Infection Prevention in Combat-Related Injuries

Part of the Joint Trauma System (JTS) Clinical Practice Guideline (CPG) Training Series
Purpose

This CPG provides evidence-based guidelines for the prevention of infections in combat casualties.

This presentation is based on the JTS Infection Prevention in Combat-Related Injuries CPG, 08 Aug 2016 (ID: 24). It is a high-level review. Please refer to the complete CPG for detailed instructions. Information contained in this presentation is only a guideline and not a substitute for clinical judgment.
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3. Standard Precautions
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Summary

- Precautions should be taken to prevent transmission of organisms between care givers and patients.
- Appropriate antibiotics should be given for specific lengths of time based on injury type.
Background

The combat environment presents unique challenges to infection control.

- Multiple patient transfers between hospitals and teams
- Austere environment
- Long distance aeromedical evacuation
- Colonization of multi-drug resistant organisms
In all patients, regardless of suspected or confirmed infectious status, standard precautions are required to include:

- **Hand Washing**: Perform even if gloves are worn, before patient contact, before aseptic tasks, after body fluid exposure risk, after contact with patients and their surroundings.

- **Gloves**: Use when anticipating direct contact with non-intact skin, mucous membranes, and blood or bodily fluids.
Continued...

- **Masks**: Protect from contact with infectious materials from patients and from contact with the patient during sterile techniques.

- **Goggles/Face Shields**: Use based on anticipated exposure to eyes. Eyeglasses and contacts are not considered adequate eye protection.
Preventing cross contamination of multi-drug resistant organisms (MDRO) and C. difficile requires special precautions:

- **Contact Precautions**: Gloves and gowns should be worn with all patients suspected or known to have MDRO or C. difficile infection (CDI).

- **Cohorting**: Cluster long term (host nation patients, > 72 hour stay) and short term (U.S. personnel) patients, and separate when possible to reduce cross contamination.

- **Skin Care**: ICU patients should undergo daily chlorhexidine gluconate bath. Full protocol available in the CPG Appendix D: Sage Antiseptic Body Cleaning.

- **Antibiotic Control**: Avoid unnecessary empiric broad spectrum antibiotics, use local antibiogram, and limit duration of antibiotic therapy.
Transmission-Based Precautions

- A broad array of injury types with prophylactic antibiotic choices along with durations are available in the CPG.
- For each traumatic injury, appropriate antibiotics should be chosen and given based on CPG recommendations.
## Post-Injury Antimicrobial Agent Selection and Duration Based Upon Injury Pattern

<table>
<thead>
<tr>
<th>Injury</th>
<th>Preferred Agent(s)</th>
<th>Alternate Agent(s)</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Extremity Wounds (includes skin, soft tissue, bone)</strong></td>
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<tr>
<td>Skin, soft tissue, no open fractures</td>
<td>Cefazolin, 2 gm IV q6-8h (^{b,c})</td>
<td>Clindamycin (300-450 mg PO TID or 600 mg IV q8h)</td>
<td>1-3 days</td>
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<tr>
<td>Skin, soft tissue, with open fractures, exposed bone, or open joints</td>
<td>Cefazolin 2 gm IV q6-8h (^{b,c,d})</td>
<td>Clindamycin 600 mg IV q8h</td>
<td>1-3 days</td>
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<tr>
<td><strong>Thoracic Wounds</strong></td>
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<tr>
<td>Penetrating chest injury without esophageal disruption</td>
<td>Cefazolin, 2 gm IV q6-8h (^{b,c})</td>
<td>Clindamycin (300-450 mg PO TID or 600 mg IV q8h)</td>
<td>1 day</td>
</tr>
<tr>
<td>Penetrating chest injury with esophageal disruption</td>
<td>Cefazolin 2 gm IV q 6-8h (^{b,c}) PLUS metronidazole 500 mg IV q8-12h</td>
<td>Ertapenem 1 gm IV x 1 dose, OR moxifloxacin 400 mg IV x 1 dose</td>
<td>1 day after definitive washout</td>
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<tr>
<td><strong>Abdominal Wounds</strong></td>
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<tr>
<td>Penetrating abdominal injury with suspected/known hollow viscus injury and soilage; may apply to rectal/perineal injuries as well</td>
<td>Cefazolin 2 gm IV q 6-8h (^{b,c}) PLUS metronidazole 500 mg IV q8-12h</td>
<td>Ertapenem 1 gm IV x 1 dose, OR moxifloxacin 400 mg IV x 1 dose</td>
<td>1 day after definitive washout</td>
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<tr>
<td><strong>Maxillofacial and Neck Wounds</strong></td>
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<tr>
<td>Open maxillofacial fractures, or maxillofacial fractures with foreign body or fixation device</td>
<td>Cefazolin 2 gm IV q6-8h (^{b,c})</td>
<td>Clindamycin 600 mg IV q8h</td>
<td>1 day</td>
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<tr>
<td><strong>Central Nervous System Wounds</strong></td>
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<tr>
<td>Penetrating brain injury</td>
<td>Cefazolin 2 gm IV q6-8h. (^{b,c}) Consider adding metronidazole 500 mg IV q8-12h if gross contamination with organic debris</td>
<td>Ceftriaxone 2 gm IV q24h. Consider adding metronidazole 500 mg IV q8-12h if gross contamination with organic debris. For penicillin allergic patients, vancomycin 1 gm IV q12h PLUS ciprofloxacin 400 mg IV q8-12h</td>
<td>5 days or until CSF leak is closed, whichever is longer</td>
</tr>
<tr>
<td>Penetrating spinal cord injury</td>
<td>Cefazolin 2 gm IV q6-8h. (^{b,c}) ADD metronidazole 500 mg IV q8-12h if abdominal cavity is involved</td>
<td>As above. ADD metronidazole 500 mg IV q8-12h if abdominal cavity is involved</td>
<td>5 days or until CSF leak is closed, whichever is longer</td>
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## Post-Injury Antimicrobial Agent Selection and Duration Based Upon Injury Pattern

