Title: CONTROVERSIES ASSOCIATED WITH AUTOTRANSFUSION DURING HEPATIC TRANSPLANTATION

Authors: D. Brajtbord, M.D., A. W. Paulsen, Ph.D., M. A. Ramsay, M.D., T. H. Swygert, M.D.
T. R. Valek

Affiliation: Department of Anesthesiology, Baylor University Medical Center and
University of Texas Southwest Medical Center, Dallas, Texas 75246

INTRODUCTION. The use of blood salvage techniques to minimize the use of banked blood products and reduce the risk of transfusion transmitted diseases, is widely accepted for many surgical procedures, but remains controversial in liver transplantation[1]. Problems associated with the use of blood salvage include: potential heparinization, contamination of the blood by abdominal contents and potential infection of an immunosupressed patient. This prospective study was designed to identify a safe heparin concentration for use during salvage and determine if any potentially harmful organisms were present in the salvaged blood. In addition, the effectiveness of the cell saver during liver transplantation was analyzed.

METHODS. Following approval by the institutional review board, informed consent was obtained from each patient who participated in the study. Patients were divided into 3 groups based upon heparin concentration used during salvage; group 1 (10,000 units/liter, n=5), group 2 (20,000 u/l, n=7), group 3 (30,000 u/l, n=5). Blood was salvaged using a Haemonetics Cell Saver III. Each unit of salvaged blood was assayed for heparin and sent for gram stain and culture before administration to the patient. The patients blood was cultured at the beginning and end of surgery. At the end of the procedure the cell saver reservoir was examined for the presence of clots. Salvaged blood from 10 additional patients was examined for fibrin split products (FSP). In addition, the perioperative blood product utilization of 44 patients (22 with cell saver and 22 without, paired by preoperative diagnoses), was reviewed retrospectively.

RESULTS. Table 1 summarizes the results of the study. Clots were noted in 3 of 12 patients who received less than 30,000 u/l of heparin, and 0 of the 5 remaining patients. Heparin was detected in 2 of 10 salvaged units from patients receiving 30,000 u/l, while no heparin could be detected in the other two groups. There were no positive cultures from any of the patients or the 20 salvaged units. Gram stains were negative in all but one unit, which had rare gram negative rods and was not administered.

Of the 10 patients (1 salvaged unit/patient) studied for the presence of FSP, 6 had levels less than 10 mcg/ml, 3 had levels between 10 and 40, and 1 had levels greater than 40 mcg/ml (patient blood levels were also greater than 40 mcg/ml).

Table 2 provides the results of the retrospective review of blood product utilization in the 2 groups. No statistically significant differences were found between the groups. Table 3 illustrates the distribution of salvaged and banked units that were administered to the 22 patients in the cell saver group.

DISCUSSION. Patients presenting for hepatic transplantation are not typical candidates for routine autologous blood retrieval, since they frequently present with low plasma proteins, clotting factor deficiencies and thrombocytopenia that usually requires blood component therapy. Salvaged blood contains primarily RBC's without proteins or clotting factors, and decreased levels of fibrinogen and platelets[2], therefore administration of more than 2 units of salvaged blood to a liver transplant patient is usually accompanied by administration of FFP and possibly cryoprecipitate and platelets as indicated. Once it can be established that patients require banked blood component therapy, then consideration must be given to the risk of transfusion transmitted diseases and the uncertain contribution of the salvaged blood to reduce this risk. Ward et al[3] suggested that the risk of receiving HIV contaminated blood with current screening techniques is 1/250000 units with a theoretical potential of 1/40000. The incidence of post transfusion non-A non-B hepatitis is commonly reported[4] to be in the range of 1/50 to 1/10 units. From Table 3, 19/22 patients received an average of 1.1 units of salvaged blood along with an average of 48 units of banked blood products, illustrating that the risk reduction from autologous blood is negligible in the majority of patients. The cost:benefit ratio of using the cell saver, considering that the cost of the cell saver is equal to roughly 8 units of banked PRBC's, is large and may not be justified in the majority of patients in this study.

There are however, circumstances which mandate the use of blood salvage techniques such as persistent blood loss where banked blood may not be available as needed. The reinfusion of large amounts of salvaged blood results in significant conservation of blood bank resources, at least in terms of PRBC's.

When salvaged blood is reinfused, data from this study suggests that there is no significant increased risk of infection, or risk of heparinization when blood is collected with 20,000 u/l of heparin. Reinfusion of significant amounts (greater than 40 mcg/ml) of FSP from fibrinolytic activity in vivo, and potentially from fibrinolysis of formed clots in the cell saver reservoir, may be undesirable and requires further study.

In summary, there are 2 groups of patients who may benefit from cell saver use during hepatic transplantation: those patients who will require only RBC's during the procedure, and those patients who require massive transfusion. A third group of patients requiring moderate amounts of blood products will not benefit from cell saver utilization until the number of salvaged units exceeds the equivalent cost of banked blood.

REFERENCES

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Table 1

HEP CONC	CLOTS	HEP ASSAY	GRAM STAIN	CULTURES
10,000 U/L	1/5	0/5	0/5	negative
20,000 U/L	2/7	0/11	1/11	negative
30,000 U/L	0/5	2/10	0/10	negative

Table 2: Mean blood product utilization (mean ± std. dev.)

UNITS ADMINISTERED	WITHOUT CELL SAVER	WITH CELL SAVER
PACKED RED BLOOD CELLS	13.4 ± 16.9	9.7 ± 9.6
FRESH FROZEN PLASMA	13.5 ± 11.6	16.1 ± 20.9
CRYOPRECIPITATE	17.3 ± 17.5	22.1 ± 34.0
PLATLETS	15.5 ± 14.0	15.5 ± 15.7

Table 3: Distribution of salvaged units given (mean ± std. dev.)

	0 - 8 UNITS	9 - 35 UNITS	OVER 35 UNITS
n OF PATIENTS	19	2	1
CELL SAV UNITS	1.1 ± 1.6	13.0 ± 4.2	50.0 ± 0
RBC's	10.1 ± 12.7	25.0 ± 4.2	40.0 ± 0
FFP	11.2 ± 9.1	41.5 ± 7.8	96.0 ± 0
CRYO	13.6 ± 14.8	75.0 ± 7.1	140.0 ± 0
PLATLETS	13.1 ± 12.5	35.0 ± 7.1	60.0 ± 0