Can Intramuscular pH Levels Diagnose Acute Compartment Syndrome?

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Purpose: Acute compartment syndrome (ACS) impacts many trauma patients. Intracompartmental pressure measurements are the current standard of care but have been shown to have important limitations. We hypothesized that pH would be sensitive and specific for determining muscle hypoxia and therefore for diagnosing ACS.

Methods: Compartment syndrome was created in 11 anesthetized adult mixed-sex beagles. ACS was created in the craniolateral compartment of a lower leg by infusion of lactated Ringer's solution. Compartment pressure and pH were recorded with commercially available probes. Our primary outcome measures were intramuscular pH.

Results: Mean arterial pressure averaged 67 mm Hg during the experiment. The compartment pressures were maintained at an average of 86 mm Hg in the experimental limb and an average of 15 mm Hg in the control limb. The initial intramuscular pH concentrations were similar in the experimental and control limbs (6.85 vs 6.85, P = 0.94). The final pH in the experimental limb was 6.28 versus 6.79 in the control limb (P <0.001). The control and experimental groups were significantly different 45 minutes after ACS creation (6.68 control vs 6.45 experimental, P = 0.001). Using a pH threshold of 6.3 or less, our data were 72.7% (39.3%-92.7%; 95% confidence interval [CI]) sensitive and 100% (57.1%-99.5%; 95% CI) specific for compartment syndrome. Receiver operating characteristic curve analysis for pH demonstrated 0.875 area under the curve.
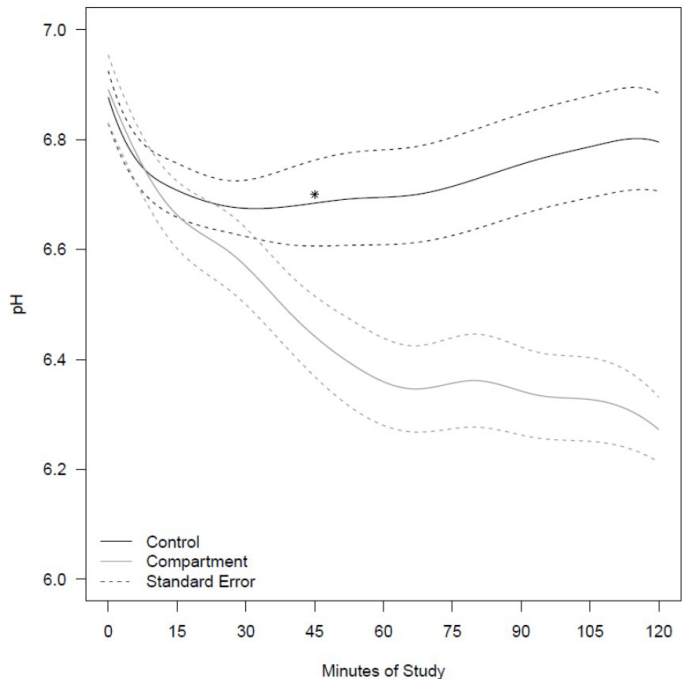

Figure 1. Intramuscular pH in control and experimental legs vs time after ACS creation.

* denotes statistical significance (p < 0.001)

Conclusion: This study describes a novel technique for diagnosing ACS in a canine model. Our results are promising and show that intramuscular pH identifies muscle ischemia within 45 minutes of ACS creation with decent sensitivity and high specificity in this animal model and further work should be aimed at refining this technology.