

Abstract Presented at the 38th Annual Seminar of
The American Academy of Cardiovascular Perfusion

January 19-22, 2017 | San Diego, CA

The Effect of Ultrafiltration on End-Cardiopulmonary Bypass Hematocrit during Cardiac Surgery

RESEARCH ABSTRACT

Authors

Linda Mongero, Alfred Stammers, Eric Tesdahl, Andrew Stasko, and Samuel Weinstein

Purpose

Ultrafiltration (UF) during cardiopulmonary bypass (CPB) is a well-accepted method for hemoconcentration to reduce excess fluid and increase hematocrit, platelet count, and plasma constituents. The efficacy of this technique may confer specific benefit to certain patients presenting with acquired cardiac defects. The purpose of this study was to evaluate the effect of UF on end-CPB hematocrit by cardiac surgical procedure type.

Methods

We reviewed 77,012 consecutive cardiac procedures from a national registry conducted between April 2012 and October 2016 at 169 institutions. Cases included in this analysis were those completed without intraoperative red blood cell transfusion, and where zero-balance UF was not used. The primary end point was last hematocrit reading taken before the end of CPB. In order to isolate the effect of UF volume removed, we controlled for a number of confounding factors, including first hematocrit on CPB, total asanguineous volume, estimated circulating blood volume, CPB urine output, total volume of crystalloid cardioplegia, total volume of other asanguineous fluids administered by both perfusion and anesthesia, type of cardiac procedure, acuity, gender, age, and total time on CPB. Descriptive statistics were calculated among three subgroups according to UF volume removed: no volume removed, between 1mL and 1500 mL removed, and 1500 mL or more removed. The effect of UF volume on the last hematocrit on CPB was modeled using ordinary least squares and restricted cubic splines in order to assess possible non-linearity in the effect of UF volume while controlling for the above-named confounding factors.

Results

We found a statistically significant non-linear pattern in the relation between UF volume removed and last hematocrit on bypass ($F = 176.7$, $df=32$, $p<0.0001$). For most

procedure types, UF was most effective at increasing last hematocrit on CPB from 1 mL to 2500 mL, with continued improvements in hematocrit coming more slowly as UF volume was increased above 2500 mL. While we did note statistically significant interactions between UF and procedure type ($F = 80.2$, $df=24$, $p<0.0001$) as well as UF and starting hematocrit on CPB ($F = 241.2$, $df=4$, $p<0.0001$), by far the most powerful explanatory variable in this analysis was the starting hematocrit on bypass ($F = 116,274.8$, $df=5$, $p<0.0001$).

Conclusions

The use of ultrafiltration during cardiopulmonary bypass resulted in significant increases in end-hematocrit, with the greatest benefit shown when volumes were under 2,500 mL.

###