prevented possibly with a primary covered stent procedure. This has also been reported with covered stents and although a covered stent is not totally protective, a well-performed procedure with a covered stent is probably superior.

A unique property of a self-expanding implant is the persistent outward force against the aortic wall and different from bare metal stents, where it must overcome the compressive forces of the vessel wall. Essentially no change in stent dimensions were noted at 24 months, although it remains unknown whether the stent edges continue to expand and push on a aortic wall potentially contributing to aortic wall damage. To that end longer term follow-up is required.

A recent randomized trial showed no major difference between covered and bare metal implants but the numbers were small (60 in each arm) and perhaps was underpowered to detect small differences. The rate of major aortic complications is likely <5% in most series. By preventing 1 to 2 major adverse events in 100 patients, major morbidity can be avoided. Covered stents should be used appropriately and deployed uniformly to avoid movement and displacement. Most adverse events are not device related but because of human error in case selection and deployment technique, with the main factors relating to patient safety being operator experience, technique, proper stent deployment, periprocedural imaging, and angiography. The study of Kische et al does not answer the question what type of implant should we be using: balloon expandable, covered or uncovered, or self-expanding. It does, however, support the continued use of endovascular repair techniques for adult arch coarctation and extend the interventionists inventory of potentially useful devices.

Disclosures

None.

References


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