Commentary: To valve, or not to valve—That is the stage I question

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In this issue of the *Journal*, Kumar and colleagues¹ for Knott-Craig's Tennessee group report the use of femoral vein homograft as a valved right ventricle-to-pulmonary artery (RV-PA) conduit in stage I Norwood procedure in 24 consecutive neonates. They demonstrate promising results, with a decent short-term rate of valve competency (2/3 at 1 month), pulmonary artery growth, and preserved ventricular function.

Advantages of this technique are theoretically numerous. As a conduit, femoral vein homograft is a compliant tissue possibly with less thrombogenicity and a lower rate of bleeding complications. In terms of hemodynamics, a valved RV-PA connection is supposed to decrease the volume overload of the single ventricle, improving its function long term.

Use of a valved homograft also comes with its share of uncertainties and drawbacks. As a conduit, its diameter is less homogeneous than that of a synthetic polymer graft, which can be a significant issue in a physiology in which the pulmonary to systemic flow ratio is of major importance. The biologic origin of this graft also increases the risks of conduit calcification or obstruction, patient sensitization, and health care costs. In terms of hemodynamics, it is important to note that most of the homografts implanted progressed to free insufficiency by the time of the stage 2 procedure. Moreover, there was a significant need for catheter interventions (14/24 patients), which carry inherent risks of complications, including vascular access issues.

Despite these limits, the group from Tennessee¹ report excellent outcomes and are to be congratulated for this significant contribution. As surgeons, we do now have an alternative technique to consider to provide pulmonary blood flow in patients undergoing a stage I operation.

A lot still needs to be figured out, however, to assess the actual and long-term effects of using a valved conduit in

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Central Message

Implantation of a valved right ventricle-to-pulmonary artery conduit in stage I procedure has been reported with mixed results. Is a valve needed? Why? How? These questions still need to be answered.

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stage I operation. The effect of volume overload related to a valveless conduit on right ventricular function with time is still unclear.² Other groups have described the use of valved RV-PA conduits during stage 1 procedures with no apparent benefit relative to nonvalved conduits.³ To answer this question, we will need to focus on 3 aspects of the problem. First, we will need to assess the right ventricular function long term in this cohort of patients in a much better way. In addition to 3-dimensional echocardiography, magnetic resonance imaging “coupling” assessment technique⁴ can find here an excellent indication in right ventricular function evaluation in patients undergoing stage I operation by assessing the interaction between load of the valved conduit and the elastance of the single ventricle. Second, a randomized, prospective multicenter trial will be needed to confirm that a valved conduit actually increases pulmonary growth and improves function long term. Finally, our community needs to understand which factors actually play a role in pulmonary arterial growth, right ventricular function, and long-term outcomes. Is it the interposition of a valve in the conduit? Is it the mechanical compliance of the conduit? Or is it maybe the geometry of the connection (regardless of whether it is valved or compliant)? In vitro mechanical experiments, computational models, and in vivo animal surgical model studies will be needed to answer these

questions and improve outcomes and quality of life for these challenging patients.

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