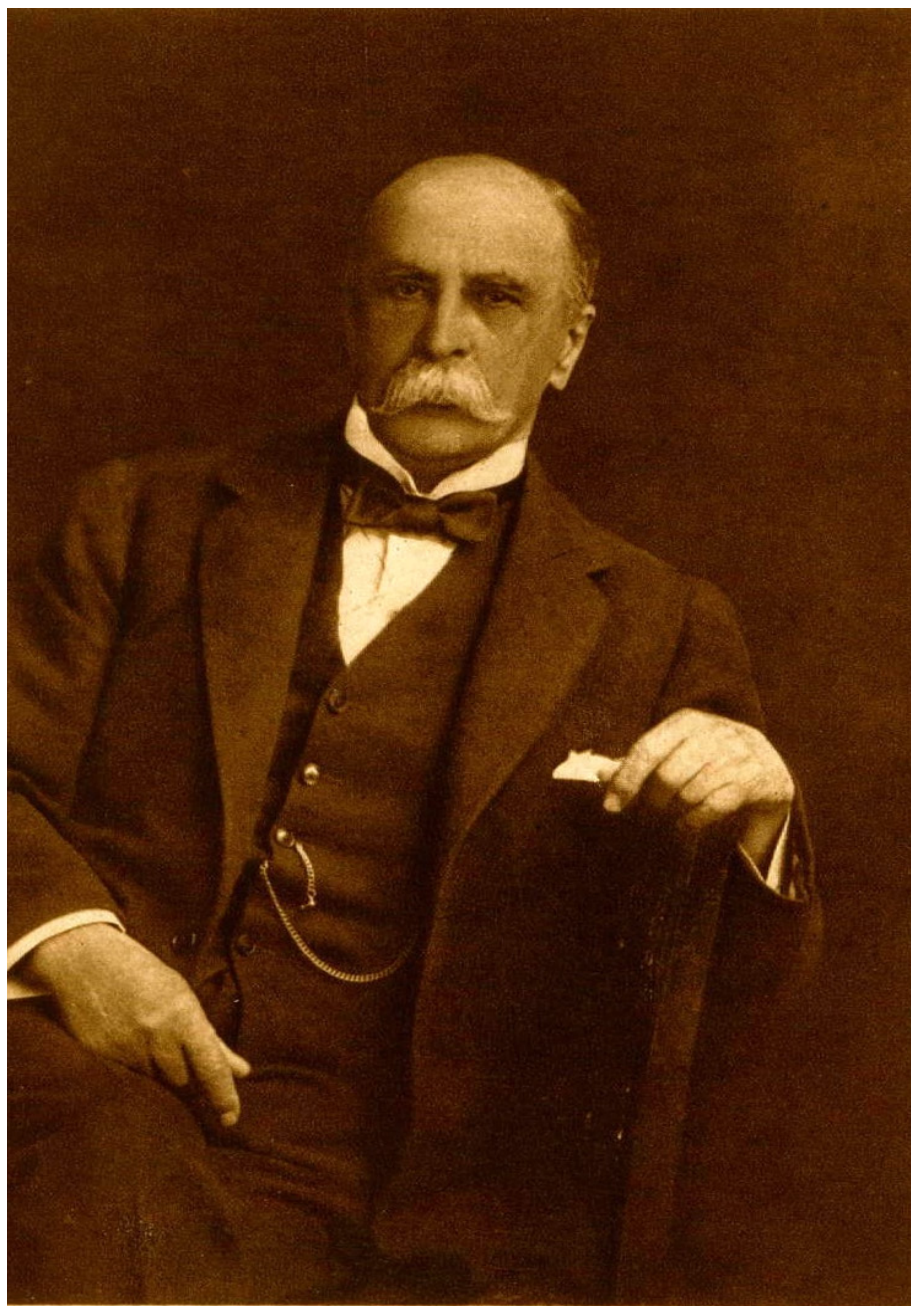


Principles in the Response to Preventing and Treating Combat-Related Injuries

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Aequanimitas

Wm Osler

"A distressing feature in the life which you are about to enter . . . is the uncertainty which pertains not alone to our science and art, but to the very hopes and fears which make us men. In seeking absolute truth we aim at the unattainable, and must be content with finding broken portions."

Sir William Osler

1889

Mortality Rates from Wounds Depicted in *The Iliad*

- Arrow wounds 42%
- Slingshot wounds 67%
- Spear wounds 80%
- Sword wounds 100%

The Golden Hour Principle

- That a victim's chances of survival are greatest if she or he receives resuscitation within the first hour after a severe injury

Emergency War Surgery 4th United States Revision

Chapter 10: Infections

- Opening Comment
 - All wounds incurred on the battlefield are grossly contaminated with bacteria. Most will become infected unless appropriate treatment is initiated quickly.

