Intraoperative Blood Transfusion Requirements and Deficient Hemostasis in Highly Alloimmunized Patients Undergoing Liver Transplantation

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DURING orthotopic liver transplantation (OLT) a large transfusion of different blood components is frequently necessary. From 1981 to 1985 at the University Health Center in Pittsburgh, 4,318 units of RBCs and 4,788 units of platelets were administered during 366 OLT performed in adults. This results in a mean of 25 units of RBCs and 30 units of platelets per operation.[1]

The majority of adult liver transplant patients receive multiple transfusions of whole blood and/or blood components during their pretransplant course because of complications relating to their original disease. The exposure of these patients to different antigens from random donors facilitates the development of alloimmunization. The heightened alloimmune state can be identified by preoperative values of panel reacting antibodies (PRA). Since platelets possess the HLA antigens of donor specificity, platelets may function as the target of host antibodies, resulting in platelet alteration and subsequent dysfunction. Thus, the effect of alloimmunization on platelet function may be one of the factors responsible for significant blood loss after large transfusions of different blood components.

In this retrospective study we compared blood loss and platelet transfusion during OLT with preoperative alloimmunization against random donor antigens, indicated by PRA values.

PATIENTS AND METHODS

Two groups of patients were randomly chosen out of 827 liver transplants performed from January 1984 to the end of December 1986 at the University Health Center in Pittsburgh.

Group 1 (26 patients) had PRA values of 0% and group 2 (20 patients) had PRA values of 70% or higher. Both groups were matched for age, weight, and diagnosis. Patients with important previous surgery or intraoperative events, eventually causing extraordinary bleeding, were excluded from the study.

The intraoperative transfusion of RBC, fresh frozen plasma, platelets, and cryoprecipitates was examined. In addition, the hemocoagulative profile was assessed using hematocrit, platelet count, fibrinogen, prothrombin time (PT) and activated partial thromboplastin time (APTT). It should be emphasized that heparin was never used pre- or intraoperatively.

Statistical analysis of differences between the match groups was done using a MacIntosh microcomputer (Apple Computer, Cupertino, CA) and Statwork software (Cricket Software, PA); the Student's *t* test was used.

RESULTS

The hemocoagulative values (mean ± SD) showed no difference between the two groups at the beginning of the OLT (Table 1). Table 2 reports the intraoperative amounts (mean ± SD) of blood components transfused during OLT in both groups. Group 2, with PRA values equal or higher than 70%, needed significantly more transfusions of all blood components compared with group 1. The only exception was for whole blood, which was very rarely used intraoperatively in our experience. Table 3 shows the hematologic values (mean ± SD) for both groups at the end of surgery. It can be seen that the larger quantity

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Table 1. Patient Group and Preoperative Clinical Parameters

	Group 1	Group 2	Significance
Age (yr)	35.0 ± 14.1	39.0 ± 12.4	NS
Weight (kg)	54.4 ± 19.2	54.3 ± 15.8	NS
Hematocrit (%)	29.7 ± 5.4	26.9 ± 4.8	NS
Platelet count ($\times 10^3/mm^3$)	114.75 ± 76.60	110.0 ± 66.5	NS
Fibrinogen (mg/dL)	229.6 ± 153.0	167.8 ± 83.6	NS
PT (s)	17.2 ± 10.4	15.8 ± 3.0	NS
APTT (s)	45.9 ± 26.7	43.6 ± 11.2	NS

Table 2. Intraoperative Transfusion

	Group 1	Group 2	Significance
RBC	8.8 ± 10.7	30.7 ± 32.6	$P = .01$
Fresh frozen plasma	9.1 ± 12.2	28.5 ± 31.6	$P = .019$
Platelets	7.8 ± 8.7	20.0 ± 20.5	$P = .024$
Cryoprecipitates	1.4 ± 2.2	11.5 ± 11.9	$P = .002$
Whole blood	1.6 ± 2.4	1.8 ± 4.1	NS

of intraoperatively transfused blood components in group 2 (Table 2) is accompanied by a coagulation profile that is considerably worse than for group 1.

DISCUSSION AND CONCLUSION

Clinical experience shows that coagulation problems and the intraoperative transfusion of large volumes of blood negatively influence surgical outcome and patient survival.[2] Our data from liver transplant patients underline these observations. Although both groups of patients had similar preoperative hemocoagulative profiles (Table 1), group 2 with higher PRA values showed significantly worsened end surgery values. The degree of postoperative coagulation problems is directly related to the amount of blood and blood components transfused intraoperatively.

Our results also indicate a close and significant correlation between previous alloimmunization to random antigens (as indicated by

Table 3. End-Surgery Hematologic Parameters

	Group 1	Group 2	Significance
Hematocrit (%)	32.1 ± 4.7	28.2 ± 4.7	$P = .01$
Platelet count ($\times 10^3/mm^3$)	143.5 ± 74.2	71.2 ± 46.6	$P = .001$
Fibrinogen (mg/dL)	165.6 ± 64.9	135.0 ± 49.3	NS
PT (s)	16.0 ± 2.5	16.2 ± 4.0	NS
APTT (s)	38.3 ± 6.4	44.6 ± 7.7	$P = .01$

PRA levels) and the necessity to transfuse blood components during OLT. Patients with PRA values above 70% needed significantly higher amounts of blood factors than patients with no detectable alloimmunization at the time of transplantation (PRA = 0%). These findings underline the relation of alloimmunization to the coagulation status in OLT patients and indicate that extraordinary blood loss during OLT may be reduced by transfusing platelets matched to the patient's HLA type.[3]

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