

High-Dose Methylprednisolone Has No Benefit Over lower Dose for the Correction of Tetralogy Of Fallot

Tetralogy of Fallot (TOF) is a ventricular septal defect associated with right ventricular (RV) outflow obstruction (infundibular and/or valvular pulmonic stenosis), concentric RV hypertrophy, and overriding aorta. ⁽¹⁾ Symptoms include cyanosis, dyspnea with feeding, poor growth, and hypercyanotic "tet" spells (sudden, potentially lethal episodes of severe cyanosis). TOF must be repaired with open-heart surgery either soon after birth or later in infancy. The goal of surgery (Complete Intracardiac Repair) is to repair the four defects of TOF so the heart can work as normally as possible. Inflammatory reaction can produce several complications after cardiac surgery. Many attempts have been made to reduce these complications; perioperative corticosteroid therapy is one of the simplest methods in pediatric open-heart surgery to reduce systemic inflammatory response and to mediate possible cardioprotective effects. ⁽²⁾

The use of steroids has been associated with improved hemodynamics and shortened duration of postoperative mechanical ventilation and intensive care stay. Conversely, steroids have been noted to increase morbidity, especially in lower-risk pediatric cardiac patients, and previous studies showed a possible association of steroids with increased number of infections, hyperglycemia, and possible perioperative renal dysfunction. ⁽³⁾

In a clinical research study published in 2016, they evaluated the optimal dose of methylprednisolone (MP) during pediatric open heart surgical procedures and compared the anti-inflammatory and cardioprotective effects of high and lower doses of methylprednisolone in children undergoing cardiac operations.

In this randomized, double-blind study, thirty children (n=30), between 1 and 18 months old and undergoing total correction of tetralogy of Fallot. They exclude the following: prematurity, defined as gestational age of less than 36 weeks; previous cardiac surgical procedures and preoperative steroid treatment. After anesthesia induction, placement of the arterial line, and collection of the first study plasma sample, were randomized in double-blind fashion to receive either 5mg/kg (n=14) or 30 mg/kg (n=15) of intravenous methylprednisolone. Plasma concentrations of methylprednisolone, interleukin-6 (IL-6), IL-8, and IL-10, troponin T, and glucose were measured at anesthesia induction before administration of the study drug, at 30 minutes on cardiopulmonary bypass (CPB), just after weaning from CPB, and at 6 hours after CPB. Troponin T and blood glucose were also measured on the first postoperative morning. ⁽³⁾

The results of this study were significantly higher mean MP concentrations ($p < 0.001$) measured at different time points ; 30 minutes after initiation of cardiopulmonary bypass, 5 minutes after protamine administration, 6 hours after cessation of cardiopulmonary in patients who received intravenous MP 30 mg/kg compared with the dose of 5 mg/kg. No significant differences were observed between the study groups in concentrations of inflammatory interleukins IL-6 ($p=0.59$ to 0.95) and IL-8 ($p=0.45$ to 0.91) or in the levels of anti inflammatory IL-10 ($p=0.37$ to 0.68) at any of the time points. Moreover, the troponin T levels of both study groups were similar at all the measured time points ($p=0.38$ to 0.98). Administration of 30 mg/kg of MP resulted in higher blood glucose concentrations at 6 hours after CPB ($p=0.04$) and on the first postoperative morning ($p=0.02$). Four patients in the MP 30 mg/kg group received insulin versus none in the MP 5 mg/kg group ($p=0.04$). Seven patients in the MP 30 mg/kg group received amiodarone infusion because of postoperative junctional ectopic tachycardia or atrial tachycardia versus 2 patients in the MP 5 mg/kg group ($p=0.06$).⁽³⁾

In conclusion, despite producing significantly higher plasma MP concentrations, the administration of 30 mg/ kg of MP at anesthesia induction was not superior in terms of anti-inflammatory or cardioprotective action compared with 5 mg/kg of MP. Conversely, the high-dose administration exposed patients to postoperative hyperglycemia. The results from the present study discourage the use of 30 mg/kg of MP during pediatric open heart surgical procedures.

References:

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