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Commentary: Ventricular assist device and bidirectional Glenn—mixing required

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Paracorporeal support for children with superior cavopulmonary connection (bidirectional Glenn [BDG] shunt) has innate challenges due to their physiology. In this issue of the *Journal*, Bedzra and colleagues¹ describe in detail their experience with long-term ventricular assist device (VAD) support in a patient with Glenn physiology who was successfully bridged to transplantation.

The patient had a transitional atrioventricular septal defect, double-outlet right ventricle with a subaortic ventricular septal defect, a subaortic obstruction from atrioventricular valve tissue, and moderate to severe pulmonary stenosis. While supported on extracorporeal membrane oxygenation, he received an innominate artery and right atrial cannula, which provided sufficient decompression of the Glenn circuit. A Berlin arterial cannula was placed in the Damus–Kaye–Stansel (DKS) anastomosis, and an inflow cannula was implanted into the left ventricular apex. This strategy was successful because this lesion mixes at several levels, and streaming from the inferior vena cava (IVC) was avoided with this cannula placement.

Decision making regarding long-term cannula placement is paramount to the successful bridge to transplantation in patients with a BDG. For example, in a patient with

CENTRAL MESSAGE

Successful long-term support using a VAD as a bridge to transplantation with superior cavopulmonary anastomosis is possible if adequate mixing is allowed.

hypoplastic left heart syndrome (HLHS) with mitral stenosis and aortic stenosis, placement of the inflow cannula in the right atrium might not allow for good mixing. The desaturated blood from the IVC would stream primarily into the VAD, causing a right-to-left shunt associated with significant cyanosis. However, this is less likely if there is HLHS with mitral/aortic atresia and an inflow cannulation in the right ventricle, because there should be good mixing. Another possible example is a patient with the cannula positioned in the right atrium who has tricuspid atresia. IVC blood flow entering the atrium would stream into the cannula before significant mixing with the pulmonary venous blood no matter how open the atrial septum is, resulting in an obligatory right-to-left shunt. Here the authors used a ventricular cannula, avoiding streaming and ensuring adequate mixing, which was beneficial for long-term oxygenation and hemodynamic support. When assessing a Glenn patient for VAD support who is too small to be promoted to Fontan, consideration of their anatomy and the inflow cannulation site is critical for success.

Also notable is the duration of support before undergoing heart transplantation. This is one of the longest cases published to date. As reported by Morales and colleagues,² the average duration of support for children with any congenital heart disease supported as a bridge to transplantation with the EXCOR VAD was 41 days (interquartile range, 10–144 days). The patient described was supported for a total of 367 days.² In

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another study, in 204 children supported with the EXCOR, the median duration of support was 40 days (range, 1-435 days).³

The authors should be congratulated for their technique and successful long-term management of this complex physiology. With increasing experience in supporting BDG patients, our approach has evolved, leading to recognition of the most important factor; mixing required.

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