Balanced Resuscitation of Polytrauma Using a Multifunctional Resuscitation Cocktail in a Swine Model

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ABSTRACT

Background and Objectives: Trauma casualties often face the dual challenge of traumatic brain injury (TBI) and hemorrhagic shock. Combat medics encounter the difficult task of managing these co-occurring conditions with conflicting resuscitation goals. Current strategies, including permissive hypotension and aggressive volume expansion, present risks of secondary brain injury and increased hemorrhage. This study explores a multi-functional resuscitation cocktail aiming to minimize blood loss and prevent secondary injuries.

Methods: In this study, 24 pigs underwent hemorrhagic shock with polytrauma including TBI, femur fracture, and aortic tear. Post-injury, animals were resuscitated using either the proposed Damage Control Resuscitation (DCR) cocktail consisting of 14mL/kg volume of 6% Hextend solution, 0.8 U/kg vasopressin, and 100mg/kg fibrinogen concentrate infused over one hour, or a standard treatment of two separate 7mL/kg Hextend Boluses separated by 30 minutes. In 14 animals, dilutional coagulopathy was induced prior to injury and resuscitation. In 10 animals, additional resuscitation with blood product transfusion and TXA administration was added following initial resuscitation intervention. Animals were monitored for up to 3 hours following the start of resuscitation.

Results: In the setting of dilutional coagulopathy, mean (SD) survival time was significantly increased with DCR cocktail at 142.3 ± 47.3 minutes compared to Hextend control at 68 ± 61.4 minutes (p=0.037). In animals resuscitated with additional blood transfusion and TXA, 100% of animals in the DCR cocktail group and 80% of the control group survived without an overall difference of survival time, blood loss, or hemodynamic endpoints. There was a trend toward improved mean arterial blood pressure and cerebral perfusion pressure, in DCR group (p=0.09).

Conclusion: The DCR cocktail, comprising Hextend, vasopressin, and fibrinogen concentrate, enhanced survival in polytrauma settings with dilutional coagulopathy. It also showed potential advantages in brain protection post-TBI, suggesting that the DCR cocktail may offer benefits in coagulopathy, cerebral resuscitation, and prevention of secondary injury in larger-scale studies.