Effect of Perioperative Goal-Directed Hemodynamic Resuscitation Therapy on Outcomes Following Cardiac Surgery: A Randomized Clinical Trial and Systematic Review

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OBJECTIVES: To evaluate the effects of goal-directed therapy on outcomes in high-risk patients undergoing cardiac surgery.

DESIGN: A prospective randomized controlled trial and an updated metaanalysis of randomized trials published from inception up to May 1, 2015.

SETTING: Surgical ICU within a tertiary referral university-affiliated teaching hospital.

PATIENTS: One hundred twenty-six high-risk patients undergoing coronary artery bypass surgery or valve repair.

INTERVENTIONS: Patients were randomized to a cardiac output-guided hemodynamic therapy algorithm (goal-directed therapy group, n = 62) or to usual care (n = 64). In the goal-directed therapy arm, a cardiac index of greater than 3 L/min/m was targeted with IV fluids, inotropes, and RBC transfusion starting from cardiopulmonary bypass and ending 8 hours after arrival to the ICU.

MEASUREMENTS AND MAIN RESULTS: The primary outcome was a composite endpoint of 30-day mortality and major postoperative complications. Patients from the goal-directed therapy group received a greater median (interquartile range) volume of IV fluids than the usual care group (1,000 [625-1,500] vs 500 [500-1,000] mL; $p < 0.001$], with no differences in the administration of either inotropes or RBC transfusions. The primary outcome was reduced in the goal-directed therapy group (27.4% vs 45.3%; $p = 0.037$). The goal-directed therapy group had a lower occurrence rate of infection (12.9% vs 29.7%; $p = 0.002$) and low cardiac output syndrome (6.5% vs 26.6%; $p = 0.002$). We also observed lower ICU cumulative dosage of dobutamine (12 vs 19 mg/kg; $p = 0.003$) and a shorter ICU (3 [3-4] vs 5 [4-7] d; $p < 0.001$) and hospital length of stay (9 [8-16] vs 12 [9-22] d; $p = 0.049$) in the goal-directed therapy compared with the usual care group. There were no differences in 30-day mortality rates (4.8% vs 9.4%, respectively; $p = 0.492$). The metaanalysis identified six trials and

showed that, when compared with standard treatment, goal-directed therapy reduced the overall rate of complications (goal-directed therapy, 47/410 [11%] vs usual care, 92/415 [22%]; odds ratio, 0.40 [95% CI, 0.26-0.63]; $p < 0.0001$) and decreased the hospital length of stay (mean difference, -5.44 d; 95% CI, -9.28 to -1.60; $p = 0.006$) with no difference in postoperative mortality: 9 of 410 (2.2%) versus 15 of 415 (3.6%), odds ratio, 0.61 (95% CI, 0.26-1.47), and $p = 0.27$.

CONCLUSIONS: Goal-directed therapy using fluids, inotropes, and blood transfusion reduced 30-day major complications in high-risk patients undergoing cardiac surgery.