This side up—Handle with care

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Sometimes when handling a parcel shipped from a faraway place, one has to be especially careful because the items within may be breakable. If not clearly marked, the outside of the package may belie the fragility of the contents. Such is the case with a less invasive approach to aortic dissection, especially in the acute and subacute phase. Open surgery, unlike the endovascular approach, reveals the delicate nature of the diseased aorta in all its facets, and advances in surgical techniques and perioperative care continue to improve patient outcomes. Nonetheless, the outcomes, although better, are occasionally punctuated with mortality and lasting morbidity in some patients.

In contrast, endovascular techniques rely on 3-dimensional reconstructed images to provide the pathoanatomy of the aorta before intervention, whereas deployment of novel devices is based mainly on the tried-and-true 2-dimensional radiologic images. Notwithstanding the sophistication of image processing or reconstruction, the “contents” and the nature of the disrupted aorta are not wholly revealed. Because of the challenging anatomic, geometric, and physiologic features of the aortic arch, progress in endovascular therapy in this portion has lagged relative to that in other segments of the thoracic and abdominal aorta. Developments in arch intervention have benefited, however, from lessons learned in treating these other “simpler” and straighter aortic regions. In view of the history of this technology and the learning process, from stent grafting for thoracic aortic aneurysmal disease in the 1990s to current methods of customized branched stent grafting preserving flow to the arch vessels, interventional approaches have steadily advanced with regard to imaging, materials, and deployment techniques, such as precise catheter manipulation and the use of the “traction” artery.¹⁻⁶ Not unexpectedly, however, substantial challenges unique to arch stent grafting remain.

Acknowledging the important historic developments in treating arch pathology, Lu and colleagues¹ are careful in their approach to branched stent grafting. In part because of the need to customize the stent-graft devices (median of 22 days), all patients are technically treated as having “chronic” dissection, although many have intimal flaps

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Central Message

Commentary on endovascular stent grafting of aortic dissection involving the aortic arch.

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that are fragile and mobile at the time of intervention. Most patients have retrograde type A dissections or type B dissections (with primary intimal tears in the descending thoracic aorta); a smaller number have type A dissections (with intimal tears in the ascending aorta or type B dissection localized to the arch). Although the goals of Lu and colleagues¹—that is, to construct a device designed to provide adequate seal with sufficient landing zones, preserve arch branch perfusion, and avoid cervical bypass procedures—are laudable, the variability in pathoanatomic characteristics of arch dissection mandates otherwise at this time. So in actuality, instead of presenting multibranched arch stent grafting, Lu and colleagues¹ conservatively use a variety of single-branched graft configurations often combined with graft fenestrations, which must align with the takeoff of arch vessels, and/or cervical bypass procedures. In brief, many patients undergo single-branched stent grafting (n = 22). In some cases, single-branched stent grafts with 1 additional graft fenestration (n = 17) or 2 graft fenestrations (n = 10) are necessary. A creative solution in treating 2 patients involves the use of 2 single-branched stent grafts with 1 branch in the innominate artery and 1 branch in the left subclavian artery. This well-coordinated approach to these ill patients results in exclusion of proximal entry tears and patency of arch branches. Importantly, there were no perioperative strokes and only 1 death from a retrograde type A dissection 6 days after the procedure; a design change with a longer proximal landing length in the ascending aorta has been implemented to lessen the chance

of retrograde dissection. In limited follow-up, there has been consistent evidence of false-lumen thrombosis and positive aortic remodeling.

What can we learn from the experience so far to address the challenges of arch stent grafting? Main concerns and goals for endovascular repair include achieving an adequate seal proximally and distally with no endoleaks, maintaining cerebral perfusion, minimizing embolic events, and ultimately improving patient survival. The device must follow the contours of the arch and ascending aorta to achieve proper orientation, resist migration and arch vessel compromise within the hyperdynamic arch, and demonstrate long-term durability. Since the early years of stent-graft development to treat aortic disease, the need to define adequate proximal and distal landing zones has been of paramount importance; coupling this requirement with that of maintaining flow to critical arch branches necessitates further technologic advances yet to come. Incorporating mechanisms for self-alignment of graft branches and fenestrations will lessen the degree of manipulation and thus the potential for tissue injury and embolic events. And to have readily available devices and components will increase the utility of stent grafting so that those with acute

aortic dissection can be considered for treatment. Endovascular stent grafting of the aortic arch must be approached with substantial planning and careful patient selection. Lest we damage the fragile contents within, when deploying an arch stent graft to optimize alignment and fixation, we must remember, “This side up—Handle with care.”

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