



Introduction

- Trauma is the #1 overall cause of death for age groups 1-44, and is the #3 leading cause of death across all age groups.
- Uncontrolled hemorrhage is the second major cause of death in the civilian trauma population, and the leading cause of preventable mortality in the first 24 hours after a trauma¹.
- In the civilian population, penetrating trauma represents a smaller portion of injury mechanism compared to blunt trauma, and is associated with a far greater percentage of major vascular injuries².
- Given these facts, there has been significant research into the development of hemostatic agents designed to improve hemorrhage control, with many of these efforts driven by the United States military. These efforts lead to the development of products seeded with hemostatic agents, such as Combat Gauze™. Combat Gauze™, a QuikClot product, is a soft, white, sterile 3 inch by 4 yard piece of gauze that is impregnated with Kaolin. Kaolin is a hemostatic agent that promotes fibrin clot formation through activation of the intrinsic clotting pathway.
- Currently all deployed US army soldiers carry Combat Gauze™ ([CG] Z-Medica QuikClot®, Wallingford, CT).
- All soldiers are advised to use it by the Tactical Combat Casualty Care (TCCC) committee in the setting of external hemorrhage not amenable to tourniquet placement³.
- Combat Gauze™ is approved by the US Food and Drug Administration (FDA) for external usage in hemorrhage (510(K); #K120782)³.
- Combat Gauze™ has successfully been shown to significantly decrease hemorrhage and mortality in femoral swine injury models⁴⁻⁶, as well as significantly increase survival time and decrease blood loss compared to swine treated with plain packing⁷.
- Combat Gauze™ is already utilized by many departments in the pre-hospital care of trauma patients with external hemorrhage.

Objectives

- To evaluate our institutional use of Combat Gauze™ in the acute treatment of penetrating wounds.
- To encourage widespread early use of Combat Gauze™ in the control of external hemorrhage in penetrating trauma.

Methods

A retrospective review of all patients at an urban Level-I Trauma Center who presented with a penetrating injury from July 1st, 2010 through September 1st, 2014 who had a wound packing technique utilized (**n=194**).

Inclusion Criteria

- Penetrating injury defined as a gunshot wound, knife stab wound, or impalement
- Use of Combat Gauze™ in the initial management of their injuries for control of hemorrhage

Exclusion Criteria

- Did not have Combat Gauze™ utilized in control of external hemorrhage
- Did not initially present to Cooper University Hospital (i.e. Transferred from outside hospital/facility)

Results

Of 194 patients admitted with penetrating trauma who had wound packing utilized during the course of their hospitalization, **5 patients** (table 1) were identified who met all inclusion criteria.

Table 1. Injury Pattern of Patients

ISS	Mechanism and Locations of Injury	Specific Injuries Requiring Operative Intervention	Operative Intervention(s) in First 24 hours following Injury	Use of Combat Gauze™	Patient Length of Stay
9	Multiple GSW's to chest	Rib Fx, Intercostal artery disruption, Lung parenchymal Injury	1. R Lung wedge resection, Intercostal art. ligation, Pericardial window (-)	2 GSW sites pre and post-operatively	25
9	Bilateral GSW's to groin areas	Left popliteal artery and vein injury	1. Femoral to below knee bypass, Thrombectomy 2. Decompressive laparotomy for ACS	2 GSW sites pre and post-operatively	35
14	Multiple chest, Abdominal, and Facial with KSW's with Sparing of the neck	Omental hematoma, Chest violation	1. Local wound exploration, Exlap, Omentectomy, Pericardial window (-)	KSW on chest and abdomen sites post-operatively	1
17	Bilateral GSW's to thigh areas	Transection L femoral vein, L profunda artery	1. Ligation L profunda art. and L femoral vein, L femoral art. thrombectomy, Fasciotomy	L groin GSW site post-operatively	22
41	GSW from 10 gauge shotgun at close range (<5 feet) to R pelvis	Multiple Pelvic Fx's, R internal iliac art. Transection, B/L internal iliac vein injuries, Distal aortic injury, Distal IVC injury, Extensive pelvic venous plexus disruption, Multiple rectal enterotomies	1. Exlap, ligation of R internal iliac art., ligation B/L internal iliac vein, primary repair of aorta; primary repair of IVC, excision blast injured pelvic bone and muscle 2. Exlap, abdominal washout, low anterior rectal resection, wound exploration ^(Image 1)	R pelvic GSW site pre-operatively ^(Image 2) and post-operatively following both procedures	47

GSW = Guns shot wound; KSW = Knife stab wound ; ISS = Injury Severity Score; ACS = Abdominal Compartment Syndrome; Fx: Fracture; B/L = Bilateral; IVC = Inferior Vena Cava



Image 1: Right pelvic shotgun wound prior to second operative exploration



Image 2: Plain film X-ray showing Combat Gauze™ packed in shotgun wound (circled)

Conclusion

- Combat Gauze controlled external hemorrhage in the acute setting for the patients identified through this study.
- There were no documented re-bleeds, and complex care (care beyond daily dressing changes) was not required for any wound site in which Combat Gauze™ was utilized.
- The cases reviewed for this study show that **Combat Gauze™ has a role in the acute control of external hemorrhage from penetrating trauma.**

Ongoing and Future Research

- Cooper University Hospital is currently involved in multiple clinical research projects involving the use of Combat Gauze™ for control of hemorrhage in the acute trauma setting.
- A study on the clinical use of Combat Gauze™ during operative control of internal hemorrhage will be presented at the 28th Annual Eastern Association of Trauma this winter.
- We are involved in multiple animal studies assessing the use of Combat Gauze in both extra and intra-corporeal control of hemorrhage.

References

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