Does peritoneal dialysis improve outcomes after heart surgery in infants?

Igor E. Konstantinov, MD, PhD, FRACS

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A thought-provoking article by Kwiatkowski and colleagues¹ is published in the current issue of the *Journal*. This retrospective case-matched study addresses the practical and important topic of using the peritoneal dialysis (PD) catheter after cardiac surgery in infants. Acute kidney insufficiency (AKI) is common in neonates and infants after heart surgery. Any research dealing with management of the AKI in infants is therefore timely and of great interest to everyone involved in the perioperative management of children undergoing heart surgery. Kwiatkowski and colleagues¹ described 42 infants who underwent heart surgery with planned intraoperative placement of a PD catheter and thoroughly matched them with 42 infants of the same age who underwent similar surgeries during the similar period but without PD catheter placement. This appears to be the largest study to date to compare outcomes between infants with and without PD catheter placement after heart surgery. Kwiatkowski and colleagues¹ observed that infants with PD catheters achieved a negative fluid balance more often within 2 days after surgery and had a shorter time to negative fluid balance, earlier extubation, lower inotropic requirement, and fewer electrolyte imbalances necessitating correction. Kwiatkowski and colleagues¹ concluded that PD is safe and associated with earlier negative fluid balance and improved clinical outcomes in infants at high-risk for AKI and recommended routine PD catheter use in these patients.

Of note, most of their patients were in fact neonates. This is not surprising, as neonatal age is generally associated with up to 5-fold increase in PD catheter use.² Furthermore, the 2 most important subgroups comprised of neonates undergoing Norwood operations and arterial switch operations. These children usually have the longest cardiopulmonary bypass times and thus are at the highest risk for postoperative AKI. Namely, AKI has been shown to be 7 times more likely in neonates and infants with

cardiopulmonary bypass times longer than 2 hours.³ Interestingly, children who require PD for AKI after heart surgery have a good long-term renal prognosis.⁴

The literature on the topic remains controversial. In a small randomized controlled trial of 22 neonates who underwent Norwood operation, Ryerson and colleagues⁵ demonstrated no benefits of prophylactic PD catheter placement. Notably, in 4 of 12 patients randomly assigned to PD catheter placement the PD catheter was left open to drain and PD was never started. The authors concluded that early attempts to achieve a negative fluid balance with a PD catheter after the Norwood procedure may be associated with an increased risk of adverse outcomes. Obviously, an early negative fluid balance after Norwood procedure could be detrimental, and PD should be used judiciously.

Because of an immense galaxy of subtle differences of managing infants in the intensive care unit, causation of a given outcome is often obscure. Moreover, the causal link between the need for a PD catheter and mortality remains controversial. Thus, Madenci and colleagues² studied 558 children with PD catheter implantation after heart surgery. They used a large public database and concluded that children who received a PD catheter after heart surgery had a 20% mortality, which remained at 12% after exclusion of patients with AKI.² This may leave an impression that the need for PD catheter per se is associated with high mortality and is only seen in high-risk patients. On the other hand, my colleagues and I at the Royal Children's Hospital in Melbourne routinely place PD catheters in all children undergoing an arterial switch operation, with an overall mortality of 2.8% in 618 children.⁶ Similarly, we routinely place PD catheters in all neonates after the Norwood operation and other complex cardiac operations. Administration of PD in our intensive care unit is done by a nurse, without involvement of the nephrology service. Placement and use of the PD catheter is a safe, simple, well-established, and low-cost procedure in our unit. Clearly, a randomized, controlled trial in the setting of our unit would not be feasible.

Overall, the literature suggests the need for a more robust guidelines for PD catheter use. The current study of Kwiatkowski and colleagues¹ is a significant and important step forward. One might speculate that causation is difficult, if not entirely impossible, to establish in a relatively small retrospective study. Similarly, their study design does not allow a definite conclusion as to whether observed improved outcomes should be attributed to PD or simple drainage through the catheter.

From the University of Melbourne, Royal Children's Hospital, Melbourne, Australia.

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Address for reprints: Igor E. Konstantinov, MD, PhD, FRACS, Royal Children's Hospital, Cardiothoracic Surgery Unit, 50 Flemington Rd, Melbourne, Victoria 3052, Australia (E-mail: igor.konstantinov@rch.org.au).

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Does PD improve outcomes after heart surgery in infants? Of course, in an ideal world a large prospective randomized trial is a must to provide a definitive answer to this question. In the real world of pediatric heart surgery, however, the study of Kwiatkowski and colleagues¹ provides the best evidence currently available to us to suggest that the use of PD after heart surgery in infants is safe and efficacious. To my knowledge, Kwiatkowski and colleagues¹ are conducting a randomized controlled trial. With the luxury of time, such a study will provide an answer. Or will it?

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