Pharmacological Treatment of Compartment Syndrome with Phenylephrine and Dobutamine Was Similar to Fasciotomy

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Purpose: Current treatment for acute extremity symptomatic acute compartment syndrome (CS) is fasciotomy. However, surgical treatment has associated morbidity and may delay the recovery of the patients. The goal of this study is to investigate the feasibility of a novel nonsurgical treatment strategy for acute CS that increases oxygen delivery to the affected extremity by increasing blood pressure in a dog CS model. We hypothesize that pharmacological treatment will raise the blood pressure, improve limb perfusion, and increase tissue oxygenation, thus rescuing muscle from CS.

Methods: CS was induced in the anterolateral compartment on bilateral legs in the animals. Intramuscular tissue oxygenation, compartment pressure, and blood pressure were recorded every 30 seconds. Pharmacological treatment was initiated 1 hour after CS was induced. Infusion of intravenous phenylephrine was titrated as needed to increase the diastolic blood pressure 30 mm Hg above the baseline (creating DP = 0 mm Hg). Intravenous dobutamine was initiated 2 hours later to maintain blood pressure. Six to seven hours after treatment, fasciotomy was performed on one leg of the animals and the skin was closed 1 hour later. In a separate nontreatment control group, CS of equivalent magnitude was induced in 6 animals in which no intervention (pharmacological nor fasciotomy) was performed. Animals were euthanized 2 weeks postoperatively at which point muscle biopsies were performed. Tissue viability was assessed by MTT (3-(4,5-dimethylthiazol-2-yl)-2,5-diphenyltetrazolium bromide) assay as previously described. This is a validated technique in which the normalized tissue viability index is expressed as a percentage of control (quadriceps muscle).

Results: After induction of CS, pharmacological treatment significantly increased PmO2 in the anterior compartment muscle. The average PmO2 in the treatment group was 18.8 ± 4.3 mm Hg (mean ± standard error [SE]). In contrast, PmO2 in the non-treated group dropped to 0 mm Hg soon after the CS was induced. Fasciotomy increased the PmO2 from 18.8 ± 6.7 mm Hg to 35.7 ± 15 mm Hg. Two weeks after surgery, the muscle viability index in pharmacological treated, pharmacological treated plus fasciotomy, and non-treated groups was 128 ± 15%, 94.3 ± 8.3%, and 41.8 ± 17% (mean ± SE), respectively. There was no significant difference in viability index between the pharmacological treated and pharmacological -treated plus fasciotomy groups ($P = 0.09$). However, both groups had significantly higher tissue viability compared to the non-treated group ($P < 0.01$).

Conclusion: Our results showed that nonsurgical pharmacological treatment can significantly increase muscle oxygen and viability and may represent an alternative, less morbid treatment for acute CS than fasciotomy. Phenylephrine is often used for for trauma patients in the perioperative setting to maintain blood pressure and could serve as initial therapy in patients with possible CS. However, in our study, the effect of phenylephrine decreased over time, and a second line drug (dobutamine) was needed after the first few hours. Keep-

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ing the blood pressure at a high level using solely pharmacological agents (phenylephrine/dobutamine combination) yielded similar results as fasciotomy for the treatment of acute CS.

- The FDA has not cleared this drug and/or medical device for the use described in this presentation (i.e., the drug or medical device is being discussed for an "off label" use). For full information, refer to page 600.