

**TITLE:** ADJUSTMENT OF VENTILATION TO CONTROL ACIDOSIS WITHOUT SODIUM BICARBONATE DURING LIVER TRANSPLANTATION

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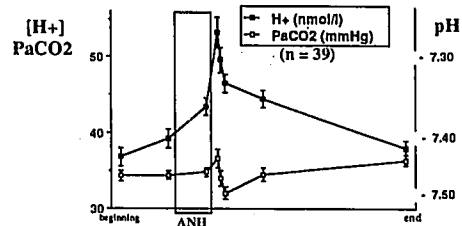
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Administration of sodium bicarbonate is usually recommended in intraoperative management of liver transplantation (LT), especially at liver graft reperfusion. However postoperative metabolic alkalosis is frequent and hypernatremia may be deleterious. Moreover a major part of the reperfusion acidosis is related to the release of CO<sub>2</sub>. This study was therefore conducted to determine if adjustment of ventilation alone may be sufficient to avoid acute acidosis during LT.

**METHODS:** Thirty nine adults undergoing LT were consecutively studied. Arterial blood gas analysis was performed at the beginning of surgery, before the anhepatic phase (ANH), before and at 2, 5, 10 and 60 min after reperfusion, and at the end of surgery. Results were obtained within 2 min and corrected for body temperature. Minute ventilation ( $\dot{V}_E$ ) was adjusted throughout the procedure to maintain the end-tidal CO<sub>2</sub> (PetCO<sub>2</sub>) in a normal range;  $\dot{V}_E$  was increased immediately before liver graft reperfusion to obtain PetCO<sub>2</sub> between 25 and 30 mmHg, then set according to blood gas analysis. Results are expressed as mean $\pm$ SE and compared by ANOVA.

**RESULTS:** Four patients received sodium bicarbonate (40, 60, 100 and 200 mEq) to control metabolic acidosis: three before ANH (due to a renal insufficiency), and one at reperfusion (related to a liver primary non fonction). The 35 other patients did not receive sodium bicarbonate. The mean courses of (H<sup>+</sup>) and PaCO<sub>2</sub> are presented in the figure.  $\dot{V}_E$  was 5.9 $\pm$ 0.2 and 4.9 $\pm$ 0.3 l.min<sup>-1</sup> before and during ANH respectively, and 11.7 $\pm$ 0.6 l.min<sup>-1</sup> at reperfusion. The highest (H<sup>+</sup>) was observed at 2 min after reperfusion (53.3 $\pm$ 2.0 nmol.l<sup>-1</sup>, i.e. pH = 7.27). Five min after reperfusion, only four patients had a pH below 7.20: three of the four patients presented above, and one with hypercapnia due to gaseous embolism at reperfusion (spontaneously reversed in 10 min). Acide-base status was in a normal range for all patients at the end of surgery.

**CONCLUSION:** Increasing twofold the ventilation at reperfusion to obtain a slight hypocapnia is usually sufficient to control acidosis. Sodium bicarbonate is seldom necessary during LT.



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**TITLE:** CALCIUM ADMINISTRATION DURING LIVER TRANSPLANTATION: INFLUENCE OF THE SAMPLING METHOD USED FOR Ca<sup>++</sup> MEASUREMENT

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Routine measurement of ionized calcium (Ca<sup>++</sup>) is useful during liver transplantation (LT), because of massive blood transfusion and unmetabolization of citrate (1). Whole blood Ca<sup>++</sup> analysis requires heparin which may bind and/or dilute Ca<sup>++</sup> unless Ca<sup>++</sup> compensated dried heparin is used (2). Thus liquid uncompensated heparin in sampling containers may decrease whole blood Ca<sup>++</sup> values (3). The aim of this study was to investigate the clinical relevance of this error on calcium administration during LT.

**METHODS:** Thirty nine consecutive LT in adults were studied. Whole blood Ca<sup>++</sup> was measured by ICA<sub>2</sub> Radiometer every hour throughout the procedure and calcium chloride was administered to maintain Ca<sup>++</sup> above 1 mmol.l<sup>-1</sup>. Two periods were retrospectively compared according to the sampling method used: 1) a Pulsator® (Portex) syringe cleared of a solution (300 U/ml) of Na heparin, during 17 LT; 2) a B129® (Radiometer) syringe with 70 U of lyophilized Li-Na heparin compensated for Na-K-Ca, during 22 LT. The amount of Ca<sup>++</sup> (mg) infused per unit of citrated blood product (UBP) was recorded. Results, expressed as means  $\pm$  SE, were compared by t-test.

**RESULTS:** The two groups did not differ for age,

duration of LT, packed red blood cells, and fresh frozen plasma transfusion. With the use of Pulsator® syringe, patients received twice as much Ca<sup>++</sup> as with the use of B129® syringe (127  $\pm$  13 vs 60  $\pm$  6 mg Ca<sup>++</sup>/UBP; p < 0.0001) (figure); ventricular arrhythmia occurred after calcium chloride administration in two patients of the Pulsator® group.

**DISCUSSION:** The sampling method does significantly influence the amount of calcium administered. This should be taken into account to avoid deleterious overadministration of calcium during LT; therefore liquid uncompensated heparin should be abandoned to sample blood for Ca<sup>++</sup> measurement.

**REFERENCES:** 1) Anesthesiology, 65 : 457-461, 1986  
2) Clin. Chem., 31 : 264-266, 1985  
3) Anesthesiology, 71 : A418, 1989

Amount of Ca<sup>++</sup> infused per unit of citrated blood product