



Red Cell Mass Is Not Well Conserved Following Elective Cardiac Surgery Despite Use Of Cell Salvage And Transfusion Guided By Peripheral Hematocrit

Mark Nelson, MD, MEd, Bruce Spiess, MD, John Kearney, MD, Pingle Reddy, MD, Jeff Green, MD, Derek Brinster, MD, Patricia Nicolato, DO, Vigneshwar Kasirajan, MD. Department of Anesthesiology and Cardiac Surgery, Virginia Commonwealth University School of Medicine, Richmond, VA, USA

Purpose

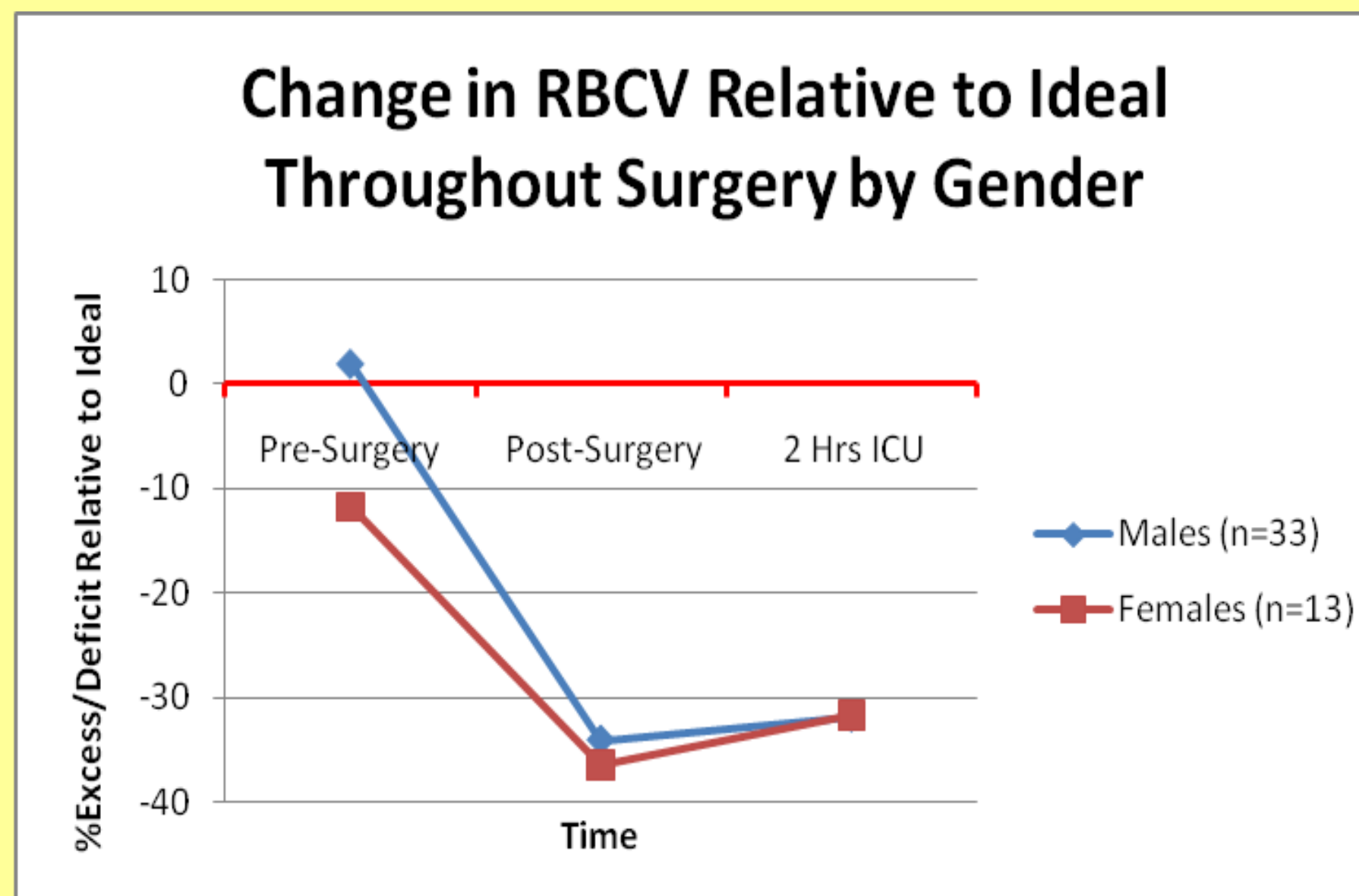
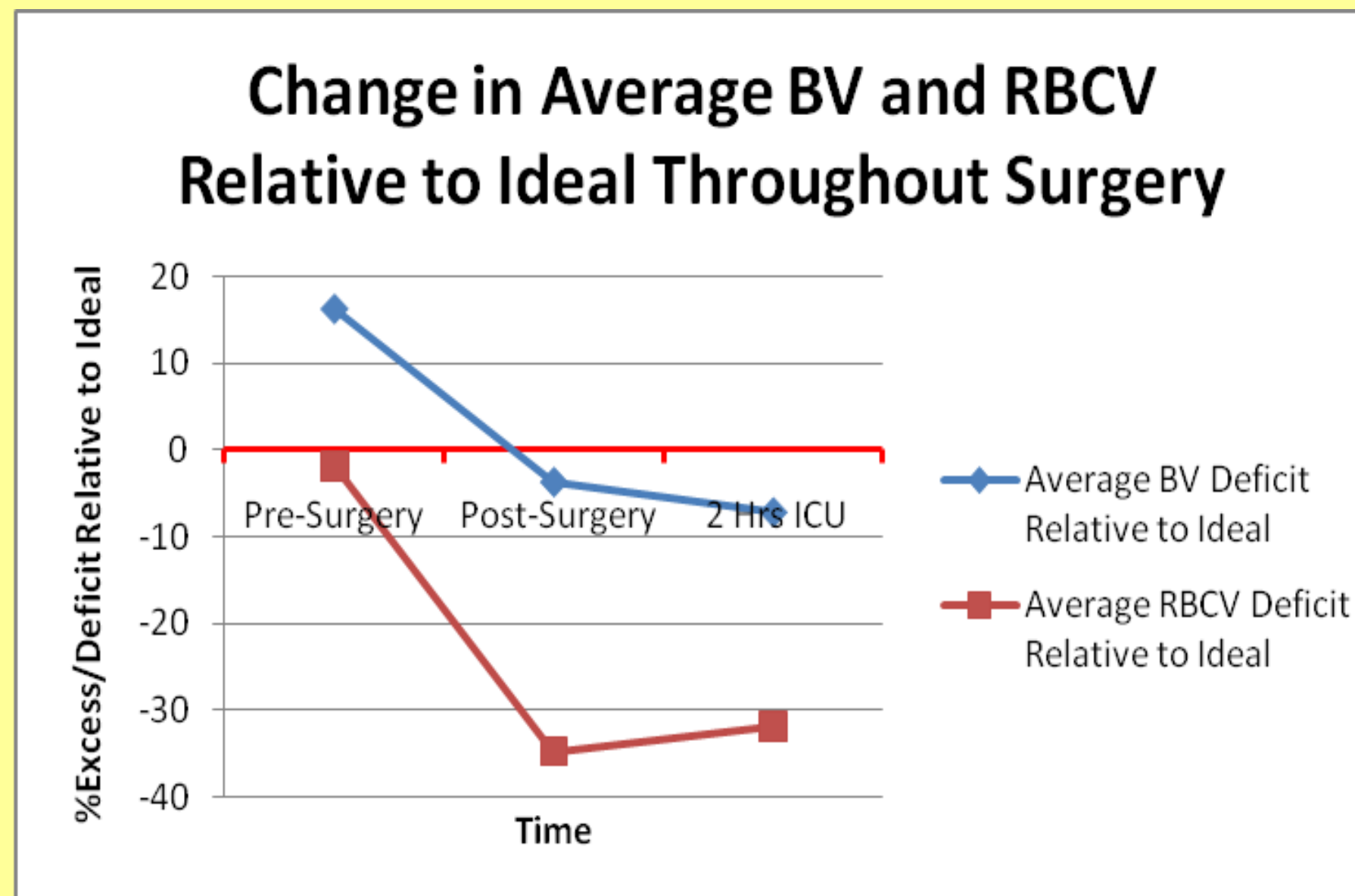
Peripheral blood hematocrit (pHct) is commonly used as a measure of red cell volume and to guide transfusion decisions during cardiac surgery. The decrease in pHct accompanying surgery could be due to excessive administration of non-RBC volume expanders or surgical blood loss. We hypothesized that red blood cell volume (RBCV) would be well conserved during surgery – despite marked decreases in pHct – due to cell salvage and transfusion practices. We examined the extent of RBCV loss during surgery and assessed the correlation of pHct with actual RBCV.

