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An Alternative Hemostatic Dressing: Comparison of CELOX, HemCon, and QuikClot.

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Objectives: Uncontrolled hemorrhage remains a leading cause of traumatic death. Several topical adjunct agents have been shown to be effective in controlling hemorrhage, and two, chitosan wafer dressing (4"x4"HemCon [HC]) and zeolite powder dressing (100g QuikClot [QC]), are being utilized regularly on the battlefield. However, recent literature reviews have concluded that no ideal topical agent exists. The authors compared a new chitosan granule dressing (35g CELOX [CX]) to HC, QC and standard dressing in a lethal hemorrhagic groin injury.

Methods: A complex groin injury with transection of the femoral vessels and 3 minutes of uncontrolled hemorrhage was created in 48 swine. The animals were then randomized to four treatment groups (12 animals each). Group 1 included standard gauze dressing (SD); Group 2, CX; Group 3, HC; and Group 4, QC. Each agent was applied with 5 minutes of manual pressure followed by a standard field compression dressing. Hetastarch (500 mL) was infused over 30 minutes. Hemodynamic parameters were recorded over 180 minutes. Primary endpoints included rebleed and death.

Results: CELOX reduced rebleeding to 0% ($p < 0.001$), HC to 33% (95% CI = 19.7% to 46.3%, $p = 0.038$), and QC to 8% (95% CI = 3.3% to 15.7%, $p = 0.001$), compared to 83% (95% CI = 72.4% to 93.6%) for SD. **CELOX improved survival to 100%** compared to SD at 50% (95% CI = 35.9% to 64.2%, $p = 0.018$). Survival for HC (67%) (95% CI = 53.7% to 80.3%) and QC (92%; 95% CI = 84.3% to 99.7%) did not differ from SD.

Conclusions: In this porcine model of uncontrolled hemorrhage, CELOX improved hemorrhage control and survival. CELOX is a viable alternative for the treatment of severe hemorrhage.

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