

Long-acting cardioplegia solution results in better outcomes for pediatric heart surgery patients

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The myocardium (muscular tissue) of the pediatric heart exhibits structural and functional differences as compared to adult myocardium. As a result, different myocardial protection techniques have been developed for clinical use in neonates, infants, and children undergoing cardiac surgery. In a presentation at the 96th AATS Annual Meeting, a team of cardiac surgeons presents the results of a prospective randomized clinical trial of pediatric surgery patients, comparing a new type of long-acting cardioplegia (heart stopping) solution to the standard short-acting agent that requires repeated dosing during surgery. On many of the key parameters measured, such as length of time needed for surgery and interruption of blood flow, the results favored the long-acting del Nido cardioplegic solution.

Baltimore, MD, May 16, 2016 - During heart surgery, it is sometimes necessary to temporarily stop cardiac activity, a process known as cardioplegia. Specific myocardial protection techniques are necessary for pediatric use. At the 96th AATS Annual Meeting, cardiac surgeons present the results of a prospective, randomized trial of pediatric heart surgery patients that shows that the del Nido cardioplegia solution, a new, long-acting agent, offers significant advantages over conventional cardioplegia, including reduced cardiopulmonary bypass and aortic cross-clamp times and faster onset of action.

"Overall, del Nido cardioplegic solution is a simple and safe

cardioprotective strategy. Cardiac performance is satisfactory in the postoperative period with a better cardiac index profile, lesser troponin-I release, and decreased morbidity," explained Sachin Talwar, MCh, of the Department of Cardiothoracic and Vascular Surgery at the All India Institute of Medical Sciences (New Delhi, India).

The del Nido solution was first proposed by researchers at the University of Pittsburgh in 1990. It offers several advantages, including prolonged action with single dose administration, which helps to avoid the harmful effects of dose repetition. It also contains lidocaine to slow down energy consumption and calcium-competing ions like magnesium to prevent damaging intracellular build-up of calcium. In practice, it can be given as a single dose through the aortic root. In comparison, the conventional method of cardioplegia tested was St. Thomas cold blood cardioplegia. This requires an initial dose of solution, followed by repeated dosing at 25-30 minute intervals during surgery.

In the first study of its kind, the investigators randomized 100 pediatric patients younger than 12 years old to del Nido and cold blood cardioplegia (STH) groups. The patients underwent elective repair of ventricular septal defects and tetralogy of Fallot between August 2014 and July 2015.

Intraoperative parameters and postoperative events were recorded. Cardiac index was calculated at four different time points, while troponin-I, interleukin-6, and tissue necrosis factor-alpha were estimated. The right ventricle was biopsied in order to examine the ultra-structural changes using electron microscopy.

The del Nido group had significantly shorter mean cardiopulmonary bypass time (67 min vs. 78 min) and mean aortic cross-clamp time (40 min vs. 48 min) than the STH group, respectively. "This is very important because long aortic cross-clamp time is an independent risk

factor for increased duration of mechanical ventilation, high incidence of low cardiac output syndrome, renal complications, and immediate post-operative mortality," commented Dr. Talwar.

The total amount of cardioplegia given was significantly higher in STH group (673 mL), compared with the del Nido group (372 mL), according to Dr. Talwar. Overall, the postoperative course was better in the del Nido group with shorter mechanical ventilatory time and ICU stay, faster recovery of cardiac index, and less need for inotropic support.

The researchers biopsied the heart muscle to see if there were microscopic effects of the different cardioplegia agents. Ultrastructural study of myocardium showed no statistically significant difference in data obtained for nuclear changes, mitochondrial changes, sarcoplasmic reticulum, and glycogen depletion. Myofibrillar disarray was significantly more evident in the STH group, while cellular edema was significantly greater in the del Nido group.

More information: "Comparison of del Nido and St. Thomas Cardioplegia Solutions for Myocardial Protection in Pediatric Patients Undergoing Open Heart Surgery: A Prospective Randomized Clinical Trial," by Sachin Talwar, Amolkumar Bhoje, Vishnubhatla Sreenivas, Shiv Kumar Choudhary, Balram Airan. Presentation at the 96th AATS Annual Meeting, May 14-18, 2016, Baltimore, MD, during the Plenary Scientific Session on May 16, 2016. aats.org/annualmeeting

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