under these controlled conditions, we consider a hemoglobin value of greater than 7 g/dL (hematocrit level, >21%) to be safe. However, as you can see in Figure 2 of our article, only 1 patient had a hemoglobin value of less than 8 g/dL (hematocrit level, 24%).

During CPB, we defined the critical hemoglobin value as 7 g/dL, regardless of the preoperative hemoglobin value and regardless of the cardiac malformation of the patient. The target hemoglobin values after CPB depended on whether (near-) anatomic correction with physiologic perfusion of the lungs was achieved (critical hemoglobin value, 8–10 g/dL) or only palliation (critical hemoglobin value, 12–16 g/dL) was established. The higher target hemoglobin value of 12 to 16 g/dL was responsible for the observation that all patients with cyanotic malformations and nonanatomic correction of lung perfusion had to receive transfusion before termination of CPB or during the further course. In contrast, in most of the other patients, reinfusion of the remaining CPB volume, processed and concentrated with a special pediatric small-bowl cell saver, was effective in establishing or maintaining the target hemoglobin value of 8 to 10 g/dL.

I have studied your recently published article with great interest and appreciate that you were able to confirm in a larger number of patients, using a comparable perfusion technique (vacuum assisted venous drainage) and CPB setup to ours (same oxygenator but not the arterial filter that we require), that miniaturized CPB contributes to improved clinical outcomes.⁵ Establishing large pools of data with comparable perfusion techniques will help to generate safety standards for CPB during this complex operation and assess which clinical parameters and monitoring techniques (especially near-infrared spectroscopy) are useful in the decision of whether to transfuse. Additionally, these data will help to define clearer outcome parameters because, for example, serum lactate concentrations might not be feasible in this regard as a result of

the high concentration of lactate in stored packed red blood cell concentrates, whereas the duration of mechanical ventilation and stay in the intensive care unit might well be acceptable.

I hope that these lines contributed to a better understanding of our article and look forward to seeing more data from your interesting work in the near future.

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A NEW DIAGNOSTIC ALGORITHM FOR ASSESSMENT OF PATIENTS WITH SINGLE VENTRICLE BEFORE A FONTAN OPERATION

To the Editor:

We read with interest the article of Prakash and associates entitled “A

new diagnostic algorithm for assessment of patients with single ventricle before Fontan operation.”¹ We found it appealing to spare these children invasive and costly procedures in the era of rampant health care costs. In their retrospective study the authors developed an algorithm that identifies high-risk patients for the completion of partial cavopulmonary connection. This algorithm is based on clinical and noninvasive imaging criteria and limits cardiac catheterization only to high-risk patients.

We and others believe that the major indication for cardiac catheterization in patients with partial cavopulmonary connection is to measure the pulmonary arterial pressure. Left ventricular function and pulmonary arterial pressure are the 2 most important criteria in identifying patients at risk for the completion of the Fontan procedure.² Should we assume that all patients with normal pulmonary artery size and normal ventricular function in the absence of pulmonary branch stenosis have acceptable levels of pulmonary artery pressure?

Ba and colleagues³ found in their report that clinical signs identified only a minority of patients in whom the Fontan procedure was contraindicated and detected a subgroup of patients with normal pulmonary artery size and high pulmonary artery pressure.

To this day, Fontan-like procedures are the only option for patients with a single ventricle. If the completion of a cavopulmonary connection is contraindicated, the patient is usually scheduled for heart transplantation. On the other hand, failure of the total cavopulmonary connection or its take-down is usually followed by a stormy postoperative course and a high mortality rate. Hence we believe that the decision to proceed to a total cavopulmonary connection is extremely delicate; cardiac catheterization remains the gold standard for the contraindication of a total cavopulmonary connection until comparative prospective

studies, if ethically feasible, prove otherwise.

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Reply to the Editor:

We would like to thank Soueidi and colleagues for their thoughtful comments on our work. We agree that the decision to proceed with a Fontan operation is a delicate one with major implications for the child's future course. It is standard clinical practice to perform cardiac catheterization for preoperative evaluation. However,

this practice is based on data from the 1970s and does not take into consideration advances in noninvasive imaging and changes in the characteristics of subjects presenting for a Fontan operation. Although cardiac catheterization is the reference standard for hemodynamic assessment, it is invasive and costly and carries several risks, including exposure to ionizing radiation.

Our work demonstrates that a comprehensive, noninvasive diagnostic algorithm that incorporates data from clinical history, echocardiography, and noninvasive angiography is effective in screening for children who might not be eligible for a Fontan operation. The proposed algorithm correctly classified all 9 subjects who were deemed ineligible for a Fontan procedure into the high-risk group, which would undergo cardiac catheterization before the Fontan operation. It is important to note that the proposed algorithm is not merely an assessment of ventricular function and pulmonary artery size but requires a more comprehensive evaluation.

With regard to pulmonary artery pressure (PAP), we made some interesting observations. First, no patient deemed ineligible for a Fontan operation had an increased PAP without an associated risk factor on history, echocardiography, or angiography. Second, in patients who underwent

a Fontan operation, preoperative PAP was not associated with adverse postoperative outcomes. We believe that these results are partly due to the rarity of significant increases in PAP in the current era of staged surgical palliation. In the current era, other risk factors, such as heterotaxy syndrome, might have become more important. In light of these findings, it might seem unreasonable to expose low-risk patients to the risks of catheterization to measure PAP.

On the other hand, it is important to note that these results are based on a retrospective analysis of patients followed at a single tertiary care center. They might not apply to patients who have not undergone a similar protocol of stage palliation. Furthermore, the proposed diagnostic algorithm requires high-quality noninvasive angiography with magnetic resonance angiography or computed tomography, which might not be universally available. We hope that our work will help stimulate further prospective investigation that will help clarify the role of noninvasive diagnostic algorithms before a Fontan operation.

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