Optimal Management to Maintain Fontan-like Circulation During Left Ventricular Assist Device Support

To the Editor:

I congratulate Fukunaga and colleagues \(^1\) for their successful management of the patient with ventricular standstill who was supported only with a left ventricular assist device (LVAD) without any right-sided mechanical support. They intended to use right-sided mechanical supports, but decided not to use them because of patient’s relatively stable hemodynamics. Considering my experience, I believe that detailed hemodynamic data might facilitate a clarification of what happened in their patient.

In one of my previous cases, \(^2\) we performed a hemodynamic and echocardiographic ramp test in the patient with the LVAD during sustained ventricular fibrillation. Mean central venous pressure was 15-20 mm Hg with waveforms for the right atrium, right ventricle, and pulmonary artery that were similar to “Fontan-like circulation.” Pulmonary capillary wedge pressure was well controlled within 10 to 15 mm Hg, and pulmonary vascular resistance was as low as approximately 2.0 WU. What is the optimal hemodynamics to maintain Fontan-like circulation?

First, relatively high volume status is required to maintain preload of the left ventricle (LV) without any helps of right ventricle. \(^3\) Considering also congestive hepatic injury, 15 to 20 mm Hg of central venous pressure may be a target. Second, an effort to reduce pulmonary vascular resistance is required to drive blood from right to left without the help of the right ventricle. \(^3\) Third, potent LV blood removal by incremental LVAD speed is required to vacuum blood from the pulmonary vascular bed without the help of the right heart. \(^3\) Of note, too much LVAD speed causes enhanced venous return and LV suction. \(^3\)

I still do not have a definite strategy to maintain such Fontan-like circulation in patients with LVADs with fatal ventricular tachyarrhythmias, because of a lack of experience. I again congratulate their successful management and believe that detailed hemodynamic assessments in multiple cases would strengthen our hypothesis and improve management strategy for patients with LVAD and refractory arrhythmia.

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References


Reply

To the Editor:

We greatly appreciate the comments of Dr Imamura \(^1\) concerning our case report \(^2\) published in *The Annals of Thoracic Surgery*. We agree that a careful assessment of hemodynamic, biochemical, and clinical variables is required to determine the optimal management of a patient with an effective “Fontan” circulation. Although acceptable hemodynamics have been reported in patients with ventricular fibrillation supported by biventricular assist devices or even isolated left ventricular assist device (LVAD) support, we believe that this is a rare description of irreversible ventricular standstill. \(^3\)

In most patients who present with ventricular arrhythmias, mechanical circulatory support is able to maintain adequate hemodynamics to allow either internal or external cardioversion to a more stable rhythm. In patients with refractory ventricular arrhythmias, we tend to favor biventricular support, and others have advocated the use of a total artificial heart. \(^4\) The unusual features of this case involved the delayed presentation (6 weeks after LVAD implant) and the relatively stable hemodynamics. Our patient’s central venous pressure was 15 mm Hg, and her pulmonary artery pressure was measured at a mean of 15 mm Hg, with no appreciable pulse pressure. A reliable cardiac output determination could not be obtained by Swan-Ganz catheter assessment. The Swan-Ganz catheter was quickly removed for fear of thrombus.

Her LVAD flow remained stable at more than 3 L/min (index of 2 L/min/m²) on low-dose dobutamine support. Given her small size and relative stability, we made the decision to bridge her to heart transplantation with careful observation in the event of deterioration. We were fortunate to have a successful outcome and believe that our management of this patient merited a report to the heart failure community.

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References