TITLE: Thromboelastographic Evaluation of the Effect of Cell Saver Blood on Coagulation in the Post Cardiopulmonary Bypass Patient

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INTRODUCTION: Recent studies have shown that despite systemic anticoagulation during cardiopulmonary bypass (CPB), many patients have evidence of activation of thrombolytic pathways post CPB[1,2]. Blood obtained from a cell saver (CS) device post-CPB may therefore be contaminated with thrombolytic factors, as well as residual heparin and buffy coat contaminants. After noting increased bleeding following administration of CS blood post CPB on several occasions, this study was instituted to determine the effects of infusion of CS blood on whole blood coagulation as reflected by the thromboelastogram (TEG).

METHODS: Following IRB approval for this prospective, randomized, blinded, placebo controlled study, written informed consent was obtained from 22 patients requiring CPB for cardiac surgery (14 aortocoronary bypass, 5 valve replacement.) Anticoagulation was achieved with heparin titrated to maintain ACT > 480 sec. CPB was performed with moderate hypothermia (26-28°C) utilizing a Bio-Medicus centrifugal pump and Bard HF4500 membrane oxygenator. Following successful weaning from CPB, heparin was reversed with protamine, titrated to an ACT < 110% of baseline. At that time, residual erythrocytes were scavenged from both the CPB circuit and a separate cardiotomy reservoir containing blood from the surgical field. Blood was processed with a Dideco BT- 795A Cell Saver, fitted with a 225 cc centrifuge bowl. After processing, a TEG tracing was obtained, and 450 cc of either CS blood or 5% albumin solution was administered. At 10 min. post infusion, a second TEG tracing was obtained. During the study period, any unsolicited comments pertaining abnormal hemostasis by either the surgical or anesthesia teams were recorded. TEG parameters were calculated as previously described [3], by a blinded observer. Data was analyzed utilizing the Mann-Whitney U test, and ANOVA for repeated measures. Statistical significance was defined as $p < 0.05$.

RESULTS: Three patients were excluded from the study: one for TEG technical problems, and two for hemodynamic instability necessitating protocol violations. There were no significant differences between the two groups for either demographic or uncontrolled variables. Platelet count decreased significantly post CPB (3.09 ± 0.76 vs. $1.54 \pm 0.53 \times 10^5$, $p < 0.0001$), but there were no intergroup differences.There were no significant differences between the two groups for any TEG parameter measured (table 1.) While 10% of the study population displayed evidence of fibrinolysis by TEG, this was only noted to be associated with clinical bleeding in one patient. No other comments about abnormal hemostasis were noted.

Table 1: Measured TEG Variables (data presented as mean±SD.)

	Alb. Pre Tx	Alb. Post Tx	CS Pre Tx	CS Post Tx
Reaction Time(min)	11.9 ± 4.7	12.6 ± 4.6	10.3 ± 2.8	11.5 ± 4.5
K-Time(min)	3.2 ± 1.8	4.2 ± 2.7	4.4 ± 1.3	5.2 ± 2.1
Alpha Angle(degrees)	59.8 ± 8.7	46.9 ± 20.1	52.4 ± 7.1	47.6 ± 7.9
Max. Amplitude(mm)	51.2 ± 17.7	46.7 ± 19.2	48.6 ± 8.5	43.8 ± 4.0

DISCUSSION: We could find no effect of CS blood on coagulation in the post CPB patient as assessed by TEG. Reaction time, a sensitive and reproducible monitor of heparin therapy did not change throughout the study period. During the study period both the CS and albumin groups displayed a trend toward decreasing maximum amplitude(MA), an expression of maximal elasticity of the clot, however, this was not significantly different between the two groups. Decreasing MA may be associated with euvolemic hemodilution, not uncommon in this setting. From this data we conclude that the practice of administering additional protamine to counteract possible residual heparin in CS blood is probably unnecessary, and that transfusion of CS blood in the post CPB patient is not associated with coagulopathy as assessed by TEG.

REFERENCES: 1- Anesthesiology 71: 3A, A3, 1989
2- Anesthesiology 71: 3A, A8, 1989
3- Anesth Analg 64: 888-96, 1985.

TITLE : LEFT VENTRICULAR FUNCTION IN BRAIN DEAD DONORS : ASSESSMENT USING TRANSESOPHAGEAL ECHOCARDIOGRAPHY (TEE)

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Successful organ transplantation is dependent upon optimal management of the circulatory system in donors. Recent experimental studies have documented ultrastructural and functionnal myocardial abnormalities in response to brain death (1). The present study was therefore conducted to evaluate the cardiac function of human brain dead donors using invasive (Swan-Ganz catheter) and non invasive TEE methods.

From June 1989 to September 1989, 22 consecutive brain dead donors (aged 34 ± 12 years) were included in the study. In each patient, cardiac evaluation using invasive arterial pressure, Swan-Ganz catheter and transesophageal echocardiography (TEE) was obtained upon arrival in the unit (T0) and repeated six hours later (T6) before organ donation. Measurements included heart rate (HR), mean arterial pressure (MAP) and cardiac index (CI). Left ventricle end diastolic (EDa) and end systolic (ESa) areas were obtained from TEE data. Ejection fraction area (EFa) was derived as (EDa - ESa)/EDa. Segmental wall motion abnormalities (SWMA) were detected.

Relevant data are presented in the table.

Table : mean ± S.D.

	T0	T6
HR (b/min)	97 ± 10	101 ± 16
MAP (mmHg)	68 ± 20	76 ± 23
CI (l/m^2)	3.02 ± 0.85	4.39 ± 1.04**
EFa (%)	48 ± 21	47 ± 17
ESa (cm^2)	8.84 ± 6.22	10.52 ± 5.8*
EDa (cm^2)	16.36 ± 5.3	20.87 ± 4.99**

* $p < 0.003$; ** $p < 0.0001$

In these 22 young brain dead donors, mean EFa was surprisingly decreased with EFa < 50 % in 11 patients including 4 patients with EFa < 30 %. In addition, SWMA were detected in 6 of these 11 patients. These impairments in EFa were persistent at T6, while at the same time an improvement in CI was demonstrated in relation to an increased EDa. Among the 4 patients with EFa < 30 %, 3 hearts were excluded by the surgeon for cardiac transplantation in view of their anatomical aspect. Swan-Ganz catheter data were not able to discriminate these patients. These data emphasize the usefullness of TEE in screening potential cardiac donors.

Reference
Novitsky et al. :Transplantation 45 : 964-966, 1988