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<tr>
<td><strong>Eye Wounds</strong></td>
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<tr>
<td>Eye Injury, Burn or Abrasion</td>
<td>Topical: Erythromycin or Bacitracin ophthalmic ointment QID and PRN for symptomatic relief Systemic: No systemic treatment required</td>
<td>Fluoroquinolone 1 drop QID</td>
<td>Until epithelium healed (no fluorescein staining)</td>
</tr>
<tr>
<td>Eye Injury, penetrating</td>
<td>Levofloxacin 500 mg IV/PO once daily. Prior to primary repair, no topical agents should be used unless directed by ophthalmology</td>
<td></td>
<td>7 days or until evaluated by an ophthalmologist</td>
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<tr>
<td><strong>Burns</strong></td>
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<tr>
<td>Superficial burns</td>
<td>Topical antimicrobials with twice daily dressing changes (include mafenide acetate® or silver sulfadiazine; may alternate between the two), OR silver impregnated dressing changed q3-5d, OR Biobrane</td>
<td>Silver nitrate solution applied to dressings</td>
<td>Until healed.</td>
</tr>
<tr>
<td>Deep partial thickness burns</td>
<td>Topical antimicrobials with twice daily dressing changes, OR silver impregnated dressing changed q3-5d, PLUS excision and grafting</td>
<td>Silver nitrate solution applied to dressings PLUS excision and grafting</td>
<td>Until healed or grafted</td>
</tr>
<tr>
<td>Full thickness burns</td>
<td>Topical antimicrobials with twice daily dressing changes PLUS excision and grafting</td>
<td>Silver nitrate solution applied to dressings PLUS excision and grafting</td>
<td>Until healed or grafted</td>
</tr>
<tr>
<td><strong>Point of Injury Delayed Evacuation</strong></td>
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<tr>
<td>Expected delay to reach surgical care</td>
<td>Moxifloxacin 400 mg PO x 1 dose. Ertapenem 1 g IV or IM if penetrating abdominal injury, shock, or unable to tolerate PO medications</td>
<td>Levofloxacin 500 mg PO x 1 dose. Cefotetan 2 g IV or IM q12h if penetrating abdominal injury, shock, or unable to tolerate PO medications</td>
<td>Single dose therapy</td>
</tr>
</tbody>
</table>
Healthcare workers and personnel are at risk for exposure of bloodborne pathogens.

- Blast injuries can introduce bloodborne pathogens if body parts from other people are impaled into the trauma patients.

- Healthcare workers are at risk during care of trauma patients for blood exposure to non-intact skin, eyes or mucosa and during breaks in surgical technique.

If exposed, source testing should be obtained for Hepatitis B (HBV) and C (HCV) Virus, and Human Immunodeficiency Virus (HIV) at time of exposure and 6 months post exposure.
Bloodborne Pathogens

- HBV Exposure:
  - Military personnel are required to have Hepatitis B vaccines, but confirmation of anti-HGV status is recommended.
  - Hepatitis B Immune Globulin is available for personnel not adequately immunized.

- HIV Exposure: 28 days of post-exposure prophylaxis should be administered within 1-2 hours, but no later than 72 hours.

- HCV Exposure: No post-exposure prophylaxis is available, but testing for the virus can be done.
Infection Control Based on Role of Care

- Role 2 and above should have a designated infection control officer.

- Infection control recommendations are available via tele-consultation if needed. ADVISOR, the ADvanced VIrtual Support OpeRational forces system, offers 24/7/365 on-demand real-time telemedicine consultations. [https://prolongedfieldcare.org/telemed-resources-for-us-mil/](https://prolongedfieldcare.org/telemed-resources-for-us-mil/)

- CPG provides general recommendations for each Role of Care.
Infection Control Based on Role of Care

