

Waiting for Weight – 2.0 Is the New 2.5



Michael E. Mitchell, MD

I congratulate the authors on outstanding outcomes and a well-written study investigating results of the arterial switch procedure over a recent 10-year period, 2005–2015. The information presented is of particular value as our specialty transitions to complete repair at lower weights. It is now fairly common to hear discussions of complete repair of increasingly complex lesions in not just the low birth weight (<2.5 kg) but in the very low birth weight (<1.5 kg) range. This is particularly true of 2 ventricle repairs but also in palliation of single-ventricle patients including the Norwood operation. As successful reports at the extremes of weights surface, pressure is exerted on our general paradigm of waiting as long as possible on complete repair in low birth weight neonates.

What is the appropriate weight threshold? In this article, the authors convey their central message that “the arterial switch operation can be safely performed in neonates weighing ≤2.5 kg” and that “imposed delays for corrective surgery may not be necessary.” These points are illustrated by a number of strengths of the analyzed dataset. Not only is there no difference between mortality or composite outcome between patients weighing 2.0–2.5 kg and patients weighing above 2.5 kg, but the analysis demonstrated lower morbidity and mortality, the composite outcome, in the group between 2.0 and 2.5 kg (Fig. 1). Further, this result was not surgeon dependent. On this point, the numbers were small; however, this institution had 5 surgeons contributing to the cohort with an equal distribution within each surgeon’s experience of the different weight ranges. Taken together, it does appear reasonable that 2.0 kg can be considered a new safe cut point.

Is there an alternate interpretation of the same data? A skeptic might observe that there were only 8 patients in the study in the <2.0 kg group, and that despite the low numbers, the composite end point was significantly worse in this low weight group with an odds ratio of nearly 4. Clearly weight still matters. This cruel critic might comment that the study actually

Division of Pediatric Cardiothoracic Surgery, Department of Surgery, Medical College of Wisconsin, Herma Heart Institute, Children’s Hospital of Wisconsin, Milwaukee, Wisconsin

Disclosures: The author has no disclosures or potential conflict of interest.

Address reprint requests to Michael E. Mitchell, MD, Division of Cardiothoracic Surgery, Department of Surgery Medical College of Wisconsin, Children’s Hospital of Wisconsin, 9000 W Wisconsin Avenue, MS B 730, Milwaukee, WI 53226. E-mail: mmitchell@chw.org
DOI of original article: <http://dx.doi.org/10.1053/j.semtcvs.2018.03.007>.



Michael E. Mitchell, MD.

Central Message

2.0 kg is a reasonable target weight threshold for performing the arterial switch procedure but care must be taken to consider significant weight-related risks.

demonstrated that low weight was associated with worse outcomes, and that the authors claim that there was no difference between those 2.0–2.5 kg and those greater than 2.5 kg might not hold because they do not prove that the study was powered enough to determine “no difference” between these groups. The finding of any statistical difference was largely dependent upon the worse outcomes in the <2.0 kg group. In response, I would point out that it helps the authors’ case that the raw results in the 2.0–2.5 kg group were better than those above 2.5 kg.

How have things changed? Throughout the paper, the authors make mention of improved surgical techniques in PA reconstruction, lower volumes of cardioplegia, and perhaps refined techniques in coronary reimplantation. Our field has moved forward with some improved understanding along these lines, perhaps the trap door or medially based flap technique for coronary reimplantation or changes in materials and methods of PA reconstruction has led to fewer early complications and as such has improved our approach to smaller patients who are less tolerant of any residual lesions. But these technical changes are probably not enough for extremely low weight neonates.

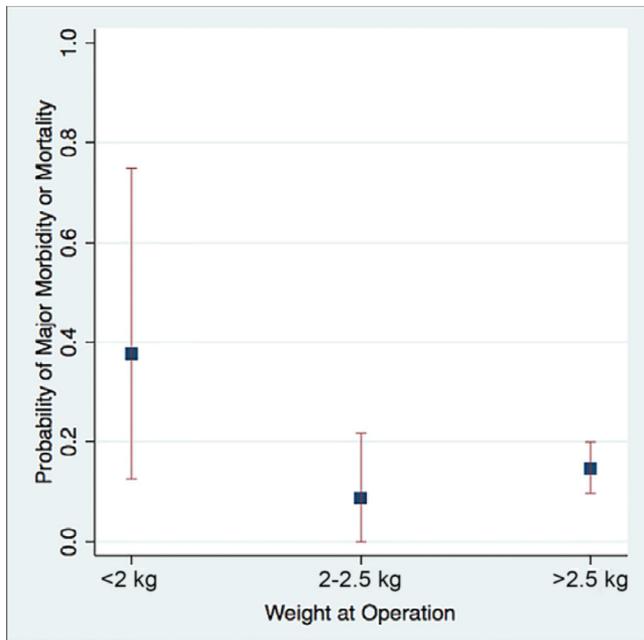


Figure 1. Major morbidity or mortality among infants undergoing the arterial switch operation by operative weight.

Continued improvement in neonatal and ICU management as well as noninvasive monitoring innovations and applications of goal-directed therapy has helped. However, to drive the field forward with consistent reduction in morbidity and mortality at even lower weights, the key innovations will probably reside in different areas. Lower blood-material interface with smaller perfusion circuits, methods to reduce and counter the inflammatory

effects of cardiopulmonary bypass, and optimized cannulas are several key areas of development. Also essential will be better ways to predict and protect against the fragility of the neonatal brain. Pulmonary issues with impaired alveolarization, dysmorphic vasculogenesis, and surfactant deficiency, cardiac issues of immaturity of the sarcoplasmic reticulum, neurologic complications stemming from immaturity of the germinal matrix as well as gastrointestinal and renal threats such as necrotizing enterocolitis, hepatic failure and impaired renal function are the key challenges to overcome when addressing patients in this lowest weight range.

There is perhaps nothing more frustrating and devastating to a family, a surgeon, the caregiving team, and even an entire congenital heart program, then undertaking a significant operation with an optimal anatomic result, only to suffer a physiologic complication that was out of everyone's control. I agree with the fundamental notion that the threshold for reproducibility following arterial switch at a major center should probably now be in the neighborhood of 2.0 kg. However, we must be vigilant to ensure that this target can be met consistently, and careful consideration of the myriad of very real weight-related risks must still be thoughtfully balanced against the risk of waiting for weight.^{1,2}

REFERENCES

1. Salna M, Chai PJ, Kalfa D, et al: Outcomes of the arterial switch operation in <2.5-kg neonates. *Semin Thorac Cardiovasc Surg* 19:488–493, 2019
2. Reddy VM: Low birth weight and very low birth weight neonates with congenital heart disease: Timing of surgery, reasons for delaying or not delaying surgery. *Semin Thorac Cardiovasc Surg Pediatr Card Surg Annu* 16:13–20, 2013