Commentary: Choosing complex biventricular repair versus Fontan—the unmet needs

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The multicenter study in Australia of Sun and colleagues,¹ reported in this issue of the *Journal*, enrolled 129 patients with D-transposition of the great arteries, ventricular septal defect, and left ventricular outflow tract obstruction (D-TGA/VSD/LVOTO; n = 85) or L-transposition of the great arteries, ventricular septal defect, and left ventricular outflow tract obstruction (L-TGA/VSD/LVOTO; n = 44) who underwent 29 Fontan procedures and 100 biventricular repair operations in a 26-year cohort. Both pathways were associated with excellent mortality and functional outcomes. The main finding is that biventricular repair required more reinterventions than Fontan procedures. The results of Fontan procedures for those patients whose anatomy is not amenable to biventricular repair, is not, at least in short term, inferior to those of biventricular repair.

This study included patients with both D- and L-TGA/VSD/LVOTO, and it also included many types of biventricular repair procedures, including anatomic repair and physiologic repair, with or without atrial switch, in the group compared with the Fontan group. The patients were simply classified into the biventricular repair or Fontan group according to their index operation. Considering the limitations in the methodology, we should not conclude that the biventricular repair is inferior to the Fontan procedure.

Studies with large case numbers of complex biventricular repair for L-TGA/VSD/LVOTO are limited in the literature. Because of the high-level technique demanded in biventricular repair, the survival outcomes of biventricular repairs are usually jeopardized by early mortality.² In contrast, the Fontan operation is a well-established procedure with low surgical mortality. The surgeon's competence should be considered during the selection between biventricular repair and the Fontan procedure.

Hraska and colleagues^{3,4} have recently suggested several surgical improvements for biventricular repair, including the modified Senning operation, training the left ventricle, avoiding heart block, modifying the Rastelli procedure to

3D CT image of CCTGA/VSD/PA before (A) and after (B) modified Senning-Rastelli operation.

Central Message

Decision making and the surgical technique of biventricular repair for D- or L-TGA, VSD, and LVOTO remain challenging and require more data.

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avoid intraventricular tunnel obstruction, and aortic translocation procedures.

In Sun and colleagues' biventricular repair group, the reinterventions included "expected" conduit replacement, a substantial proportion of pacemaker implantations (n = 12), and other unexpected reinterventions (n = 19 after exclusion of the pacemaker procedures).¹ The number of reinterventions does not seem so impressive if the nature of disease is taken into consideration. The most common unexpected reintervention procedures were for left ventricular outflow tract obstruction (n = 8), which did not occur in patients who underwent the Nikaido procedure, and right ventricular outflow tract obstruction (n = 5), for which all 5 underwent the réparation à l'étage ventriculaire procedure. The left ventricular outflow tract obstruction is a known complication after the Rastelli procedure, and the use of the Nikaido procedure and resection of the infundibular muscle could eliminate the morbidity.⁵

In the study of Sun and colleagues,¹ the median follow-up duration was 6.2 years, which is inadequate for observation of complications related to long-term Fontan circulation. Addition of a bidirectional Glenn shunt in anatomic repair (one-and-a-half ventricle repair) had facilitated avoidance of systemic vein obstruction and right ventricular outflow reintervention^{6,7}; however, this strategy was not evaluated in this study.

In summary, this experience in Australia provides considerable information for the management of this complex and heterogeneous group of patients. More long-term data on the outcomes of the Fontan procedure and biventricular repair are still needed. The surgical techniques for biventricular repair are challenging and still being progressively improved. With improvement in the anatomic repair and preservation of ventricular function, the long-term outcomes of biventricular repair are likely to be superior to those of Fontan palliation for those patients with suitable anatomy. Considering the anatomic, physiologic, and surgical details of each patient is more important than reading the overall statistical outcomes of this group of patients.

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