

**Adsorbent Hemostatic Agent****Controls moderate to severe blood loss by promoting coagulations**

CLINICAL INFORMATION

Comparative Analysis of Hemostatic Agents in a Swine Model of Lethal Groin Injury.

Journal of Trauma-Injury Infection & Critical Care. 54(6):1077-1082, June 2003.

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Abstract

Background : Techniques for better hemorrhage control after injury could change outcome. A large-animal model of lethal, uncontrolled hemorrhage was developed to test whether the use of various hemostatic agents would decrease bleeding and improve early survival.

Methods : A complex groin injury was created in 30 Yorkshire swine (42-55 kg) to produce uncontrolled hemorrhage. This injury included semitranssection of the proximal thigh and complete division of the femoral artery and vein. After 5 minutes, the animals were randomized to (n = 6 animals per group) no dressing (ND), standard dressing (SD), SD and Rapid Deployment Hemostat (RDH) bandage, SD and QuikClot hemostatic agent (QC), or SD and TraumaDEX (TDEX). Limited volume 0.9% saline (1,000 mL over 30 minutes) resuscitation was started 30 minutes after injury. We measured blood loss, early mortality (180 minutes), and physiologic markers of hemorrhagic shock (e.g., cardiac output, blood pressure, hemoglobin, metabolic acidosis).

Results : Application of wound dressing decreased mortality in all groups compared with the ND group (83% mortality). However, this difference was significant ($p < 0.05$) only for the QuikClot hemostatic agent (0% mortality). Before the application of dressing (first 5 minutes), there were no differences in blood loss between the groups. After application of dressings, the QC group had the lowest blood loss (4.4 +/- 1.4 mL/kg).

Conclusion : ***Of the hemostatic agents tested, QuikClot improved survival and decreased bleeding in a swine model of lethal vascular and soft tissue injury.***

**Adsorbent Hemostatic Agent****Controls moderate to severe blood loss by promoting coagulations****Application of a Zeolite Hemostatic Agent Achieves 100% Survival in a Lethal Model of Complex Groin Injury in Swine.**

Journal of Trauma-Injury Infection & Critical Care. 56(5):974-983, May 2004.

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Abstract

Background: Techniques for better hemorrhage control after injury could change outcome. We have previously shown that a zeolite mineral hemostatic agent (ZH) can control aggressive bleeding through adsorption of water, which is an exothermic process. Increasing the residual moisture content (RM) of ZH can theoretically decrease heat generation, but its effect on the hemostatic properties is unknown. We tested ZH with increasing RM against controls and other hemostatic agents in a swine model of battlefield injury.

Methods: A complex groin injury was created in 72 swine (37 +/- 0.8 kg). This included semitranssection of the proximal thigh and complete division of the femoral artery and vein. After 3 minutes, the animals were randomized to 1 of 10 groups: group 1, no dressing (ND); group 2, standard dressing (SD); group 3, SD + 3.5 oz ZH with 1% RM (1% ZH); group 4, SD + 3.5 oz ZH with 4% RM (4% ZH); group 5, SD + 2 oz ZH with 1% RM (1% ZH 2oz); group 6, SD + 3.5 oz ZH with 8% RM (8% ZH); group 7, SD + chitosan-based hemostat, HemCon (HC); group 8, SD + 3.5 oz nonzeolite mineral hemostat, Quick Relief (NZH); group 9, SD + bovine clotting factors-based hemostat, Fast Act (FA); and group 10, SD + 30 g of starch-based hemostat, TraumaDex (TDex). Resuscitation (500 mL of Hespan over 30 minutes) was started 15 minutes after injury and hemodynamic monitoring was performed for 180 minutes. Primary endpoints were survival for 180 minutes and blood loss. In addition, maximum wound temperatures were recorded, and histologic damage to artery, vein, nerve, and muscle was documented.

Results: Use of 1% ZH decreased blood loss and reduced mortality to 0% ($p < 0.05$). Increasing the RM adversely affected efficacy without any significant decrease in wound temperatures. Minimal histologic tissue damage was seen with ZH independent of the percentage of RM.

Conclusion: *The use of zeolite hemostatic agent (1% residual moisture, 3.5 oz) can control hemorrhage and dramatically reduce mortality from a lethal groin wound.*

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Intracorporeal Use of the Hemostatic Agent QuickClot in a Coagulopathic Patient with Combined Thoracoabdominal Penetrating Trauma

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J Trauma. 2004;56:205–208.

The clinical triad of acidosis, coagulopathy, and hypothermia represent a significant therapeutic challenge in trauma patients. Hemorrhage and exsanguination can rapidly become uncontrollable, and a vicious cycle emerges, with significant overall mortality despite treatment. The concept of damage control surgery arose as a method of effectively controlling exsanguinating patients such that these underlying physiologic abnormalities may be corrected.¹ However, the key to success is to control major hemorrhage while delaying other nonessential procedures until the patient has been adequately resuscitated. This case represents the first reported intracorporeal use of a novel hemostatic agent, QuikClot (Z-Medica, Newington, CT), resulting in immediate lifesaving hemorrhage control in a patient with hemorrhage not amenable to conventional methods of hemostasis.

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