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EXTREME HEMODILUTION IS ASSOCIATED WITH INCREASED COGNITIVE DYSFUNCTION IN THE ELDERLY AFTER CARDIAC SURGERY

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Introduction: Hemodilution during cardiopulmonary bypass (CPB) to a hematocrit (HCT) < 19% has been associated with a doubling of the in-hospital mortality rate when compared to a HCT > 25%. In animals subjected to middle cerebral artery occlusion, resultant infarct size increases as the hemoglobin is lowered. We therefore hypothesized that severe hemodilution during CPB adversely affects neurocognitive outcome after cardiac surgery.

Methods: Following IRB approval, 107 patients undergoing CABG surgery were enrolled. Patients were excluded if they had a history of symptomatic cerebrovascular disease, uncontrolled hypertension, alcoholism, psychiatric illness, renal failure, active liver disease, or less than a 7th grade education. Patients were prospectively randomized to: 1) Minimal hemodilution (HCT > 27%) or 2) Profound hemodilution (HCT 15-17%). Target HCT's were achieved by transfusing packed red blood cells (PRBC) or harvesting whole blood at initiation of CPB. Experienced psychometricians blinded to the patient's treatment group evaluated the patients with a well-validated battery of 6 cognitive tests preoperatively and again at 6 weeks after surgery. Cognitive deficit was defined by factor analysis as a decline of one standard deviation or more in at least 1 of 4 cognitive domains (dichotomous outcome). A change score (continuous outcome) was also calculated by subtracting the baseline from the follow-up sum of the 4 domain scores. The effect of hemodilution on postoperative cognition was tested using multivariate modeling accounting for age, years of education, and baseline cognition. In post hoc analysis, a third matched "control" group who underwent moderate hemodilution (HCT 18-25%) was added.

Results: Patients in the mild (N=56), profound (N=51), and control (N=59) groups were similar with regards to age, years of education, and Parsonnet scores (P=NS). In multivariate analysis, profound hemodilution was associated with greater cognitive dysfunction (p=0.02). An interaction between profound hemodilution and age was also detected wherein older patients with profound hemodilution experienced a greater decline in cognitive performance (p=0.03, Figure 1). No cognitive differences were detected between the control and minimal hemodilution groups. The serious adverse event rate in both the minimal (18%) and profound (19%) hemodilution groups were substantially greater than in the control group (2%, p=0.004). Higher rates of cryoprecipitate, fresh frozen plasma, and PRBC transfusion were seen in the profound hemodilution group compared to the control group while the minimal hemodilution group experienced a greater number of PRBC transfusions (p<0.05).

Conclusions: Profound hemodilution is associated with greater cognitive decline after CABG surgery, particularly in the elderly. The higher serious adverse event rate in the minimal hemodilution group suggests that PRBC transfusion to higher HCT levels during CPB may not be prudent.