Methods

A series of three direct blood volume measurements were performed on 46 patients: (1) before surgery; (2) immediately after surgery; and (3) 2 hours after transfer to the ICU. Total Blood Volume (TBV), Red Blood Cell Volume (RBVC) and Plasma Volume (PV) were measured using the indicator dilution technique via a commercially available, FDA approved semi-automated system (BVA-100 Blood Volume Analyzer, Daxor Corporation).

Results

Despite the use of surgical blood salvage and pRBC transfusions, patients had an average net loss of 648 ± 444 mLs ($p < 0.0001$) of RBCV following cardiac surgery. Since RBCV has a Hct of 100%, this correlates to a surgical blood loss of 1944 ml. Male patients showed an average net loss of 774 ± 432 mLs ($p < 0.0001$) while females showed an average net loss of 328 ± 297 mLs ($p = 0.0035$) RBCV. These figures correlate to a surgical blood loss of 2322ml and 984ml respectively. Regression analysis showed only a mild correlation of pHct with RBCV post-surgery ($R^2 = 0.49$). Normalization of the Hct (which adjusts for abnormally low or high blood volume due to plasma volume derangements) strengthened this correlation ($R^2 = 0.96$).



Conclusions

Direct blood volume measurement can be used to identify deficits/excesses in RBCV that are not evident from the pHct. Our findings showed a strikingly higher loss of RBCV than was hypothesized, particularly in male patients (2253ml). In patients with blood volume abnormalities – which most of these surgical patients exhibited – the pHct does not provide an accurate estimate of RBCV.