


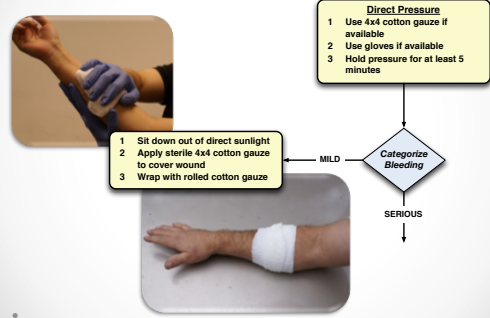
Costal Emergency Medicine Conference

Advanced Hemorrhage Control Solutions and Devices



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Bleeding Wound



Direct Pressure

- 1 Use 4x4 cotton gauze if available
- 2 Use gloves if available
- 3 Hold pressure for at least 5 minutes

Categorize Bleeding


MILD

- 1 Sit down out of direct sunlight
- 2 Apply sterile 4x4 cotton gauze to cover wound
- 3 Wrap with rolled cotton gauze

SERIOUS

- Requires advanced maneuvers
- Arterial Bleeding
- Major Venous Bleeding
- Uncontrolled bleeding
- Bleeding associated with
 - Cool/sweaty skin
 - Lightheadedness/dizziness
 - Change in alertness

Serious Bleeding




Improved (Individual) First Aid Kit

- Utility Pouch
- **Combat Application Tourniquet**
- Emergency Elastic Bandage (Israeli Pressure Dressing)
- Compressed Gauze Bandage
- 2" Adhesive Tape
- **Combat Gauze Dressing**
- Nasopharyngeal Airway
- Patient Exam Gloves

Tourniquets

Prehospital Utilization

Tourniquet Use

Survival With Emergency Tourniquet Use to Stop Bleeding in Major Limb Trauma

Practical Use of Emergency Tourniquets to Stop Bleeding in Major Limb Trauma

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What Do We Know

- Tourniquets Appear to be Effective
- Tourniquets Appear to Have a Low Complication Rate
 - Retrospective studies
 - Complex extremity injuries
 - Unique population
 - Limited number of subjects

Study Question

Does the use of emergency tourniquets save lives?

- Under what circumstances
- What are the complications

Survival With Emergency Tourniquet Use to Stop Bleeding in Major Limb Trauma

- Methods
 - Study Design
 - Prospective observational study
 - Cohort and subgroup analysis
 - All patients presenting to the hospital with a tourniquet were included
 - Definitions
 - Tourniquet = any limb constrictive device used to stop extremity bleeding
 - Use categorized:
 - Geographically
 - Physiologically
 - Statistical Analysis
 - Descriptive
 - Chi-squared and student-t
 - Kaplan-Meier survivorship analysis

Survival With Emergency Tourniquet Use to Stop Bleeding in Major Limb Trauma

- Results
 - Demographics
 - 232 patients
 - 428 tourniquets placed on 308 limbs
 - Mean ISS = 14
 - Explosions were the most common mechanism

Survival With Emergency Tourniquet Use to Stop Bleeding in Major Limb Trauma

The figure contains three Kaplan-Meier survival curves labeled A, B, and C. Each graph plots 'Survival' on the y-axis (0% to 100%) against 'Days' on the x-axis (0 to 35).
 Graph A: 'Survival: Tourniquet Used vs. Not Used (at 28 Days)'. The 'No Tourniquet' line shows a survival rate of approximately 80% at day 28, while the 'Yes Tourniquet' line shows a survival rate of approximately 95%.
 Graph B: 'Survival: No Shock vs. Shock Tourniquet Use (at 28 Days)'. The 'No Shock' line shows a survival rate of approximately 95% at day 28, while the 'Shock' line shows a survival rate of approximately 85%.
 Graph C: 'Survival: Prehospital vs. ED Tourniquet Use (at 28 Days)'. The 'Prehospital' line shows a survival rate of approximately 95% at day 28, while the 'ED' line shows a survival rate of approximately 90%.

