The Management of Abdominal Evisceration in Tactical Combat Casualty Care

TCCC Guideline Change 20-02

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ABSTRACT

Historically, about 20% of hospitalized combat injured patients have an abdominal injury. Abdominal evisceration may be expected to complicate as many as one-third of battle-related abdominal wounds. The outcomes for casualties with eviscerating injuries may be significantly improved with appropriate prehospital management. While not as extensively studied as other forms of combat injury, abdominal evisceration management recommendations extend back to at least World War I, when it was recognized as a significant cause of morbidity and was especially associated with bayonet injury. More recently, abdominal evisceration has been noted as a frequent result of penetrating, ballistic trauma. Initial management of abdominal evisceration for prehospital providers consists of assessing for and controlling associated hemorrhage, assessing for bowel content leakage, covering the eviscerated abdominal contents with a moist, sterile barrier, and carefully reassessing the patient. Mortality in abdominal evisceration is more likely to be secondary to associated injuries than to the evisceration itself. Attempting to establish education, training, and a standard of care for nonmedical and medical first responders and to leverage current wound management technologies, the Committee on Tactical Combat Casualty Care (CoTCCC) conducted a systematic review of historical Service guidelines and recent medical studies that include abdominal evisceration. For abdominal evisceration injuries, the following principles of management apply:

- Control any associated bleeding visible in the wound.
- If there is no evidence of spinal cord injury, allow the patient to take the position of most comfort.
- Rinse the eviscerated bowel with clean fluid to reduce gross contamination.
- Cover exposed bowel with a moist, sterile dressing or a sterile water-impermeable covering. It is important to keep the wound moist; irrigate the dressing with warm water if available.
- For reduction in wounds that do not have a substantial loss of abdominal wall, a brief attempt may be made to replace/reduce the eviscerated abdominal contents. If the external contents do not easily go back into the abdominal cavity, do not force or spend more than 60 seconds attempting to reduce contents. If reduction of eviscerated contents is successful, reapproximate the skin using available material, preferably an adhesive dressing like a chest seal (other examples include safety pins, suture, staples, wound closure devices, etc.). Do not attempt to reduce bowel that is actively bleeding or leaking enteric contents.
- If unable to reduce, cover the eviscerated organs with water-impermeable, nonadhesive material (transparent preferred to allow ability to reassess for ongoing bleeding; examples include a bowel bag, IV bag, clear food wrap, etc.), and then secure the impermeable dressing to the patient using an adhesive dressing (e.g., Ioban, chest seal).
- Do NOT FORCE contents back into abdomen or actively bleeding viscera.
- Death in the abdominally eviscerated patient is typically from associated injuries, such as concomitant solid organ or vascular injury, rather than from the evisceration itself.
- Antibiotics should be administered for any open wounds, including abdominal eviscerating injuries. Parenteral ertapenem is the preferred antibiotic for these injuries.

KEYWORDS: *abdominal injury; abdominal evisceration; battle-related abdominal wounds; prehospital management*

Proximate Reasons for This Proposed Change

To date, the CoTCCC guidelines have not specifically addressed the issue of abdominal evisceration. There had been discussion by the Wilderness Medical Society at a Tactical Combat Casualty Care (TCCC) workshop in the late 1990s. However, the discussions of this topic at the WMS workshop were never integrated into the TCCC Guidelines.[1] Given the potential for prolonged casualty care (PCC) in future conflict,[2,3] delayed surgical treatment may complicate the care of these patients. Initial assessment and resuscitation in trauma management to effect ongoing PCC are included in the CoTCCC guidelines, reducing both initial mortality and subsequent morbidity. In the case of battlefield abdominal trauma, current research efforts are largely focused on hemorrhage. Truncal and junctional hemorrhage remain a key focus due to the difficulty of managing these conditions in the prehospital environment, in the hope of preventing mortality.[4,5] As a subcomponent of abdominal wounding, the specific management of abdominal evisceration includes initial hemorrhage control, wound care, and continued reassessment including serial examinations to ensure eviscerated contents remain viable and