Chapter 10: Infections

- Fundamental Concept
 - Prompt surgical source control, including debridement and drainage, are the cornerstones of prophylaxis/treatment of all war wound infections.

- General Principles
 - Surgical and antibiotic treatment should begin as early as possible, ideally within 3 hours after injury and be repeated in the prophylaxis of war wound infections.
 - Optimally, surgical debridement should be achieved within 6 hours of injury.
 - Following initial exploration and debridement, the wound should be sufficiently irrigated to ensure that all dead material, bacterial contamination, and foreign material have been washed from the wound.

Principles in the Response to Preventing and Treating Combat-Related Injuries

Guidelines for the Prevention of Infections Associated With Combat-Related Injuries: 2011 Update

Endorsed by the Infectious Diseases Society of America and the Surgical Infection Society

Overwhelming majority of the recommendations in the guidelines:

IB Strong recommendation, moderate-quality evidence

Evidence from RCTs with important limitations (inconsistent results, methodological flaws, indirect, or imprecise) or exceptionally strong evidence from unbiased observational studies

Desirable effects clearly outweigh undesirable effects or vice versa

Recommendations to Prevent Infections Associated with Combat-Related Injuries Based on Level of Care

Role 1: Self-aid, buddy aid, combat lifesaver, and combat medic/corpsman care at point-of-injury; physician/physician assistant care at battalion aid station or shock trauma platoon; no patient holding capacity

Role 2: Medical company or expeditionary medical support; 72-hour patient holding capacity, basic blood transfusion, radiography, and laboratory support. May be supplemented with surgical assets

Role 3: Combat support hospital, Air Force Theater hospital, or casualty receiving ships; full inpatient capacity with intensive care units and operating rooms

Role 4: Regional hospital or USNS hospital ships, typically outside of the combat zone; general and specialized inpatient medical and surgical care

Role 5: Care facilities within United States, typically tertiary care medical centers

Levels of Care for US Wounded in Iraq/Afghanistan

| Level of care | Description |
|---------------|---|
| I | Battalion Aid Station (unit level, combat medic, immediate first aid and transport) |
| II | Forward Surgical Team, limited emergency surgery capabilities |
| III | Army Combat Support Hospital (theater hospital with intensive care) |
| IV | Landstuhl Regional Medical Center, Germany (multidisciplinary surgical trauma management for catastrophic injury) |
| V | Major stateside trauma centers with teaching and research: Brooke Army Medical Center, Walter Reed Army Medical Center, National Naval Medical Center, San Diego Naval Medical Center |

Recommendations to Prevent Infections Associated with Combat-Related Injuries Based on Level of Care

| Level of Care* | Care Category | Recommendations |
|--|----------------------------|--|
| Role 1/Level I (prehospital) | Initial care in the field | -Bandage wounds with sterile dressings (avoid pressure over eye wounds) (IB) Stabilize fractures (IB) Transfer to surgical support as soon as feasible (IB) |
| | Postinjury antimicrobials | Provide single-dose point-of-injury antimicrobials (Table 3) if evacuation is delayed or expected to be delayed (IC) |
| Role 1/Level II / Role 2/Level II without surgical support (IIa) | Postinjury antimicrobials | Provide IV antimicrobials (Table 3) as soon as possible (within 3 h) (IB) Provide tetanus toxoid and immune globulin as appropriate Enhance gram-negative coverage with aminoglycoside or fluoroquinolone not recommended (IB) Addition of penicillin to prevent clostridial gangrene or streptococcal infection is not recommended (IC) Redose antimicrobials if large volume blood produce resuscitation (IC) Use only topical antimicrobials for burns (IB) |
| | Debridement and irrigation | Irrigate wounds to remove gross contamination with normal saline, sterile, or potable water, under low pressure (bulb syringe or equivalent) without additives (IB) Do not attempt to remove retained deep soft tissue fragments if criteria met (IB) . [†] Provide cefazolin 2 g IV × 1 dose |

Role 1: Self-aid, buddy aid, combat lifesaver, and combat medic/corpsman care at point-of-injury; physician/physician assistant care at battalion aid station or shock trauma platoon; no patient holding capacity

Role 2: Medical company or expeditionary medical support; 72-hour patient holding capacity, basic blood transfusion, radiography, and laboratory support. May be supplemented with surgical assets

Level I: Battalion Aid Station (unit level, combat medic, immediate first aid and transport)

