



Biomedical Engineering Seminar Series

Johns Hopkins School of Medicine and the Whiting School of Engineering



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Host: Dr. Leslie Tung

Monday, October 19, 2009 at 1:30

Talbot Room, Traylor 709

Video-Teleconferenced to Homewood Campus,
Rome Room, Clark 110

Light lunch will be provided in Traylor 709



Cyclohexanone Contamination in Extra Corporeal Circuits as a Novel Putative Trigger for Post-Extra Corporeal Circuit Morbidity-SIRS

Extracorporeal circulation (EC; cardiopulmonary bypass, extracorporeal membrane oxygenation, hemo-dialysis) has become a primary tool in operating rooms and ICUs, providing critical life support. However, EC also introduces a host of unique morbidities, which are collectively known as the Systemic Inflammatory Response Syndrome (SIRS) and are characterized by complement activation, labile blood pressure, depressed cardiac output, ventricular dysfunction, arrhythmias, pulmonary hypertension, neurological dysfunction (short term memory loss, gustatory and olfactory alterations), respiratory distress, renal insufficiency, and vascular leak/edema formation. Although several randomized clinical trials have been conducted to try to minimize the effects of various triggers, EC SIRS morbidity rates still remain high and represent a significant barrier to improved patient care. However, it is still unknown what exactly triggers these responses and, consequently, how to employ appropriate intervention strategies to minimize them before, during or after EC.

We have evidence that 1) Cyclohexanone (CHX), an organic solvent used in the production (wet joint welding) of polyvinyl chloride (PVC) materials in EC circuits, leaches from the PVC into the contained fluids and 2) CHX administration at concentrations observed at the JHMI, 210 to 3694 $\mu\text{g/L}$, can reproduce impaired cardiac function, edema, neurological dysfunction and respiratory distress. CHX infusion in rats has led to arterial pressure instability, depressed cardiac contractility, increased wet-to-dry organ weight ratios, respiratory distress and heart rate-arterial pressure uncoupling (depressed baroreceptor function). In isolated vessel studies CHX treatment revealed 1) augmented contraction to alpha agonists and 2) severely attenuated endothelial production of NO. In addition, neuronal cell cultures showed withdrawal of axons following two hours of CHX exposure and 24 hours of recovery. These preliminary results suggest that CHX, at levels of 50 $\mu\text{g/L}$, can contribute to the development of several of the morbidities associated with EC. Common patient complaints are: Edema formation, Short term memory loss, Labile arterial blood pressure, Labile heart rate, Loss or change of taste, Loss or change in smell, Fatigue, and Erectile dysfunction

This series of translational investigations could provide an avenue by which clinicians can ameliorate several post-EC morbidities. The data have been disclosed to the Food and Drug Administration (FDA) and members of the NIH-Heart Lung Blood Institute. CHX can be found in multiple medical and consumer products on the market. This includes IV storage bags, CPB tubing, ECMO, dialysis, household plumbing and new cars.

<http://www.hopkinsmedicine.org/ibbs/news/events.html>

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