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Commentary: Pump stop and go! But is there a safer way through traffic?

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CENTRAL MESSAGE

Assessment of myocardial recovery to select patients for durable LVAD explantation can be performed successfully in a standardized fashion; however, there may be even safer protocols to consider.

Durable left ventricular assist device (LVAD) support as a “bridge to recovery” leading to LVAD explantation remains the Holy Grail of advanced therapies for heart failure. Although pharmacologic therapy using the Harefield protocol with clenbuterol (a β_2 agonist) resulted in device explant in more than two-thirds of patients, these results have not been widely reproducible.^{1,2} Thankfully, hope is not all lost. The recently reported RESTAGE-HF (Remission from Stage D Heart Failure) trial results suggest that >50% of patients with nonischemic cardiomyopathy can undergo successful LVAD explantation after optimization with a standardized pharmacologic regimen using a standard cocktail of widely available heart failure drugs.³ As therapies to optimize the conditions for myocardial recovery after LVAD implant are demonstrated to have efficacy, determining which patients should undergo explantation will become critical to achieve success at improving the incidence of device explantation.⁴

Hrytsyna and colleagues⁵ present their experience with using a standardized protocol to predict successful LVAD explantation in this issue of the *Journal*. They identified 21 of 544 patients (3.9%) who successfully proceeded to LVAD explantation with a 95.2% 1-year survival. Not surprisingly, the patients undergoing explant were younger and

had nonischemic cardiomyopathy. Importantly, the authors’ standardized protocol used echocardiography under pump stop conditions and subsequent cardiac catheterization with balloon outflow graft occlusion. Both pump stop and balloon graft occlusion are events that raise concern for adverse events, primarily the generation of thromboembolic event or hemodynamic collapse. Neither occurred in any of their patients; however, in 2 cases the pump could not be restarted immediately. Fortunately, both patients tolerated their LVADs not restarting; however, others may not be so fortunate. Although both LVADs in question were identified under a subsequent recall, one cannot assume that future devices will be immune from similar issues, nor will all patients tolerate their pumps not restarting. Furthermore, stopping the LVAD required the presence of a cardiologist, cardiac surgeon, and LVAD engineer, which makes this event resource intensive and may not be feasible in many centers.

We question whether the LVAD needs to be stopped completely as part of the assessment. The authors themselves point out that there were no significant differences in the hemodynamic and echocardiographic measurements during pump stop conditions between those who were ultimately selected for explant and those who were not. One also wonders whether the acute regurgitation that occurs during the pump stop contributed to the reasons for exclusion from consideration for explantation. The hemodynamic changes observed during balloon outflow graft occlusion determined who underwent

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explantation using their protocol. Considering that during continuous-flow LVAD implantation, we start the pump with the outflow graft completely clamped, we believe balloon graft occlusion can be performed with the pump speed turned down to a minimal net flow state. Thus, hemodynamic assessment can be performed with no pump flow but with the pump still spinning and no need to “restart” the pump.

Although the results of this standardized protocol demonstrate that successful LVAD explantation can be performed in a predictable fashion, there may be room for improvement to allow similar protocols to be safely adopted more widely.

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Commentary: The debate continues on optimal myocardial recovery assessment

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In their article in the *Journal*, Dr Hrytsyna and colleagues report their experience with a protocolized method of assessing myocardial recovery with the aim of aggressive left ventricular assist device (LVAD) explantation.¹ This single-institution retrospective review has 2 helpful characteristics: a large LVAD population (544 patients) and a long-standing protocol-based assessment for explantation, initiated in 2016. After 4 years of using this protocol, 57 patients (10%) met the authors' screening criteria and underwent speed manipulation under echocardiographic guidance (including pump stoppage). Of these patients, 37 underwent right heart catheterization–guided pump

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CENTRAL MESSAGE

A standardized and continuous approach to left ventricular assist device explantation allows for safe assessment of myocardial recovery, although pump stoppage may provide undue risk and necessitates further review.

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stop with graft occlusion. Finally, 21 patients fulfilled all criteria and were explanted. The rate of 3.9% is higher than the reported myocardial recovery rates in Europe and North America (1%-2%).^{2,3} There is no way to truly determine whether this is the optimal protocol and recovery rate, and with only 1 LVAD reimplantation in a non-compliant patient, this protocol ultimately may be too conservative. However, simply developing and then using any protocol increases awareness, screening, and thus, ultimately, explantation.

The authors note a variety of complications, including 3 patients with severe hypotension and 2 patients with pump stoppage malfunctions, one with eventual restart but the