Safety and Efficacy of a Novel Abdominal Aortic Tourniquet Device for the Control of Pelvic & Lower Extremity Hemorrhage

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Introduction

Hemorrhage from penetrating pelvic and inguinal injuries is a potentially preventable cause of death.

Commonly employed pre-hospital strategies to achieve hemostasis in these areas have limited efficacy.

This study examines the safety and efficacy of a novel, externally-applied pneumatic abdominal aortic tourniquet.

Materials & Methods

• Eight (n=8) anesthetized swine

• The tourniquet was applied for 60 minutes.

• Carotid artery, femoral artery, internal jugular vein, and urinary bladder pressures were monitored at 5 minute intervals.

• Serum potassium and lactate levels were obtained at 0 minutes, 55 minutes, and 65 minutes.

• Doppler ultrasound was recorded at 5 minute intervals to measure blood flow through the femoral artery.

• After release of the device, an open laparotomy was performed, and tissue samples from the large and small intestine were collected and sent for gross and histological examination.

Figure 1: Tourniquet after application

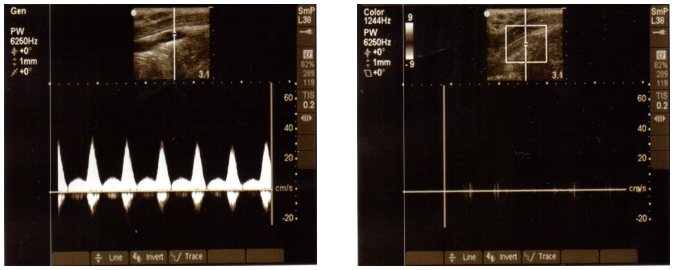

Figure 2: Spectral Doppler of femoral artery demonstrating cessation of flow

Results

After application of the device:

• Flow was essentially undetectable in the femoral artery and vein by power and spectral doppler.

• Femoral artery pressure was significantly reduced in relation to carotid pressure.

• There were no significant differences in MAP or CVP measurements among animals.

• Serum lactate increased 2.3 mmol/l with tourniquet release ($p<0.001$).

• Serum potassium had no change with tourniquet release.

• Gross and histological examination revealed no signs of significant ischemia or necrosis of the small and large intestine.

Conclusion

The abdominal aortic tourniquet appears safe and effective in decreasing or eliminating blood flow to the pelvis and lower extremities when applied for 60 minutes.