TITLE: INCREASES IN ARTERIAL OXYGEN TENSION DURING LIVER TRANSPLANTATION

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Introduction. Patients with end-stage liver disease may exhibit varying degrees of right-to-left shunting which is thought to be the result of intrapulmonary vascular shunts as well as V/Q mismatching. This can be reflected in an elevated alveolar-arterial oxygen tension gradient, the magnitude of which is determined by the amount of shunting as well as the rate of total body oxygen consumption. Intraoperative changes in oxygen consumption may thus affect arterial oxygenation to a significant degree.

Methods. The data from 21 consecutive patients undergoing OLT were examined retrospectively. Veno-venous bypass and 5cm PEEP were used in all cases. Arterial blood gas values and inspired oxygen concentrations were evaluated at 4 periods during surgery: prebypass during the dissection phase (PRE), twice during veno-venous bypass (BYP-1, BYP-2), and at least 10 minutes following reperfusion of the graft liver (POST). P_AO2 was estimated using the alveolar gas equation: $P_AO2=FIO2(P_{Bar}-P_{H2O})-P_ACO2/R$, assuming $P_ACO2=pCO2$ and $R=0.8$. The resulting A-a O2 gradients were compared using Student's paired t-test. Body core temperature (measured in the pulmonary artery) was also analyzed in a similar fashion.

Results. There was a significant reduction in A-a O2 gradient and temperature between prebypass and the subsequent 3 periods (see Table). A significant increase in gradient also occured between the BYP-2 and POST.

Discussion. A significant increase in arterial pO2 occurs during the anhepatic stage of OLT, resulting in a decrease in the alveolar-arterial O2 tension gradient. This appears to be due to a decrease in total body oxygen consumption from hypothermia and removal of the metabolically active liver. The increase in A-a gradient following reperfusion, in the face of unchanging body temperature, probably reflects additional oxygen consumption from the newly grafted liver.

Table.

[mean±SEM]	PRE	BYP-1	BYP-2	POST
pO2 (mmHg)	295±9	*315±10	*344±17	*319±14
A-a grad.(mmHg)	48±8	*35±6	*24±8	*33±8
Temp.(°C)	35.5±.2	*34.7±.2	*34.1±.2	*34.2±.2

* - significantly different from PRE (p<0.05)

TITLE: REMOVAL OF CITRATE FROM BANKED BLOOD USING THE CELL-SAVER

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Introduction. Patients undergoing Orthotopic Liver Transplantation (OLT) often require massive infusions of banked blood products. Acute hypocalcemia with resultant cardiovascular depression as a result of citrate loading is a recognized problem. The effectiveness of removing a variety of soluble factors from blood using the cell-saver has been demonstrated, however using the autotransfusion system to remove citrate from banked blood has not been described.

Methods. Three units of AS-3 preserved packed red blood cells (PRBC's) were separately washed through a cell saver system (Haemonetics Cell Saver III) using one liter of normal saline for each unit of blood. Prior to and following washing, Hct and volume of the units were measured, and a citrate assay performed. The results appear in Table I. The citrate content per unit of PRBC was calculated by multiplying the assayed citrate value by the approximate plasma volume of packed cells: (1 - Hct)*(unit volume). Similar calculations were performed for the units post-processing. These results appear in Table II. The data were compared using t-tests.

Results. After processing, citrate levels were markedly reduced to a mean of 0.50 mmol/L. Citrate content per unit of washed blood was significantly reduced from 1.48 to .113 mmol. The difference between the pre- and post-washing samples was significant in both cases ($p< 0.0005$).

Discussion. This study demonstrates the ability of the cell saver to remove a significant portion of citrate present in banked blood. Processing of banked blood through the cell saver prior to administration could result in a marked decrease in the amount of citrate load supplied to a patient. In patients with impaired or absent hepatic function (e.g. the anhepatic stage of OLT), this may minimize the devopment of hypocalcemia and resultant cardiovascular depression.

Table I. SERUM CITRATE LEVELS

Unit	Pre-wash	Post-wash
A	16.7 mmol/L	0.47 mmol/L
B	17.3 mmol/L	0.67 mmol/L
C	15.5 mmol/L	0.37 mmol/L
	16.5±0.92 mmol/L	0.50±0.15 mmol/L

Table II. ESTIMATED CITRATE LOAD (per unit)

Unit	Pre-wash	Post-wash
A	1.50 mmol	0.106 mmol
B	1.56 mmol	0.151 mmol
C	1.40 mmol	0.083 mmol
	1.48±0.08 mmol	0.113±0.035 mmol