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further management to prevent desiccation and ischemia. The presence of eviscerated abdominal contents does not imply that sources of intra-abdominal or pelvic bleeding will be able to be identified and controlled through the defect in the abdominal wall. The CoTCCC does continue to make recommendations to reduce the mortality from truncal hemorrhage, especially when the source of hemorrhage is in the abdomen or the pelvis, but these recommendations are distinct from the recommendations for managing abdominal evisceration. Active management of abdominal evisceration is recommended to reduce hemorrhage, increase intra-abdominal organ viability, reduce hypothermia, and reduce complications related to sepsis.

Photo courtesy Dr D Marc Northern

Background

Abdominal wounds have historically been responsible for around 20% of all wounds presenting to a hospital in armed conflict, with mortality due to these wounds dropping proportionally as forward surgery and rapid transport became increasing available.[6,7] In 1875, Sir William MacCormac, surgeon-in-chief of the Anglo-American Ambulance in the Franco-Prussion War, wrote, "Of penetrating wounds of the abdomen, we saw but few, and the subjects of these died rapidly of peritonitis and shock." After a 54-day campaign in Metz, MacCormac noted, "As might be anticipated, the penetrating abdominal wounds were all fatal."[8] These pre–World War (WW) I discussions led to debate in the surgical community whether there was value in laparotomy for war wounds of the abdomen versus the orthodoxy of the time to manage abdominal wounds as expectant. This viewpoint evolved somewhat in favor of laparotomy in WWI. In WWI, abdominal wounding was recognized as a significant cause of mortality, with most estimates ranging between 55% and 77% of patients dying due their injuries. Abdominally wounded patients were still almost always triaged "expectant," even if they were able to reach a surgeon within 1 hour.[9] Mortality was so high that in Dr George G. Davis's case series (N = 2,525 combat-wounded patients) under his care in a WWI evacuation hospital, he reported only one survivor of bayonet wounding to the abdomen. He concluded that bayonet wounds of the abdomen are almost always lethal due to hemorrhage.[6]

In WWII, mortality rates due to abdominal injury dropped significantly to 18-36%.[6,7] The Korean War and the US experience in Vietnam saw even further decreases to 12%, and then to as low as 4% mortality in one series in Vietnam. Hardaway's study of 17,726 wounded American soldiers in Vietnam over 15 months, from March 1966 to July 1967, provided evidence to support improved survival due to wide availability of blood and blood products on the battlefield and rapid medical evacuation to surgical management.[10] Notably, in patients who died of wounds (DOW), with abdominal wounding as their primary injury, 60% succumbed to hemorrhage, 25% to sepsis, and 15% to pulmonary insufficiency. By the end of Vietnam, research was drawing a clear correlation between number of intraabdominal organs injured and mortality, with survivors having an average of 1.8 injured organs.[7]

In one review from OEF/OIF, abdominal wounds constituted 9.4% of 6,609 wounds recorded by the US Joint Trauma Registry; 81% of abdominal injuries were caused by explosions, 17% by gunshots, and 2% by motor vehicle collisions.[11] Little was published on *prehospital* management of abdominal wounding during the Operation Iraqi Freedom (OIF) and Operation Enduring Freedom (OEF) era from 2001–2015. This is likely due to the fact that "golden hour" MEDEVAC became a Secretary of Defense mandate in Afghanistan in 2009, directing that every seriously injured combat casualty would arrive at a medical treatment facility with surgical capability within 1 hour of the MEDEVAC mission approval. This policy produced a significant reduction in Case Fatality Rate, with an estimated 359 lives saved from 2009–2013.[12] Clearly, early operative management of the abdominally wounded combatant is essential, and discussion during the OIF/OEF era centered largely around damage control surgery vs. definitive laparotomy.[13] During this same time period, De Robles and Ayuste published a review of 98 laparotomies performed for civilian stab wound victims with omental evisceration. Based on their findings that 81% of their patients had therapeutic laparotomy, they recommended prompt operative management for any abdominal trauma with omental evisceration.[14]

