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Does the Type of Cardioplegic Technique Influence Hemodilution and Transfusion Requirements in Adult Patients Undergoing Cardiac Surgery?

RESEARCH ABSTRACT

Authors
Alfred H. Stammers, MSA, CCP; Eric A. Tesdahl, PhD; Linda B. Mongero, BS, CCP; Andrew J. Stasko, MS, CCP; Samuel Weinstein, MBA, MD

Background
During cardiac surgery myocardial protection is performed using diverse cardioplegic (CP) solutions with and without the presence of blood. New CP formulations extend ischemic intervals, but utilize high-volume, crystalloid base solutions. The present study evaluated four commonly utilized CP solutions and their effect on hemodilution during cardiopulmonary bypass (CPB).

Methods
Records from 16,670 adult patients undergoing cardiac surgery with CPB between February 2016 and January 2017 were reviewed. Patients were classified into one of four groups according to CP type: 4 to 1 blood to crystalloid (4:1), microplegia (MP), del Nido (DN), and histidine-tryptophan-ketoglutarate (HTK). Covariate-adjusted estimates of group differences were calculated using multivariable logistic and linear mixed effects regression models. The primary endpoint was intraoperative transfusion of allogeneic red blood cells (RBC), with a secondary endpoint of intraoperative hematocrit change.

Results
Among all patients, 8,350 (50.1%) received 4:1, 4,606 (27.6%) MP, 3,344 (20.1%) DN, and 370 (2.2%) HTK. Both 4:1 and MP were more likely to be utilized in patients undergoing coronary revascularization surgery, while DN and HTK were seen more often in patients undergoing valve surgery ($p<0.001$). The highest volume of crystalloid CP solution was seen in the HTK group, 2,000, [1,754, 2,200] while MP had the lowest 50 [32, 67], $p<0.001$. Ultrafiltration usage was as follows: HTK - 84.9%. DN - 83.7%, MP - 40.1%, and 4:1 - 34.0%,

p<0.001. There were no statistically significant differences on the primary outcome, risk of intraoperative RBC transfusion. However, there were statistically significant differences amongst all but one of the pair-wise comparisons of CP methods on hematocrit drift (p<0.05 or smaller), with MP having the lowest predicted drift (-7.8%) and HTK having the highest (-9.4%).

Conclusions

During cardiac surgery, the administration of different CP formulations results in varying intraoperative hematocrit drift related to the volume of crystalloid solution.