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Commentary: Sine qua non of a left ventricular assist device exchange: Consideration of patient, pathology, and pump

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By the end of this decade, the number of Americans afflicted with heart failure is expected to rise to more than 8 million.¹ In medically refractory patients, durable left ventricular assist devices (LVADs) can bridge patients to recovery, decision, transplantation, or destination therapy.² Between 2006 and 2017, more than 25,000 patients received mechanical assist devices. The vast majority, more than 20,000 of these, were LVADs.¹

Although LVAD technology started in the 1960s, the clinical application of Food and Drug Administration–approved devices did not start until the 1990s.² Early versions of the LVAD relied on pulsatile technology and demonstrated superior survival over medical management. The pulsatile models were superseded by continuous-flow LVADs. The HeartMate II (Abbott Laboratories, Abbott Park, Ill), an axial-flow pump, was introduced in 2007 and demonstrated improved survival compared with pulsatile LVADs. Stroke, bleeding, and infection, however, continued to challenge the clinical application of LVADs. Eventually, the HeartWare (Medtronic, Minneapolis, Minn) HVAD was introduced as a smaller, intrapericardially placed, centrifugal-flow device that eliminated

Suggested surgical approaches based on the primary pathology.

CENTRAL MESSAGE

The success of an LVAD exchange will depend on careful and circumspect consideration of patient, pathology, and pump-specific factors.

mechanical bearings. But the persistent complications of thrombosis, stroke, and hemorrhage remained, necessitating the development of yet another device. As a response to circumstance, necessity gave birth to the HeartMate 3 (Abbott Laboratories, Abbott Park, Ill), which would enter the forum as a fully magnetically levitated centrifugal-flow device. But as case data mounted, reports of increased risks of neurological adverse events and pump failure led to the withdrawal of the HVAD from the market on June 3, 2021. Although the landscape of LVADs may change with a seeming parade of new devices responding to needs, the devices are here to stay. It is clearer than ever that cardiac surgeons will need to know how to address these chronic complications, some of which may require a surgical exchange.

In this issue, Osho and D'Alessandro³ describe various surgical approaches for an LVAD exchange. This overview is timely, especially given the recent Food and Drug Administration Class I recall of the HeartWare HVAD. The authors' proposed algorithm is particularly attractive, because it eschews a one-size-fits-all approach. Instead, the authors urge surgeons to consider the underlying pathology and patient-specific and device-specific factors. In addition to the traditional reoperative sternotomy, a left thoracotomy, subcostal incision, subxiphoid incision, and right anterior thoracotomy may provide alternative routes for exchange. In patients with extensive infection or thrombosis, concurrent procedures, or an upgrade to an incompatible device, a reoperative sternotomy is

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Disclosures: The authors reported no conflicts of interest.

The *Journal* policy requires editors and reviewers to disclose conflicts of interest and to decline handling or reviewing manuscripts for which they may have a conflict of interest. The editors and reviewers of this article have no conflicts of interest.

Received for publication Nov 5, 2021; revisions received Nov 5, 2021; accepted for publication Nov 12, 2021; available ahead of print Jan 17, 2022.

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JTCVS Techniques 2022;12:100-1

2666-2507

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<https://doi.org/10.1016/j.jtc.2021.11.016>

FIGURE 1. Suggested surgical approaches based on the surgical pathology.

recommended (Figure 1). In patients with pathologies limited to the pump or driveline, however, limited incisions may be used (Figure 1). In patients in whom the issue is limited to the outflow graft, a reoperative sternotomy or a limited incision may be suitable, depending on the extent of graft involvement (Figure 1).³

The overview and algorithm proposed by Osho and D'Alessandro³ is comprehensive, timely, and illuminating. The commentary about the potential use of cerebral protection devices, which have been used in an off-label manner for other cardiac indications,⁴ is particularly instructive. Likewise, the caution about right ventricle management during LVAD exchange is informative and relevant, because right ventricle failure portends a poor prognosis after LVAD placement, especially in patients with destination therapy.⁵

The jury is still out about comparative outcomes. The results of comparative studies, which are predominantly in the

form of small case series, may have been overstated in this overview. Further investigation is needed to draw definitive comparisons between limited-incision approaches and reoperative sternotomies. Nevertheless, preliminary signals are encouraging, and the heart failure community eagerly awaits further data.

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