Infection, especially if associated with delayed presentation, must be considered at all echelons of care. A study of 211 predominantly host-nation injured patients cared for on the USNS Comfort during the first months of the Iraq War found 30% of abdominal injuries were infected, yielding an odds ratio of 2.7 for an abdominal injury to develop an infection.[15]

The US Department of Defense Trauma Registry (DODTR) provides additional recent evidence for the overall burden of abdominal evisceration in combat. Data from a 14-year period during US combat operations reveal 26,548 abdominal procedures were performed, comprising 13% of combat surgery from 2002 to 2016.[16] Of note, any trauma patient who dies before reaching Role 2 care will likely not be found in the DoDTR. Therefore, the mortality rate for casualties with abdominal eviscerations could potentially be higher than what has been published although the evisceration is unlikely to be the proximate cause of death, but the hemorrhagic component of this wounding pattern would contribute most to the mortality.

In his review of patients from ongoing armed conflict in Nigeria, Olorundare studied 109 abdominal injuries over a 2-year period from 2010 to 2012. Eviscerated bowels were present in 34 patients (31%) and were largely due to ballistic wounding (10:1 ratio of penetrating trauma to blunt trauma for all abdominal wounds). The case fatality rate was 10.8%, and

mortality in abdominally wounded patients was usually due to hemorrhage. Concomitant head injury, 3 or more injured intraabdominal organs, and delayed presentation (defined as greater than 12 hours from time of injury) were associated with mortality. Small intestine 69 (63.3%), colon 48 (44%), and liver 41 (37.6%) were the most commonly injured organs. In this series, abdominally wounded patients required an average of 2100mL of blood products to restore hemodynamic stability. Death after 48 hours was almost universally due to sepsis.[17]

IED fragment entry at right groin (visible on lower aspect of photo) with exit at LUQ with small bowel evisceration. Photo courtesy Dr Brian Eastridge

In February 2019, the CoTCCC reviewed the current literature and prehospital evidence for management of abdominal evisceration. In addition to questions about what each of the US DoD Services are teaching regarding prehospital management of abdominal evisceration, the following questions were raised during this review:

1. What is the overall combat trauma burden of abdominal evisceration?
2. What are the preventable and proximate causes of death in abdominal injury and abdominal evisceration specifically?
3. What specific prehospital interventions could reduce the mortality of abdominal evisceration?
4. Does wound management in the pre-hospital setting favorably impact patient mortality? If so, what is the preferred method for managing abdominal evisceration?
5. Does a requirement exist for a novel wound management device to improve outcomes in casualties with abdominal evisceration?

Discussion

1. **What is the overall combat trauma burden of abdominal evisceration?**
   While there is no specific study addressing abdominal evisceration as a cause of death, approximately 7% of modern battlefield injuries may be expected to present with an abdominal evisceration.[7,10,17] In one civilian trauma study, evisceration of small bowel or omentum was always associated with significant intraperitoneal injury.[18] One Cook County Hospital study specifically investigated evisceration after abdominal stab wounds. Researchers noted that 78% of abdominal eviscerations due to stabbing had an intra-abdominal injury that required repair.[19]
2. **What are the preventable causes of death in abdominal injury and abdominal evisceration specifically?**
   In the past, the recommendations in the TCCC Guidelines for casualties with penetrating abdominal trauma have focused primarily on preventing death due to abdominopelvic hemorrhage, since that is the primary cause of preventable death in casualties with this type of wound. An estimated two-thirds of deaths involving war-related abdominal evisceration are due to hemorrhage.[7] It is unclear whether the presence of eviscerated abdominal contents should result in any alteration of TCCC recommendations regarding the management of noncompressible sources of hemorrhage, but the presence of a source of bleeding that is visible as a result of the evisceration does offer the potential to use a CoTCCC-recommended hemostatic dressing to control that source of bleeding. Infection is also a potentially preventable cause of death in eviscerating injuries, with sepsis causing death in an estimated 25% of combat wounded abdominal trauma patients.[7] Finally, an estimated 15–25% of patients with eviscerating injury will have associated thoracic injuries.[7,20] Thoracic injuries that produce open or tension pneumothoraces should be managed in accordance with TCCC recommendations for those conditions.
3. **What prehospital interventions reduce the mortality of abdominal evisceration?**
   Treatment for any noncompressible hemorrhage must remain the primary consideration in the prehospital management of eviscerating injuries. In the abdominally injured patient, careful handling of the evisceration wound itself will likely reduce overall bacterial contamination. The expert consensus from CoTCCC members was that protection of eviscerated intraabdominal contents may reduce local inflammation and cell death, protecting the natural gut/bloodstream barrier from insult, in addition to reducing heat and vapor loss from extruded organs. Antibiotics should be administered for any open wounds, including abdominal eviscerating injuries.[21–23] Due to considerations including spectrum of coverage, variable gut absorption secondary to injury, drug stability, once-daily dosage, and other logistical constraints, parenteral ertapenem is the preferred choice for eviscerating injuries.
4. **Does wound management in the prehospital setting favorably impact patient mortality? If so, what is the preferred method for managing abdominal evisceration?**