Level II: Forward Surgical Team, limited emergency surgery capabilities

Recommendations to Prevent Infections Associated with Combat-Related Injuries Based on Level of Care

| | | |
|--|----------------------------|---|
| Role 2/Level II with surgical support (IIb)/ Role 3/ Level III | Postinjury antimicrobials | <p>Provide IV antimicrobials (Table 3) as soon as possible (within 3 h) (IB)</p> <p>Provide tetanus toxoid and immune globulin as appropriate</p> <p>Enhance gram-negative coverage with aminoglycoside or fluoroquinolone not recommended (IB)</p> <p>Addition of penicillin to prevent clostridial gangrene or streptococcal infection is not recommended (IC)</p> <p>Redose antimicrobials if large volume blood produce resuscitation (IC)</p> <p>Use only topical antimicrobials for burns (IB)</p> <p>Antimicrobial beads or pouches may be used (IB)</p> <p>Provide postsplenectomy immunizations if indicated (IB)</p> |
| | Debridement and irrigation | <p>Irrigate wounds to remove contamination with normal saline or sterile water, under low pressure (5–10 PSI, e.g., bulb syringe or gravity flow) without additives (use 3 L for each Type I, 6 L for each Type II, and 9 L for each Type III extremity fractures) (IB)</p> <p>Do not attempt to remove retained deep soft tissue fragments if criteria met (IB).[†] Provide cefazolin 2 g IV × 1 dose</p> <p>Do not obtain cultures unless infection is suspected (IB)</p> |
| | Surgical wound management | <p>Surgical evaluation as soon as possible (IB)</p> <p>Only dural and facial wounds should undergo primary closure (IB)</p> <p>NPWT can be used (IB)</p> <p>External fixation (temporary spanning) of femur/tibia fractures (IB)</p> <p>External fixation (temporary spanning) or splint immobilization of open humerus/forearm fractures (IB)</p> |

Role 2: Medical company or expeditionary medical support; 72-hour patient holding capacity, basic blood transfusion, radiography, and laboratory support. May be supplemented with surgical assets

Role 3: Combat support hospital, Air Force Theater hospital, or casualty receiving ships; full inpatient capacity with intensive care units and operating rooms

Level II: Forward Surgical Team, limited emergency surgery capabilities

Level III: Army Combat Support Hospital (theater hospital with intensive care)

Recommendations to Prevent Infections Associated with Combat-Related Injuries Based on Level of Care

| | | |
|-----------------|----------------------------|--|
| Role 4/Level IV | Postinjury antimicrobials | Complete course of postinjury antimicrobials (Table 3) Antimicrobial beads or pouches may be used (IB) Provide postsplenectomy immunizations if indicated (IB) |
| | Debridement and irrigation | Irrigate wounds to remove contamination with normal saline or sterile water, under low pressure (5–10 PSI, e.g., bulb syringe or gravity flow) without additives (use 3 L for each Type I, 6 L for each Type II, and 9 L for each Type III extremity fractures) (IB) Do not attempt to remove retained deep soft tissue fragments if criteria met (IB) . [†] Provide cefazolin 2 g IV × 1 dose Do not obtain cultures unless infection is suspected (IB) |
| | Surgical wound management | Wounds should not be closed until 3–5 d postinjury (IB) Only dural and facial wounds should undergo primary closure (IB) NPWT can be used (IB) External fixation (temporary spanning) of femur/tibia fractures (IB) External fixation (temporary spanning) or splint immobilization of open humerus/forearm fractures (IB) |

Role 4: regional hospital or USNS hospital ships, typically outside of the combat zone; general and specialized inpatient medical and surgical care

Level IV: Regional Medical Center

Performance Measures in the Prevention of Infection Associated With Combat-Related Injuries

1. Use of a recommended antimicrobial versus other antimicrobial or combination of antimicrobials for postinjury therapy
2. Time from injury to delivery of postinjury antimicrobials
3. Change in rates of colonization with MDR bacteria at admission to tertiary care medical facilities outside the combat zone
4. Change in rates of infection with MDR bacteria during care at tertiary care medical facilities outside the combat zone

A Clinically Relevant Definition and Statement

- Wound infection defined as “invasion and multiplication of microorganisms in a wound resulting in tissue injury and a host reaction”¹
 - “Infection is a clinical diagnosis.”

- Statement of the International Committee of the Red Cross (ICRC)
 - “The best antibiotic is good surgery.”²

¹Eardley WGP et al. *Phil Trans R Soc B* 2011;366:204-218

²Giannou C, Balcan M. 2009 Infections in War Wounds. *War Surgery*, pp. 263-266. Geneva, Switzerland: International Committee of the Red Cross