PH MANAGEMENT DURING HYPOThERMIC CARDIOPULMONARY BYPAS DOES NOT INFLUENCE CEREBRAL OXYGEN CONSUMPTION

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Controversy regarding optimal pH management techniques during hypothermic cardiopulmonary bypass (CPB), includes reports of disproportionate decreases in cerebral metabolic rate for oxygen (CMRO2) during pH-stat management at 27°C, vs preservation of cerebral flow/metabolism coupling with disproportionate decreases in cerebral blood flow (CBF) reported during alpha-stat pH management. The following study was designed to prospectively assess the influence of pH management on CBF and CMRO2 in patients during hypothermic CPB.

Methods: After obtaining institutional ethics committee informed consent, 5 patients, mean age 58±14 yr undergoing hypothermic CPB had CBF measured using 53Xe clearance. Using a jugular catheter for sampling effluent cerebral venous blood, CMRO2 was determined as the product of CBF and cerebral arterial-venous oxygen content difference. Once a stable nasopharyngeal temperature had been obtained during CPB, patients were randomly assigned to either pH-stat or alpha-stat pH management techniques and CBF and CMRO2 were measured. Following this, the alternate pH management technique was employed and CBF and CMRO2 were remeasured after a minimum 5 min equilibration period. Data were analyzed using a paired t-test with p < 0.05 required for significance.

Results: There were no significant differences in temperature or mean arterial pressure between the two measurement periods. Mean temperature corrected PaCO2 was 31.6±2.6 mmHg during alpha-stat and 40.8±3.8 mmHg during pH-stat pH management (p<0.05). Mean CBF was significantly higher in the pH-stat 32.9±5.2 ml.100g-1.min-1 vs alpha-stat 26.2±6.1 ml.100g-1.min-1 (p<0.05). There was no significant difference in CMRO2 between the two techniques 1.57±0.27 vs 1.40±0.27 ml.100g-1.min-1, respectively.

Discussion: This study is consistent with previous reports demonstrating alterations in CBF, but no differences in CMRO2. Dying alpha-stat vs pH-stat pH management, but does not support the concept of decreases in CMRO2 resulting from differences in pH management over this range of PaCO2 values.


Title: PHOSPHOLIPASE A Activity and Prostaglandin Levels During Cardiac Surgery

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Prostaglandin levels (TXB2, 6-Keto) are elevated during CPB. Phospholipase A (PLA) is an enzyme involved in release of free fatty acids necessary for prostaglandin production. This study examined PLA activity and its relationship to prostaglandin levels during cardiac surgery.

Twelve adult patients undergoing CABG were studied with institutional approval and informed consent. Samples for measurement of PLA, TXB2 and 6-Keto were obtained before induction, after incision, before and after heparin (3 mg/kg), at 15, 30 and 60 min of CPB, before and after protamine, and at end of operation. PLA was measured by the method of Ballou; TXB2 and 6-Keto by radioimmunoassay.

No significant changes were detected until heparin administration. With this, PLA activity rose significantly (0.13±0.02 to 0.46±0.09 pmol/min/mg; p<0.05) and was accompanied by a significant rise in 6-Keto (96±28 to 454±92 pg/ml; p<0.05). These remained elevated until after CPB. Platelet degranulation produced significant decreases (0.50±0.07 to 0.23±0.05 p.mol/min/mg; p<0.05) and 370±100 to 200±47 pg/ml; p<0.05 respectively). TXB2 levels did not increase until CPB (124±20 to 197±36 pg/ml; p<0.05), but remained elevated after protamine (195±32 to 240±49 pg/ml) reversing the TXB2/6-Keto ratio (0.94±0.29 to 1.85±0.57).

These data demonstrate that heparin administration produces significant increases in PLA activity associated with increases in 6-Keto but not TXB2 levels. The increase in TXB2 occurs with CPB and may be due to a number of factors (endothelial dysfunction, etc.). While platelet degranulation reduces PLA activity and returns 6-Keto toward control levels, it has no effect on TXB2 levels. The reversal of the TXB2/6-Keto ratio by protamine may be a factor in the deleterious effects sometimes associated with its administration.