Thinkers needed to improve biventricular assist device outcome

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Previous studies have demonstrated poor survival with biventricular assist device support (BIVAD). Analyses from 3 large multicenter databases show the following survivals with BIVAD versus left ventricular assist device support (LVAD): 68% versus 93% at 6 months in the United Network for Organ Sharing registry (n = 408 vs n = 3230),¹ 50% versus 80% at 1 year in the Interagency Registry for Mechanically Assisted Circulatory Support (n = 358 vs n = 11,672),² and 53% versus 81% at 1 year in the International Society for Heart and Lung Transplantation Registry for Mechanically Assisted Circulatory Support (n = 210 vs n = 5509).³

The study by Bartfay and colleagues⁴ in this issue of the *Journal* challenges this existing knowledge. Although their patients with BIVAD were sicker, the 1-year survival was 85%, comparable to the 86% survival of the patients with LVAD. This remarkable accomplishment was attained not only by their strategy of aggressive BIVAD use but also by their thoughtfulness and creativity, which are exemplified by their use of the ROTAFLOW pump (MAQUET Cardiovascular, LLC, Wayne, NJ) with the EXCOR cannulas (Berlin Heart GmbH, Berlin, Germany) during the early postoperative period.

Generalization of their strategy, however, is not so straightforward because of the significant challenges associated with biventricular failure in addition to the limitations of the study, which are well stated in the article.⁴ Biventricular failure is commonly declared by the need for BIVAD. Unarguably, BIVAD is used for refractory right ventricular (RV) dysfunction coexisting with left ventricular failure. The clinical presentation of these patients is diverse, with various degrees of hepatorenal dysfunction, lower extremity edema, and ascites, all of which are the result of chronic venous hypertension. The insidious nature of this condition and the lack of a standardized assessment modality for the RV function result in diagnostic and management delays. Cardiac surgeons are familiar with the similar difficulty in severe tricuspid regurgitation and certain congenital heart diseases. In this context, it is not a surprise that the survival is worse with BIVAD than

BIVAD therapy is not equal to biventricular failure.

Central Message

BIVAD is used in biventricular failure or cardiogenic shock, and accordingly it has an inferior outcome to LVAD. More thoughts and efforts are required for substantial improvement of BIVAD outcome.

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LVAD, and it also may not be a surprise to see a better BIVAD outcome in less advanced RV failure.

BIVAD is also used in refractory cardiogenic shock regardless of the RV function, and it is probably inappropriate to classify these patients as having biventricular failure (Figure 1). What is clear, however, is that this is the sickest patient population with the worst outcome, and thus it is not a surprise to see a worse outcome with BIVAD.

Finally, we need a revolution in durable continuous-flow RV assist device technology. Going back to pulsatile-flow pumps, as presented in this article,⁴ is unlikely to be a welcome solution unless the expected transplant wait time is short (as it was in this article). Surgeons' contributions (or struggles) to constructing a BIVAD system with the available technologies include total artificial hearts, various configurations of continuous-flow LVAD technology, and continuous-flow LVAD with external or percutaneous RV assist device support. The current strategy in our program at Columbia University Medical Center is first to resuscitate the patient and optimize the patient's condition with minimally invasive external LVAD combined with a percutaneous venous cannula and an oxygenator, providing biventricular support.⁵ This allows the determination of futile cases while minimizing the surgical insult and resource use, as well as providing time for more deliberate assessment of the RV function.

Surgeons should continue to think of how to improve the outcomes of these patients. This is one of the frontiers with opportunities.

FIGURE 1. Biventricular assist device therapy is not equal to biventricular failure.

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