Survival With Emergency Tourniquet Use to Stop Bleeding in Major Limb Trauma

- Conclusions
 - Survival Rate Was Higher in Patients With Tourniquets Used Versus Tourniquets Not Used - **Effective**
 - Survival Rate Was Higher if Shock Was Absent Before Tourniquet Use Than if it Was Present - **Early is Better**
 - Survival Rate Was Higher With Earlier Application (Prehospital) of Tourniquet - **Early is Better**
 - Palsies Were Infrequent and Transient With Tourniquet Use

Original Contributions

BATTLE CASUALTY SURVIVAL WITH EMERGENCY TOURNOISET USE TO STOP LIMB BLEEDING

Kragh 2009

Update to Original Study

- Total study population increased to 499
- Consistent findings of lifesaving benefits and low complications

Hemostatic Bandages

Prehospital Utilization

Hemostatic Bandage Use

Determination of Efficacy of New Hemostatic Dressings in a Model of Extremity Arterial Hemorrhage in Swine

Advanced Hemostatic Dressings Are Not Superior to Gauze for Care Under Fire Scenarios

What Do We Know

- Hemostatic bandages are widely deployed and utilized by U.S. and foreign armed forces
- Hemostatic bandages are effective in animal models
 - Decrease bleeding time
 - Increase MAP
 - Improve survival

Mechanisms

- Factor Concentrators**
 - Inert minerals
 - Rapid absorption of water
 - Exothermic reaction
- Mucoadhesive Agents**
 - Chitosan
 - Cross-link erythrocytes with wound surface
 - Independent of platelets or clotting factors
- Pro-coagulant Agents**
 - Kaolin
 - Enhances activity in the "intrinsic" arm of the clotting cascade

Study Question

Do hemostatic bandages work better than standard gauze?

- Hemorrhage control
- Blood loss
- MAP
- Survival

Determination of Efficacy of New Hemostatic Dressings in a Model of Extremity Arterial Hemorrhage in Swine

- **Methods**
 - Study Design
 - Controlled experimental trial
 - Swine model of severe hemorrhage
 - Comparison of 4 hemostatic bandages and one standard gauze bandage (PB)
 - Trauma Stat (TS) – Silica and Chitosan
 - Combat Gauze (CG) – Kaolin
 - Celox-D (CXb) – Chitosan
 - HemCon-RTS (HC) - Chitosan
 - Statistical Analysis
 - Descriptive
 - Chi-squared and student-t
 - Kaplan-Meier survivorship analysis

Determination of Efficacy of New Hemostatic Dressings in a Model of Extremity Arterial Hemorrhage in Swine

Figure 2. The pretreatment and posttreatment blood loss (mean ± SEM) of pigs treated with hemostatic dressings. No difference was found in initial hemorrhage (pretreatment blood loss) among groups. The posttreatment blood loss in CG was <20% of the volumes in the other groups (TS or PG), but this difference was not statistically significant (HCs and CXb data were not included).

Figure 4. Kaplan-Meier analysis of survival time of pigs treated with each dressing. The CG-treated animals lived significantly longer than PG- or TS-treated ($p < 0.05$) pigs, and CXb data were not included.

Determination of Efficacy of New Hemostatic Dressings in a Model of Extremity Arterial Hemorrhage in Swine

- **Results & Conclusions:**
 - CG treated animals demonstrated less blood loss (not significant) and significantly higher MAPs
 - Survival:
 - Combat Gauze = 80%
 - Trauma Stat = 20%
 - Placebo Gauze = 33%
 - Combat Gauze was the most efficacious dressing
 - It works by increasing blood clotting activities and the formation of a hemostatic clot
 - Thus it might not be as effective in the coagulopathic patient

Advanced Hemostatic Dressings Are Not Superior to Gauze for Care Under Fire Scenarios

Study Question: Are hemostatic bandages effective in the absence of compression?

- Hemorrhage control
- Blood loss
- MAP
- Survival

Bleeding Wound

Serious Bleeding

Hemorrhage Control

1. No one should die from a compressible extremity wound
2. Rapidly and appropriately applied direct pressure is a critical intervention
3. Hemostatic bandages are effective when utilized as specified
4. Tourniquets save lives when used early in the setting of major limb trauma