PEDIATRIC CARDIAC SURGERY: EFFECT OF A MINIATURIZED BYPASS CIRCUIT IN REDUCING HOMOLOGOUS BLOOD TRANSFUSION

To the Editor:

I read with great interest the excellent article by Koster and colleagues.¹ We have recently published our experience in treating 150 pediatric patients with a 120-mL prime volume miniaturized bypass circuit, vacuum-assisted venous drainage, and intermittent warm blood microplegia.² Our results, although less impressive than those of Koster and colleagues,¹ confirmed the efficiency of a small prime volume for reduction of allogeneic blood transfusion. With a nadir hemoglobin value of 8 g/dL during cardiopulmonary bypass, we demonstrated the good tolerance of hemodilution using 2 markers: preoperative and postoperative lactate levels (which were lower in patients undergoing bloodless surgery than in transfused patients) and time to extubation (which was shorter in patients undergoing bloodless surgery than in transfused patients). Our major concern was to not counterbalance the potential benefit of bloodless surgery by altering the intraoperative or postoperative care, thus inducing other risks. We firmly believe that transfusion cannot be the only outcome end point in such a study group.

Pediatric perfusion is a challenging technique with conflicting goals. The benefit expected from reducing transfu-

sion requirements is a better immediate outcome at a lower cost.³ On the other hand, a too low hematocrit level is hazardous, and less than 23.5% is said to be associated with lower Psychomotor Development Index scores and increased lactate levels.⁴ In the literature the need for some norepinephrine bolus, increased inotropic support, increased ventilation time, and increased length of critical care or hospitalization stay have all been related to low perioperative hematocrit levels.

In Koster and colleagues' study group,¹ the factor triggering blood transfusion during surgical intervention was clearly a hemoglobin value of less than 7 g/dL. However, the triggering factor was less clear for the 4 patients transfused during the further course. The rationale to tolerate the same nadir level of 7 g/dL of hemoglobin during surgical intervention in patients with large differences in preoperative hemoglobin levels (from 11.1 g/dL [the lowest level in the study] to 16.0 g/dL [the highest level in the study]) is not obvious. Similarly, the technique used to reverse the intraoperative anemia and reach the postoperative hemoglobin target values, namely 8 to 10 g/dL in patients with anatomic correction and 12 to 16 g/dL in cyanotic patients with palliative procedures, is unclear.

Even if 85% of the patients were finally transfused, Koster and colleagues¹ are to be congratulated for their energy in promoting bloodless neonatal surgery. The efficiency of the miniaturized bypass circuit in reducing blood transfusion is well established. However, the link between bloodless surgery and improved immediate clinical outcome has yet to be confirmed, as has its lack of harm on late neurological outcome.

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References

1. Koster A, Huebler M, Boettcher W, Redlin M, Berger F, Hetzer R. A new miniaturized cardiopul-

monary bypass system reduces transfusion requirements during neonatal cardiac surgery: initial experience in 13 consecutive patients. *J Thorac Cardiovasc Surg.* 2009;13:1565-8.

2. Durandy Y. The impact of vacuum-assisted venous drainage and miniaturized bypass circuits on blood transfusion in pediatric cardiac surgery. *ASAIO J.* 2009;55:117-22.
3. Hickey E, Karamlou T, You J, Ungerleider RM. Effects of circuit miniaturization in reducing inflammatory response to infant cardiopulmonary bypass by elimination of allogeneic blood products. *Ann Thorac Surg.* 2006;81:2367-72.
4. Wypij D, Jonas RA, Bellinger D, Del Nido PJ, Mayer JE, Bacha EA, et al. The effect of hematocrit during hypothermic cardiopulmonary bypass in infant heart surgery: results from the combined Boston hematocrit trials. *J Thorac Cardiovasc Surg.* 2008;135:355-60.

doi:10.1016/j.jtcvs.2009.06.030

Reply to the Editor:

We thank Dr Durandy very much for her comments. We completely agree that performing transfusion-free surgery cannot be a goal in itself. There are convincing data from the adult world and first data from the pediatric world of cardiac surgery showing that transfusion of allogeneic blood impairs clinical outcomes. However, the small scale of our investigation and the great heterogeneity of cardiac malformations meant that the study was not powered to perform an assessment in this regard.

As you outlined, in addition to the technical aspects of the perfusion technique and the cardiopulmonary bypass (CPB) setup, definition of the critical hemoglobin value as a trigger for transfusion remains a key question. As you outlined, Jonas and colleagues¹ reported adverse neurological outcomes in patients with a hematocrit level of less than 20%, whereas a hematocrit level of 24% was safe.² In these patients surgical intervention was performed during deep hypothermic cardiac arrest or with low-flow CPB. In our investigation only 6 patients underwent deep hypothermia. However, we performed regional arterial cerebral perfusion and continuous measurement of cerebral oxygenation using near-infrared spectroscopy, which is an established monitoring tool under these circumstances.^{3,4} Therefore

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