CRITICAL CARE

COMMENTARY

Blood transfusion and the lung: first do no harm?

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See related research by Tuinman *et al.*, http://ccforum.com/content/15/1/R59

Abstract

Marked variability in transfusion practice exists in cardiac surgical patients, with consumption of approximately 20% of the worldwide allogeneic blood supply. Observational studies have reported an association between red blood cell transfusion and adverse outcome, including pulmonary complications, in cardiac surgery. Tuinman and colleagues report that transfusions were associated with activation of pulmonary inflammation and coagulation by measurement of biomarkers in bronchoalveolar lavage fluid, and suggest that transfusion may be a mediator of acute lung injury. This study provides interesting preliminary data, but is limited by multiple confounding variables (plasma transfusion, use of anticoagulants and heparin antagonists) and the small sample size. A large multicenter, prospective, randomized clinical trial regarding the safety (inclusive of pulmonary complications) and efficacy of red blood cell transfusion in cardiac surgery is needed.

Tuinman and colleagues report the results of a single-institution study in cardiac surgery patients (n = 45), documenting that bronchoalveolar lavage fluid cytokine and coagulation markers were significantly increased in a dose-dependent manner with transfusions [1]. They conclude that transfusion was associated with activation of pulmonary inflammation/coagulation and systemic coagulation derangement.

The data are interesting and provocative, and provide a biologic basis for observational studies that reported an association between red blood cell (RBC) transfusions and increased pulmonary complications, including acute lung injury and acute respiratory distress syndrome [2,3]. Translational research studies like this are needed to move this field forward.

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Although increased inflammatory/coagulation markers were identified in the multiple transfusion cohort, no clinically relevant difference in pulmonary function (including the PaO_2/FiO_2 ratio) was identified [1]. Duration of mechanical ventilation was longer in the multiple transfusion cohort, but all were of less than 1 day duration.

A major study limitation is that the three cohorts were not defined on the basis of RBC transfusions alone, as the multiple transfusion cohort received plasma/platelets in addition to RBC transfusions. This factor significantly confounds the issue, as plasma administration is associated with significantly increased risk for pulmonary complications [4-7]. In a systematic review/meta-analysis of 37 studies, plasma transfusion was associated with significantly increased acute lung injury risk (odds ratio, 2.92; 95% confidence interval, 1.99 to 4.29) [8].

Most importantly, the effects of anticoagulants, heparin antagonists (for example, protamine) or blood-saving strategies (for example, cell-saver technique) and the degree of intraoperative blood loss and hypoperfusion/shock were not considered. Additional study limitations include the small sample size, and increased EuroSCORE in the multiple transfusion cohort, and an inability to assess age of blood as a variable.

The fundamental question of whether RBC transfusion is safe/effective in cardiac surgery is important, and this current study highlights significant concerns particularly with regard to pulmonary complications. Significant variability in transfusion use in cardiac surgery persists, ranging from 7.8 to 92.8% for RBC transfusion [9]. The Transfusion Requirements in Critical Care trial excluded cardiac surgical patients and patients who received transfusions before admission to the ICU [10]. The recent Transfusion Requirements After Cardiac Surgery trial – a single-center prospective, randomized clinical trial with patients (n = 502) randomized to a liberal strategy (maintain hematocrit ≥30%) or to a restrictive strategy (maintain hematocrit ≥24%) – reported that for each transfused RBC unit, the risk of respiratory complications increased (odds ratio, 1.27; 95% confidence interval, 1.12 to 1.45; P <0.001) with no difference in 30-day all-cause mortality [11].

To resolve this issue regarding transfusion, a large multicenter, prospective, randomized clinical trial

regarding the safety (including pulmonary complications) and efficacy of RBC transfusion in cardiac surgery is needed. The National Heart, Lung, and Blood Institute established a State-of-the-Science Symposium on Transfusion Medicine to identify important clinical trial research issues in this field, and a trial in cardiac surgery was strongly recommended [12].

Abbreviations

FiO_2, fraction of inspired oxygen; ICU, intensive care unit; PaO_2, partial pressure of arterial oxygen; RBC, red blood cell.

Competing interests

The author declares that she has no competing interests.

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