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SUPPORTING UNIVENTRICULAR HEART IN BIVENTRICULAR CIRCULATION

To the Editor:

I read with great interest a recent report of Bleiweis and colleagues1 on ventricular assist device (VAD) support in neonates and infants with a failing univentricular circulation. Neonates and infants with failing univentricular circulation might be listed for urgent heart transplantation after initial palliative surgery. Furthermore, a subgroup of high-risk patients with univentricular circulation might be best served with primary transplantation. Because the donor hearts are not readily available for these challenging patients, durable VAD support as bridge to heart transplantation is often the only alternative to death. Although successful VAD support in these children has been reported,2,3 such support is associated with high mortality rates due to stroke, respiratory failure, or infection, all associated with difficult balance of systemic and pulmonary circulation. The recent review showed that survival of these young children with univentricular circulation supported with a VAD was poor, with less than 50% survival by the 3-month mark.4,5

Herein I propose and illustrate the principles of supporting the univentricular heart in biventricular circulation that would likely reduce mortality and morbidity to the level of that in age-matched children with biventricular circulation supported with a VAD. The procedure could be used in patients with hypoplastic left heart syndrome after previous palliation, including the Norwood procedure (Figure 1, A), but, of course, it would be easier done as a primary procedure in children without previous palliative surgery, if VAD support is required as a bridge to heart transplantation. The ring-enforced conduit is sutured to the atrial septal defect (Figure 1, B) and passed through the wall of the right atrium, so that the oxygenated blood from the left atrium is drained to the VAD chamber (Figure 1, C). The pulmonary artery is detached from the aortic root and the normal anatomical position of the pulmonary artery is restored (Figure 1, D). The outflow graft is anastomosed to the aorta (Figure 1, E), so that VAD supports the systemic circulation (Figure 1, F), whereas the pulmonary circulation is supported by the native univentricular heart. The whole procedure can be done with the heart beating and perfused, so that ventricular function is not compromised. Such support would result in normal blood oxygen saturation.

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FIGURE 1. A, The univentricular heart after the initial palliative procedure. B, Ring-enforced conduit is anastomosed to the atrial septal defect. C, The conduit is passed through the right atrial wall, so that oxygenated blood from the left atrium is drained into the ventricular assist device. D, The normal pulmonary artery anatomy is restored. E, The outflow graft is anastomosed to the aorta. F, The ventricular assist device supports the systemic circulation, whereas the native single ventricle supports the pulmonary circulation. RA, Right atrium; SVC, superior vena cava; IVC, inferior vena cava; LA, left atrium; LPV, left pulmonary vein; RPV, right pulmonary vein; MV, mitral valve; TV, tricuspid valve; PA, pulmonary artery; RV, right ventricle.