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INVITED COMMENTARY

Hemodilution during cardiopulmonary bypass is a known risk factor for adverse postoperative outcome and is further complicated by the effects of erythrocyte transfusion on organ systems, especially the kidneys. In addition, being female seems to confer a higher risk of adverse outcomes after cardiac surgery. The greater risk of hemodilution among females, and the higher risk of acute kidney injury (AKI) with increasing hemodilution, raises the question whether the relationship between hemodilution and AKI differs among genders. In this issue of *The Annals of Thoracic Surgery*, Mehta and colleagues [1] examine this question in a retrospective study of more than 13,000 cardiac surgery patients. They have confirmed that hemodilution on cardiopulmonary bypass is associated with the risk of AKI in both genders, although females have a lower rate of AKI for any hematocrit less than 26%. These findings are notable, given that females had lower baseline creatinine values and lower glomerular filtration rates, but a higher peak percentage postoperative creatinine change. A sensitivity analysis found that in nontransfused patients, greater hemodilution was associated with AKI in both genders, but higher operative mortality only in men. Interestingly, transfused patients did not see the equivalent risk of AKI or mortality.

This study has two notable findings: better tolerance of hemodilution among women undergoing cardiac surgery, and the higher risk of adverse outcomes in nontransfused patients. The study suggests that either maintenance of higher hematocrit by avoidance of excessive hemodilution, blood loss prevention, or earlier transfusion, especially among men, may be beneficial. Although the association of hemodilution and AKI is known, the study by Mehta and colleagues [1] describes gender differences in this relationship. Gender disparity in outcomes after cardiac surgery has been investigated previously, and results have been mixed. Some studies have found higher mortality rates among women undergoing cardiac surgery, but additional analyses indicated equivalent risk in higher-risk subcategories [2]. Although women seem to have worse risk profiles, their improved tolerance of dilutional anemia compared with men in this study is intriguing. This

is especially true given the prevalence of higher red cell distribution width—a known marker of cardiovascular risk—among women [3]. Perhaps the biologic adaptation to a lower red cell volume equips women to tolerate the acute exposure to hemodilution better than men. The authors then pose a justifiable question: Should current transfusion threshold guidelines be revised given the difference in risk of adverse effects associated with hemodilution between genders? The answer might be found in future studies designed to examine gender differences and outcome risk in further detail. Meanwhile, risk reduction by avoidance of both excessive hemodilution and postoperative transfusion by targeted preoperative transfusion in patients with anemia is a strategy that is being explored with interesting results [4].

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