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Resuscitation Science Symposium

Session Title: Session IV: Best Original Resuscitation Science Poster Session

Abstract 177: Rat to Pig Translation: Small-Volume 7.5% NaCl Adenocaine/Mg²⁺ Has Multiple Physiological Benefits During Hypotensive and Blood Resuscitation in the Porcine Model of Severe Hemorrhagic Shock

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Background: Currently there is no effective small-volume fluid for hypotensive resuscitation in far-forward combat environments. In the rat model of extreme hemorrhagic shock, we have shown that a small IV bolus of 7.5% NaCl Adenocaine (adenosine and lidocaine) and Mg²⁺ (ALM) had a significant hemodynamic and survival benefit. The present study tests whether small-volume 7.5% NaCl ALM translates from rat to the porcine model of severe hemorrhagic shock.

Methods: Pigs (35–40kg) were anesthetized and bled to mean arterial pressure (MAP) of 35–40 mmHg for 90 min (~75% blood loss). Pigs were randomly assigned to receive 4 ml/kg 7.5% NaCl (n=8) or 4 ml/kg 7.5% NaCl ALM (n=8). Data were collected at baseline, shock, hypotensive fluid resuscitation (60 min), and during return of shed blood (180 min). Core temperature (CT) was 38.2°C and allowed to drift during shock and resuscitation. Sig*p<0.05.

Results: A single IV bolus of 7.5% NaCl ALM generated higher MAP (48±2 vs 32±3* mmHg), higher cardiac output (3.1±0.4 vs 2±0.2* l/min), higher O₂ delivery (7.6 vs 5.3* ml/min/kg) and higher arterial pH (7.28 vs 7.20*) at 60 min hypotensive resuscitation, with lower blood lactate (7.4 vs 11.2* mM), lower base excess (-6 vs -11* mEq/L) and lower plasma K⁺ (4.4 vs 5.5* mM) than 7.5% NaCl controls. One control died during hypotensive resuscitation from cardiovascular collapse. After 30 min blood return, whole body O₂ consumption decreased in ALM pigs (5.9 to 5.1 ml/min/kg), and increased in controls by 34% (4.5 to 6.0* ml/min/kg). After 90 min, blood lactate in the ALM group decreased from 7.4 to 3.0* mM, and from 11.2 to 6.8 mM in controls, and after 180 min the ALM pigs had ~3-fold higher urine output (100±25 vs 30±8 ml*) with ~3-fold lower protein/creatinine ratio. Heart rate (~20%) and CT (~0.4°C*) were consistently lower in ALM pigs, and systemic vascular resistance was 30% higher after blood return compared with 7.5% NaCl controls.

Conclusion: Small-volume 7.5% NaCl ALM affords superior resuscitation benefits and hemodynamic stabilization following severe hemorrhagic shock in pigs. The multiple benefits may imply improved autonomic control of restorative and homeostatic functions. ALM resuscitation may have applications in the pre-hospital environment and mass casualty situations.

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