The questionable role of the hybrid procedure

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Keywords: Hybrid procedure • Norwood procedure • Hypoplastic left heart syndrome

The hybrid procedure was first proposed in 1993, and again in 2002, as an alternative to the Norwood procedure for hypoplastic left heart syndrome, in order to avoid complex cardiac surgery in the neonatal period with all its possible neuro-developmental sequelae [1, 2]. It became popular, however, with the idea that it may prove useful for a subgroup of patients at very high risk of mortality after the Norwood procedure, despite the remarkable reduction in the overall mortality of this operation [3, 4]. These are babies with low weight and/or aortic atresia.

The hybrid procedure has been used increasingly for over a decade, without being confined to high-risk cases. Nevertheless, it has failed to show its superiority to the Norwood procedure [5]. This prompted Pizarro et al. to dissect out and define the major risk factors for this procedure, hoping to improve its results by case selection [6]. They show that the two major risk factors for mortality in the Norwood procedure (low weight and aortic atresia) also apply to the hybrid approach, with no survivors when both risk factors coexist. This finding is very important; it makes case selection problematic and paradoxical, since excluding these babies defeats a major purpose of the hybrid procedure. Indeed, case selection here discriminates against the very patients this procedure was hoped to serve. This questions the utility of this approach altogether.

For the hybrid procedure to be useful when compared with the Norwood procedure, it must either achieve better neuro-developmental outcome, or lower overall mortality, or better outcome in high-risk cases. Its neuro-developmental outcome has already disappointed in one study at 1-year follow-up, although more work is needed to clarify this [7]. Lower overall mortality is not achieved [5]. Now, it turns out that it cannot help the high-risk babies either [6].

Furthermore, the hybrid procedure is actually worse than the Norwood procedure in at least one important aspect—distortion of the branch pulmonary arteries by banding, as evidenced by the high rate of reinterventions on these vessels [8–10]. This is a very significant, yet under-emphasized, drawback of the hybrid procedure, since these patients are being prepared for an eventual Fontan which may be jeopardized by pulmonary arterial distortion.

So, what does the hybrid procedure offer? It has certainly failed to live up to the original expectations. In addition, its important disadvantage with respect to the risk of pulmonary arterial distortion has been brought to light. However, as Pizarro et al. highlight, it may have found another role as a temporizing measure for cases where an eventual biventricular repair is planned [6]. Although such a temporizing measure may also be achieved with the Norwood procedure, subsequent biventricular repair is shorter and easier (and presumably safer) if the first procedure was the hybrid approach. Also, the concern regarding pulmonary arterial distortion is less significant since a biventricular repair is
more forgiving in this respect. This role may turn out to be the main application of this procedure.

**Conflict of interest:** none declared.

**REFERENCES**


