which may explain why the LT is associated with less and shorter duration of pleural drainage.

The truth seems to be that both provide extremely effective Fontan circulations with nearly entirely equivalent outcomes. In a Fontan physiology, good ventricular function and low pulmonary vascular resistance pretty much trump anything and are likely to be far more important in dictating outcomes than the exact type of the Fontan we choose.⁵ The roles of fenestrations and anticoagulation regimens may also have much more relevance than LT versus ECC.

We can be reassured that both LT and ECC have excellent outcomes and, to some extent, we are free to choose what we are most comfortable with. The authors suggest a randomized clinical trial (always the ideal solution) but the reality is that there may be little appetite for this given that outcomes with both are so good. It may be that new large registries, such as the Australia and New Zealand Fontan Registry, may give us the answer.

Given the efficacy of both techniques, future interest is likely to be more focused on providing augmentation for the existing Fontan circulations, whether as mechanical or bioassisted, temporary or permanent systems. Which is better, LT or ECC? Final answer: We don't know yet (Figure 1).

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Commentary: The Fontan technique controversy: Where is the real equipoise?

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Daley and Udekem¹ summarize a PubMed database search of reported outcomes comparing the lateral tunnel and extracardiac conduit (ECC) techniques for the modified Fontan operation. Following an extensive review of

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CENTRAL MESSAGE

The optimal technique for the Fontan operation remains elusive. Other long-term challenges of the Fontan physiology dominate our decision-making.

pertinent publications, the authors conclude that "after almost 3 decades, there is little evidence of the superiority of one technique over the other in terms of long-term outcomes." However, a number of potential differences are discussed. In viewing this controversy, we see common themes that have played out in other areas of cardiac surgery, namely, the presumptive advantage of cardiac reconstructions using autologous tissues with the opportunity for

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growth versus the relative simplicity and flexibility (often with reduced suture lines) of an artificial substitute. The relevant studies attribute outcome differences to these various advantages or deficiencies.

A major issue reviewed is conduit size and the absence of growth potential with the ECC. The authors find support for an optimal conduit size of 16 to 18 mm. This important information, in which oversizing is discouraged, supports published evidence indicating a very low incidence of conduit replacement when a 16-mm polytetrafluoroethylene ECC is used at the Fontan operation.² This size is generally suitable for patients weighing at least 12 kg. However, systematic late studies documenting the absence of important gradients at the connection with the inferior vena cava are lacking. Direct or indirect evidence of late partial obstruction at the level of the inferior vena cava must be a centerpiece of future investigations.

The authors review multiple papers purporting to support or reject survival differences between the 2 techniques. The major reported differences were early post-Fontan, raising the possibility of subtle selection bias, surgeon preference, and/or differences in other patient-associated risk factors. The authors refer to potential anastomotic angulation, distortion, and gradients with the ECC that could affect early mortality, especially among surgeons not highly experienced with this technique. However, a growing number of reports indicate an extremely low hospital mortality (0%-2%) following the Fontan operation in the current era,^{2,3} suggesting that imperfect operations with either the lateral tunnel or ECC approach are rare. Thus, in assessing long-term outcomes, disciplined analytics (such as multi-phase hazard models) are mandatory to clearly distinguish risk factors in the early phase from those later post-Fontan. The focus should be on the comparative hazard ratios in the constant and late phases when generating inferences about the survival advantage of one technique over the other. However, of course, the real focus must be on those aspects/limitations of the Fontan *concept* that, while extending duration and quality of life for patients with single ventricle, also limit long-term survival second-

ary to chronic hepatic venous hypertension in the absence of pulsatile pulmonary blood flow.

The authors acknowledge the challenges of equipoise in establishing a randomized clinical trial comparing the 2 surgical approaches. In recruiting surgical participation in such a trial, the differing interpretation of “equipoise” is relevant. In 1987, Freedman⁴ emphasized the concept of “clinical equipoise,” in which uncertainty of superiority between 2 therapeutic choices within the medical community is sufficient for participation. Other interpretations focus on whether the individual participating surgeon/physician believes there is true uncertainty about the superiority of one approach over the other. This, of course, is especially germane in the study of 2 very specialized surgical techniques. Not only may individual equipoise be challenging, but engaging surgeons to participate is complicated when they have already accumulated considerable experience with one technique. So, the likelihood of a successful randomized clinical trial appears remote.

After digesting this interesting report, perhaps we can again refocus on the really pressing issues in the Fontan space. Given the current low hospital mortality and good long-term survival with either technique, most pediatric cardiac surgeons and cardiologists will exercise their equipoise in decision-making regarding the optimal timing of Fontan after the bidirectional Glenn, whether to leave an additional source of pulmonary blood flow post-Glenn, long-term management of hepatic venous hypertension, and the timing of referral for heart (or heart–liver) transplantation with the failing Fontan.

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