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Commentary: Del Nido cardioplegic solution: Is it really better than any other?

Frank W. Sellke, MD

The del Nido cardioplegic solution (DNS) has recently received a large amount of attention as a method to improve myocardial protection for both pediatric and adult patients undergoing cardiac surgery. Although some have proposed that the myocardial protection afforded by DNS is actually superior to other commonly used solutions, the real benefit of DNS is as a way to speed up an operation by limiting the times a surgeon needs to deliver the cardioplegia. DNS was originally developed for pediatric cardiac surgery as a single-dose formula.¹ Although DNS has been studied in pediatric patients, its effectiveness in adults is still under investigation. DNS contains a base solution of Plasma-Lyte A (Baxter Healthcare Corp, Deerfield, Ill), which has an electrolyte composition similar to extracellular fluid. In the original formulation, the concentrations of electrolytes before the addition of cardioplegic additives are 140 mEq/L sodium, 5 mEq/L potassium, 3 mEq/L magnesium, 98 mEq/L chloride, 27 mEq/L acetate, and 23 mEq/L gluconate, but this has been modified by many clinicians, including the authors of the study under consideration. The formulation of both original and modified versions serves as the crystalloid component, which is mixed with blood at a ratio of 4 parts crystalloid to 1 part fully oxygenated patient whole blood. Of note, it is a potassium-rich, lidocaine-containing solution with a

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CENTRAL MESSAGE

Del Nido cardioplegic solution may improve myocardial protection and increase the speed of an operation. However, caution must be taken to maintain optimal protection during long operations.

lower hematocrit level than conventional blood-based cardioplegia and the only glucose and calcium in the delivered solution is from the patient blood mixed with the crystalloid component. The magnesium is a useful component to limit calcium influx and sequestration into cells.

Lenoir and colleagues² examine the effectiveness of DNS compared with traditional blood cardioplegia on myocardial protection and clinical outcomes in patients undergoing prolonged aortic root surgery. Both solutions were initially delivered at 4°C but with different volumes. In the DNS group, after 60 minutes, an additional volume was administered if the myocardial ischemic time was anticipated to exceed 90 minutes. In the blood cardioplegia group, the solution was readministered every 15 to 20 minutes. Myocardial protection was assessed by gathering the highest postoperative creatine kinase-MB isotype levels and troponin T levels at 1, 12, 24, and 48 hours after surgery. Both groups did well, but there was a trend toward higher troponin T levels in the DNS group compared with standard blood cardioplegia

group patients ($P = .07$). In patients with myocardial ischemic time >180 minutes, median creatine kinase-MB isotype levels were higher in the DNS group compared with the blood cardioplegia group ($P = .01$). Clinical outcomes were similar in both groups. This suggests that for long operations, repeated delivery of a solution may be required to optimize myocardial protection. This is actually common sense and comes down to simple chemistry and physics. For a 3-hour operation, much of the potassium and lidocaine that arrests the heart will have long washed out, and operating room lights shining on the heart will heat it similar to chicken in the all-you-can-eat buffet at a local restaurant. With similar clinical outcomes, it remains uncertain if 1 solution or method of delivery is better than the other. An interesting aspect of the study is that the purported beneficial components of DNS are also present in the blood cardioplegia solution, namely magnesium sulfate (2 vs 2.5 g), mannitol (3.26 vs 10 g) lidocaine (130 vs 40 mg), and bicarbonate (13 vs 1 mEq) in the DNS versus the blood cardioplegia solutions, respectively. Thus, the investigators are comparing 2 DNS-like solutions with differing concentrations of the same components. Also, 4 different surgeons

were involved in the operations, and the delivery volumes were very different in the 2 groups, making direct comparisons problematic. However, this is an interesting and timely study, suggesting that DNS is safe and effective for short- and medium-length adult cardiac operations, but in the setting of a prolonged operation, surgeons should consider giving more than 1 or 2 shots of the solution. Unfortunately, with the many differences between groups, one is still left wondering which method of myocardial protection is better, or if they are in fact very similar in efficacy. After all, despite decades of investigation into different ways to protect the heart during surgery, there is still no single solution confirmed to be superior to any other. The only way to really solve this issue is to have a double-blind randomized controlled trial comparing DNS with another cardioplegic solution.

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Commentary: Cardioplegia in complex root surgery for adults: Many solutions, but does it really matter?

Mustafa Zakkar, PhD, FRCS,^a and
Vito Domenico Bruno, MD, PhD^b

The importance of cardioplegia during cardiac surgery should be never undervalued: Significant improvements in cardiac surgery and complex operations have been

Vito Domenico Bruno, MD, PhD (left), and Mustafa Zakkar, PhD, FRCS (right)

CENTRAL MESSAGE

The potential benefits of different types of cardioplegia in aortic root surgery are still debated. Del Nido cardioplegia solution may be a valid solution, although larger studies are needed.

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