YOUNG INVESTIGATOR PRESENTATION

B1

Title: Therapeutic Hypercapnia Attenuates Acute Lung Injury following Splanchnic Ischemia Reperfusion in the in vivo Rat.

Authors: JG Laffey, D Engelberts, BP Kavanagh

Department(s): Departments of Critical Care Medicine, and The Lung Biology Programme, Research Institute, Hospital for Sick Children, Toronto, Ontario, MS 1X 8

Introduction: Acute Lung Injury [ALI] is a major cause of morbidity and mortality in critical care. Although the pathobiology of multi-organ dysfunction is complex, ischemia-reperfusion [IR] injury, particularly in the splanchnic vasculature, is considered to play a pivotal role. We have previously demonstrated that CO2 can modify lung injury independent of alterations in lung stretch and have hypothesized that deliberate elevation of FiCO2 [Therapeutic Hypercapnia, TH] may protect in a broad spectrum of critical illnesses. In this study, we hypothesized that TH would protect against splanchnic IR injury.

Methods: We utilized an in vivo anesthetized, mechanically ventilated, rat model of Superior Mesenteric Artery (SMA) IR induced ALI. In the first series animals were randomized to: [1] TH-IR, (FICO2, 0.05), [2] CON-IR, and [3] TH-SHAM, [4] CON-SHAM, where no IR was applied. All animals received standard FiO2 (0.21), fluid management and ventilation parameters. After laparotomy, the SMA was occluded for 40 minutes, then reperfused for 60 minutes in TH-IR and CON-IR. In the second series randomized animals received TH either: [1] 15 mins pre-, or [2] 15 mins post-reperfusion vs [3] CON.

Results: Following IR injury, TH was associated with better preservation of lung capillary permeability, lung mechanics, systemic oxygenation, A-a gradient (222±23 vs 303±22mmHg, P<0.05) vs control. Furthermore, TH was associated with an improved acid-base (Base excess 1.9±1.8 vs 6±1.8, P<0.05) and lactate profile. In the second series, the degree of ALI was as follows: TH pre-reperfusion < TH post-reperfusion < Control.

Conclusions: We conclude that in the current model: [1] TH is protective vs splanchnic IR induced ALI; [2] TH may confer protection vs extrapulmonary injury. [3] Application of TH post reperfusion is protective, thought to a lesser degree than TH pre-reperfusion. If these findings are confirmed in additional models, TH may become a candidate for clinical testing in critical care.

References:

Pulmonary Capillary Permeability

![Graph showing pulmonary capillary permeability](http://example.com/graph.png)