POSTER SESSION XVI

A157

Title: PLASMA GLUTAMATE AND ASPARTATE LEVELS DURING CARDIAC SURGERY

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Myocardial ischemic damage may occur during cardiopulmonary bypass (CPB), following depletion of Krebs cycle intermediates. The amino acids (AA), L-glutamate and L-aspartate are added to cardioplegic solution (CPS) in an attempt to replenish ∝-ketoglutarate and oxaloacetic acid. The added AA increase O_2 and lactate uptake, ATP levels and improve contractility. However, these AA also function as transmitters in the CNS and have the potential for inducing vasodilation and neurotoxicity. The object of this study was to determine plasma levels & effects of AA added to CPS.
METHODS Following informed consent, 17 patients undergoing CPB for CABG were studied. Five patients received standard CPS (Controls), 12 patients (Treatment Group) received CPS containing glutamate 13mM/L and aspartate 13mM/L. Arterial blood samples were obtained at various times indicated in the Table. Plasma fractions were frozen and analyzed by HPLC. Hemodynamic parameters were measured and SVR calculated. Plasma conc. of AA were analyzed by using ANOVA & other variables by factor analysis and t test.
RESULTS While on CPB, SVR was 35% lower in the treatment group compared to controls ($p<0.01$). Plasma conc. of AA did not change before, during or after CPB in the controls. Glutamate and aspartate conc. increased 30-40X (mean 2236 and 1243 μmol/L) following administration of CPS containing AA. In these patients, plasma levels declined in a linear fashion with a plasma half-life of 20 minutes post-CPB. At two hours post-CPB, plasma AA levels were 3X normal. None of the controls required vasopressor medication post-CPB, whereas 33% of patients in treatment group required vasopressors for several hours to maintain BP due to low SVR (400-500 dyne•sec•cm^{-5}).
DISCUSSION The addition of glutamate and aspartate to CPS resulted in a decrease in SVR during and for two hours post-CPB, necessitating the use of potent vasoconstrictors (epi, norepi) to maintain BP. Combined with this undesirable effect is the potential hazard of neurotoxicity secondary to the markedly increased plasma levels of glutamate and aspartate during and after CPB.

Plasma Glutamate and Aspartate Concentrations in Patient Undergoing CABG

	GLUTAMATE (μmol/L)		ASPARTATE (μmol/L)	
TIME	CONTROL GROUP	TREATMENT GROUP	CONTROL GROUP	TREATMENT GROUP
AWAKE	74.3 ±22.4	72.0 ±28.6	8.74 ±2.89	12.90 ±8.29
POST-INDUCTION	52.6 ±10.6	76.8 ±16.3	10.60 ±0.09	7.76 ±3.37
CPB BEFORE CPS	53.2 ±18.9	56.2 ±24.4	13.30 ±2.95	12.40 ±6.27
POST CPS	47.1 ±10.5	2236**** ±227	8.04 ±3.21	1243*** ±571
POST CPB 10 MINS.	49.8 ±16.8	1313**** ±342	10.70 ±6.09	478.** ±322.4
60 MINS.	48.1 ±13.6	478.2* ±355.4	7.78 ±1.72	104.8 ±136.1

* $p<0.03$, ** $p<0.02$, *** $p<0.001$, **** $p<0.0001$

A158

TITLE: Does Angiotensin-Converting Enzyme Inhibition Block Tourniquet Hypertension?

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Introduction: Acute elevation of blood pressure is an undesirable, yet frequent, consequence of tourniquet application for limb surgery(1,2). The etiology of tourniquet hypertension is not well understood at present. Intravenous enalaprilat, an angiotensin-converting enzyme inhibitor, has been shown to improve hemodynamic stability intraoperatively(3,4). Therefore, we evaluated the prophylactic effect of intravenous enalaprilat upon tourniquet-associated hemodynamic events.

Methods: After IRB approval and informed consent, we studied 20 ASA I-II patients, ages 18-75, scheduled to undergo limb surgery. Patients were randomized into two groups to receive preoperatively either placebo or 1.25 mg enalaprilat, both intravenously, 20 minutes prior to induction. Patients received the same general anesthetic regimen. Enflurane was used, as a rescue medication, to control tourniquet hypertension. Mean arterial pressure (MAP) and heart rate were recorded by an automated blood pressure cuff. Statistical analyses were performed by ANOVA with repeated measures; $p<0.05$ was considered to be statistically significant.

Results: MAP (Fig. 1) increased significantly and equivalently in 8 patients from the placebo group and 6 patients from the enalaprilat group after tourniquet inflation ($p<0.01$ vs. pre-incision). MAP was not, however, significantly different between the responders in the placebo and enalaprilat groups. Moreover, heart rate (Fig. 2) was not significantly different between, or within, the responders from the placebo and enalaprilat groups. In addition, enalaprilat did not appear to reduce the enflurane requirement for the control of tourniquet hypertension; 3 of 8 episodes in the placebo group and 4 of 6 episodes in the enalaprilat group required 0.20 ± 0.15 and 0.38 ± 0.22 enflurane MAC·hr, respectively.

Figure 1

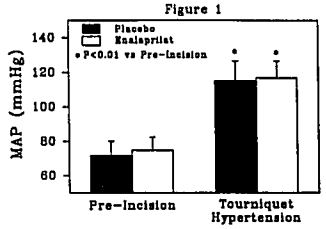
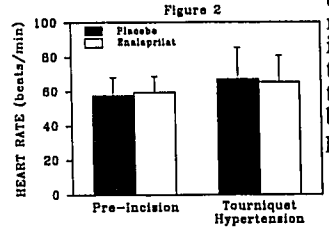


Figure 2



Discussion: Prophylactic treatment preoperatively with intravenous enalaprilat did not effectively blunt the hemodynamic response to the pneumatic tourniquet. This is particularly interesting in light of a recent report that intravenous enalaprilat did block the hypertensive response to endotracheal intubation (3). It suggests that the hemodynamic response to tourniquet and intubation may be mediated by different pathway(s).

1. Acta Anaesthesiol Scand 29:142-147. 1985
2. Br J Anaesth. 54:333-336. 1982
3. Anesth Analg 72:S236. 1991
4. Anesth Analg 69:833-839. 1989