Photo courtesy Dr Brian Eastridge.

Evisceration from a 5.56 round that fragmented as it passed through a vehicle door prior to impacting the casualty

There exists no definitive study or clinical trials to address prehospital management of abdominal evisceration. Current recommendations will necessarily be based on experienced surgical opinion and extrapolated causes of death from the aforementioned studies.

5. **Does a requirement exist for a novel wound management device to best manage abdominal evisceration?**
   Prehospital management of abdominal evisceration can be adequately performed using currently fielded and commonly available medical materials. For prolonged casualty care considerations, there is a need for a bowel bag with adjustable base ring that adheres to skin, allowing for a more durable, longer-term dressing application.

CONCLUSION

Approved Change to the TCCC Guidelines

Current Wording

Basic Management Plan for Tactical Field Care

12. Inspect and dress known wounds.

Approved Change (changes in red text)

Basic Management Plan for Tactical Field Care

12. Inspect and dress known wounds.
    a. Inspect and dress known wounds
    b. Abdominal evisceration – [Control bleeding]; rinse with clean (and warm if possible) fluid to reduce gross contamination. Hemorrhage control – apply hemostatic dressing or hemostatic agent to uncontrolled bleeding. Cover exposed bowel with a moist, sterile dressing or sterile water-impermeable covering.
       - Reduction: do not attempt if there is evidence of ruptured bowel (gastric/intestinal fluid or stool leakage) or active bleeding.
       - If no evidence of bowel leakage and hemorrhage is visibly controlled, a single brief attempt (<60 seconds) may be made to replace/reduce the eviscerated abdominal contents.
       - If successful, reapproximate the skin using available material, preferably an adhesive dressing like a chest seal (other examples include suture, staples, wound closure devices).
       - If unable to reduce; cover the eviscerated organs with water impermeable nonadhesive material (transparent preferred to allow ability to reassess for ongoing bleeding); examples include a bowel bag, IV bag, clear food wrap, etc. and secure the impermeable dressing to the patient using adhesive dressing (examples: Ioban, chest seal).
       - Do NOT FORCE contents back into abdomen or actively bleeding viscera.
       - The patient should remain NPO.

Considerations for Prolonged Casualty Care.

Prolonged Care Considerations:

- It is OK to attempt reduction if a patient presents late after injury.
- Odds of a stable, successful reduction are low – make a single attempt to reduce and then dress in place.
- Hypothermia – monitor closely as exposed abdominal contents will result in more rapid heat loss.
- Re-evisceration – In the event of re-evisceration (hernia) remove the skin closure and cover the eviscerated organs as recommended in 12b.
- If no known endpoint exists for surgical care, consider attempting reduction as long as there is no gastric/intestinal fluid or stool leakage.

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