



BEST TRAUMA RELATED POSTER-2015 ORS MEETING

Correlation of NIRS and Histological Muscle Damage in a Prolonged Trauma/infusion Model of Extremity Compartment Syndrome (ECS)*Steven Budsberg, DVM*

Background/Purpose: Extremity compartment syndrome (ECS) can result in devastating consequences if missed or if treatment is delayed. Recently, near-infrared spectroscopy (NIRS) has been shown to provide continual, real time, noninvasive measurement of regional perfusion in an infusion model of ECS. In a different model, NIRS evaluation of the compartment provided a reliable, sensitive measure correlating to both an increase and decrease in tibial intracompartmental pressures (TICP) and tibial compartment perfusion pressures (TIPP), respectively. Furthermore, significant correlations between muscle degeneration, edema, hemorrhage, and NIRS were found. The purpose of the study presented here was to evaluate the correlation between NIRS and histological muscle damage in a prolonged trauma/infusion model of ECS.

Methods: Six Landrace swine were used in the study. Pigs were maintained on isoflurane and positioned in dorsal recumbency. NIRS sensors (Nonin Medical) were placed on each leg with 1 cm of craniolateral compartment musculature proximal and cranial/caudal to the sensor. Two 18-gauge needles were centered under the sensor on both limbs and used for direct pressure transducer measurement of compartmental pressure as previously described. Continual time synchronized measurements of systemic blood pressure (systolic, diastolic, and mean arterial pressures, pulse rate, respiratory rate, compartmental pressures, and regional oximetry from the NIRS sensors) were collected. Baseline data were established for control and test craniolateral tibial regions. Trauma was induced by dropping a 2-kg weight 30 times from 100 cm directly on the test limb. NIRS sensors were replaced and albumin infusion elevated TICP to above mean arterial pressure yielding a TIPP below 0 mm Hg that was maintained for 8 hours. Pigs were randomly assigned to two groups. Three pigs were euthanized at 8 hours and cranial tibial muscle biopsies (scored for muscle damage) were taken. The other 3 pigs underwent fasciotomies and data were collected for an additional 2 hours at which time muscle biopsies were taken. A repeated-measures analysis of variance was used to test for differences in TICP, NIRS, and TIPP measurements between and within test and control limbs at each time point. Multiple comparisons were adjusted using Tukey test.

Results: As expected significant negative correlations of TICP and NIRS, and positive correlations of TIPP and NIRS were observed. NIRS values decreased relative to the control limb from compartment pressure-induced ischemia for the 8-hour duration and then rebounded to a hyperemic state following reduction of TICP.

Conclusion: The presence of delayed/missed ECS with muscle necrosis did not alter the characteristic NIRS response to ECS.