characteristics of the aorta in LDS versus MFS patients. In the setting of AAD, it is the practice at Johns Hopkins to perform the distal anastomosis open, presumably regardless of the patient's genotype. Likewise, unless the arch is enlarged, it is their practice to clamp the aorta just proximal to the innominate artery. Atraumatic clamps are not atraumatic, and injury to the media and/or intima with clamping may lead to downstream effects. If the tissue of Loey-Dietz is more vulnerable to crush injury it would stand to reason that subsequent pathology could follow.

The tear-directed and pathology-oriented approach by the team at Johns Hopkins continues to lead the way in the diagnosis and management of connective tissue disorders. This latest study adds to our understanding of the subtle differences in these potentially deadly diseases.

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Commentary: Aortic surgery in patients with Loeys–Dietz syndrome: When, why, and how?

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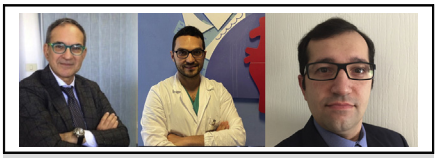

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CENTRAL MESSAGE

Loeys–Dietz syndrome is rare but can lead to severe complications of the aorta. Knowing what to do in the presence of a patient with this disease is important for any aortic surgeon.

Connective tissue disease (CTD) represents a rare genetic disorder that determines the weakness of the blood vessels and can lead to severe complications such as aneurysms, aortic dissections, and vascular ruptures. The most common disorders are Marfan syndrome (MFS) and Loeys–Dietz syndrome (LDS): These clinical entities are caused by mutations in the genes encoding fibrillin-1 and transforming growth factor-β receptors 1 and 2, SMAD3, or transforming growth factor-B2, respectively.[1] Aortic dissections and aneurysms are leading factors affecting morbidity and mortality in this cohort of patients, and the surgical treatment of CTD-related thoracoabdominal aortic aneurysm still represents a challenge. Current guidelines for the repair of root and ascending aortic disease are well established, and several prior studies have reported good outcomes after elective surgery in this subset of patients.[2] Modern molecular biology advancements, such as mapping of the human genome and the refinement of surgical techniques, have significantly improved the management and life expectancy of these patients while generating new evidence of the late effects of their vasculopathy, especially outside the aortic root, and in particular to the need of further intervention for progressive disease affecting the aortic arch.[3] However, few data are available to guide treatment for patients with

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CTD with aortic disease extending beyond the root. Also, the role of thoracic endovascular aortic repair in this setting is even less defined.

In the current issue of the *Journal*, Schoenhoff and colleagues[4] present the results of their experience in the management of 79 patients with LDS compared with 256 patients with MFS who underwent primary aortic root surgery at the Johns Hopkins Hospital between 1995 and 2015. The indication for surgery in patients with LDS was based on the underlying mutation and the severity of the phenotype. In the LDS group, 11% of patients initially presented with acute aortic dissection (67% type A, 33% type B) compared with 7.4% (95% type A, 5% type B) in the MFS patient group. In contrast, 89% of the LDS group and 92.5% of the MFS group presented with aneurysm. An important point emerges from this study: patients with LDS undergoing elective root repair have an increased risk for subsequent arch interventions. Although the need for secondary arch intervention in patients with LDS and MFS who presented with acute aortic dissection or had a dissection during follow-up was not different (46% vs 50%, $P = 1.0$), reoperations in patients with LDS without dissection were significantly more frequent (12% vs 1.3%, $P = .0004$). Of note, in patients with LDS, a continuous growth of the nonresected distal ascending aorta and the proximal arch was prevalent as a mode of failure.

In the contemporary era, recommendations regarding arch interventions at the time of root surgery are mainly based on the expected rate of subsequent reinterventions. However, to make an informed decision, the risk of an additional arch intervention during the first procedure should be balanced with the risk of a reoperative arch procedure in the future. At present, there is little evidence weighting the burden of replacing the aortic arch as an additional procedure during elective or emergency proximal aortic repair, thus making comparison with patients undergoing secondary total arch replacement difficult. In this sense, the need for specialized aortic centers of excellence becomes paramount. There is a large consensus that patients affected by complex aortic disease related to CTD may benefit from treatment at dedicated specialized aortic centers with significantly improved outcomes and decreased mortality.[5] The new standardized techniques of cerebral protection together with the increasing enrollment of the right axillary artery as a site of arterial cannulation for total arch replacement have shown a significant reduction of postoperative cerebral events compared with the more traditional deep hypothermic circulatory arrest without any cerebral protection.[6] In this context, it seems important to mention the constant development of new branched prostheses, which increases the surgeons' armamentarium in the treatment of complex aortic arch pathology, reducing the risk of procedural failure.[7]

The main limitation of the study is the lack of uniformity in the indication for redo surgery, mainly because the authors report the reinterventions that were performed on the study population, whether surgery was performed at Johns Hopkins Hospital or elsewhere. In this sense, not necessarily all patients underwent surgery according to the same indications as reported in the study. However, we believe the current study provides important information that can guide us when deciding on the indications for aortic surgery in such a complex group of patients, so that we will be able to better understand when, why, and how to safely treat them.

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