Title: EVALUATION OF HAEMONETICS CELL-SAVER PRODUCTS OBTAINED DURING CARDIOPULMONARY BYPASS

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Introduction: The Haemonetics Cell-Saver III is used to salvage blood during cardiothoracic surgical procedures. Previous studies have characterized the reinfused washed red blood cell product; however, little information exists on the cellular and noncellular properties of the discarded supernatant produced during the processing cycle.[1,2] This study was designed to evaluate protein properties, electrolyte composition and red blood cell (RBC) properties of the reinfused and discarded products generated by the Cell-Saver from blood obtained from the cardio-pulmonary bypass (CPB) circuit.

Methods: After institutional review, ten patients scheduled for aortocoronary bypass grafting were studied. Patients with pre-existing hematologic or endocrine disease were excluded. The CPB circuit consisted of a Cobe Optiflo II bubble oxygenator, a Bentley BCR 3500, a Pall arterial filter, Cobe Plastron tubing and a Cinco heart-lung machine. The circuit was primed with 1100cc of Plasmalyte, 500cc of hetastarch, 22.5 gms of 15% mannitol and 8,000 units of heparin. Each patient received an additional 22.5 gms of mannitol, and Plasmalyte was added to maintain circuit volume. No patient received blood or blood products prior to or during CPB. After termination of CPB, the blood contained in the isolated CPB circuit, including oxygenator and tubing, was processed by the Cell-Saver. The Cell-Saver products consisted of washed RBCs and discarded supernatant. Samples for analysis were obtained from the bypass circuit after completion of CPB (S1) and from the reinfused washed RBC's (S3). Representative samples of the first, middle and last third of the discarded supernatant (S2A, S2B and S2C respectively) were collected. Specimens were analyzed for the following: hemoglobin (Hb gm/dl), free hemoglobin (FHb mg/dl), potassium (K^+ meq/l), total protein (TP gm/dl), oncotic pressure (OP mmHg), PT (sec) and PTT (sec). The data are presented as means ± standard deviations. Student's t-test was used to compare S1 with S2C and S3. A P value of < 0.05 was considered significant.

Results (Table): Cell-Saver processing produced a supernatant (S2A, S2B, S2C) with TP and OP values not different from S1 ($P>0.05$). Conversely, the reinfused washed RBCs (S3) contained TP and OP levels lower than S1 ($P<0.05$). S3 Hb was significantly greater than S1 ($P<0.05$) as expected; however, FHb was not different among groups. K^+ decreased in S3 compared to S1 ($P<0.05$) but was not different between S1 and the supernatant ($P>0.05$). PT and PTT values in S3 were significantly greater ($P<0.05$) than S1.

	Sample 1	Sample 2A	Sample 2B	Sample 2C	Sample 3
Hg	9.5±1.2	0.3±0.1	0.3±0.1	0.3±0.1*	17.6±2.5*
FHb	126.0±95.8	130.0±100.1	137.1±99.8	119.6±67.1	100.0±49.6
OP	12.0±2.4	12.6±2.5	12.6±2.6	12.7±3.2	2.6±1.5*
TP	3.6±0.5	3.6±0.2	3.6±0.4	3.3±0.7	1.2±0.4*
K^+	5.4±1.0	5.0±0.4	5.0±0.4	4.7±0.9	2.3±0.9*
PT	19.6±2.2	20.3±2.8	20.9±2.5	24.4±9.4	44.0±5.6*
PTT	40.6±8.3	40.9±7.9	43.0±7.9	53.3±25.5	106.7±9.4*

* $P < 0.05$ vs. S1

Discussion: Reinfusion of Cell-Saver produced washed RBCs provides the benefit of a high hemoglobin autologous tranfusion. However, this study showed the supernatant contained almost all of the protein salvaged from CPB blood. Although the identification and quality of these proteins is unknown, they could include components from the immune and coagulation systems. In addition, the supernatant had K^+, FHb and OP values which were not significantly different from the unprocessed CPB blood. We conclude that, other than Hb, the supernatant and unprocessed CPB blood are similar and that potentially important proteins are discarded with the supernatant. Furthermore, since the S3's PT and PTT were greatly elevated, multiple infusions of S3 could potentially impair coagulation.

References:

1. Cordell AR, Lavender SW: An appraisal of blood salvage techniques in vascular and cardiac operations. Annals of Thoracic Surg 31:421-25, 1981.
2. Ottesen S, Froysaker T: Use of Haemonetics Cell Saver for autotransfusion in cardiovascular surgery. Scand J Thor Cardiovasc Surg 16:263-68, 1982.