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<th>RECOMMENDATIONS</th>
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| Role 1 (Prehospital) | Initial care in the field | • Bandage wounds with sterile dressings (avoid pressure over eye wounds).  
• Stabilize fractures.  
• Transfer to surgical support as soon as feasible. |
| Post-injury antimicrobials | • Provide single dose point of injury antimicrobials (Appendix B*) if evacuation is delayed or expected to be delayed |
| Role 1 and Role 2 without surgical support (2a) | Post-injury antimicrobials | • Provide intravenous antimicrobials for open wounds (Appendix B*) as soon as possible (within 3 hours).  
• Provide tetanus toxoid and immune globulin as appropriate.  
• Gram negative coverage with aminoglycoside or fluoroquinolone not recommended.  
• Addition of penicillin to prevent clostridial gangrene or streptococcal infection is not recommended.  
• Redose antimicrobials if large volume blood product resuscitation.  
• Use only topical antimicrobials for burns. |
| Debridement and irrigation | • Irrigate minor wounds to remove gross contamination with normal saline, sterile, or potable water without additives.  
• Debridement and irrigation of large wounds should be done at a surgical facility (Role 2b or 3).  
• Do not attempt to remove retained deep soft tissue fragments if criteria met. Provide Cefazolin 2 gm IV x 1 dose. |

*Appendix B: Post-injury Antimicrobial Agent Selection and Duration Based Upon Injury Pattern
Infection Control Based on Role of Care

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| Role 2 with surgical support and Role 3 | Post-injury antimicrobials | • Provide intravenous antimicrobials (Appendix B*) as soon as possible (within 3 hours).  
• Provide tetanus toxoid and immune globulin as appropriate.  
• Gram negative coverage with aminoglycoside or Fluoroquinolone not recommended.  
• Addition of penicillin to prevent clostridia gangrene or streptococcal infection is not recommended.  
• Redose antimicrobials if large volume blood product resuscitation.  
• Use only topical antimicrobials for burns.  
• Antimicrobial beads or pouches may be used.  
• Provide post splenectomy immunizations if indicated. |
| Debridement and irrigation | • Irrigate wounds to remove contamination with normal saline or sterile water using bulb irrigation, gravity irrigation, or pulse lavage without additives. For open fractures, use 3 L for each type I, 6 L for each type II, and 9 L for each type III extremity fractures.  
• Repeat debridement and irrigation every 24-48 hours until wound is clean and all devitalized tissue is removed.  
• Do not attempt to remove retained deep soft tissue fragments if criteria met.† Provide Cefazolin 2 gm IV x 1 dose.  
• Do not obtain cultures unless infection is suspected. |
| Other surgical management | • Surgical evaluation as soon as possible.  
• Only dural and facial wounds should undergo primary closure.  
• Negative pressure wound therapy (NPWT) can be used.  
• External fixation (temporary spanning) of femur/tibia fractures.  
• External fixation (temporary spanning) OR splint immobilization of open humerus/forearm fractures. |
# Infection Control Based on Role of Care

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</table>
| Role 4         | Post-injury antimicrobials | • Complete course of post-injury antimicrobials (Appendix B*.)  
                  |                 | • Antimicrobial beads or pouches may be used.  
                  |                 | • Provide post splenectomy immunizations if indicated. |
|                | Debridement and irrigation | • Irrigate wounds to remove contamination with normal saline or sterile water using bulb.  
                  |                 | • Irrigation, gravity irrigation, or pulse lavage without additives. For open fractures, use 3L for each type I, 6 L for each type II, and 9 L for each type III extremity fractures.  
                  |                 | • Repeat debridement and irrigation every 24-48 hours until wound is clean and all devitalized tissue is removed.  
                  |                 | • Do not attempt to remove retained deep soft tissue fragments if criteria met.† Provide Cefazolin 2 gm IV x 1 dose.  
                  |                 | • Do not obtain cultures unless infection is suspected. |
|                | Other surgical management | • Wounds should not be closed until 3-5 d post-injury when wound is clean and all devitalized tissue is removed.  
                  |                 | • Only dural and facial wounds should undergo primary closure.  
                  |                 | • Negative pressure wound therapy (NPWT) can be used.  
                  |                 | • External fixation (temporary spanning) of femur/tibia fractures.  
                  |                 | • External fixation (temporary spanning) OR splint immobilization of open humerus/forearm fractures. |

*Appendix B: Post-injury Antimicrobial Agent Selection and Duration Based Upon Injury Pattern
Intent (Expected Outcomes)

- All patients with skin, soft tissue, open fractures, exposed bone or open joint injuries: Cefazolin 2 gm IV every 6-8 hours or Clindamycin 600 mg IV every 8 hours initiated at the first role of surgical care.

- All patients with penetrating brain injury: Cefazolin 2 gm IV q6-8 hours with consideration of adding Metronidazole 500 mg IV every 8-12 hours will be initiated at the first role of surgical care.

- All patients admitted to the ICU will have Sage antiseptic body cleaning daily.

Data Source

- Patient Record
- Department of Defense Trauma Registry
Performance/Adherence Measures

- Cefazolin 2 gm IV or Clindamycin 600 mg IV was initiated at the first role of surgical care, within 3 hours of admission, on patients with skin, soft tissue, open fractures, exposed bone or open joint injuries.

- Cefazolin 2 gm IV PLUS Metronidazole 500 mg was initiated at the first role of surgical care on patients with penetrating abdominal injury and suspected/known hollow viscus injury, soilage and rectal/perineal injuries.

- Cefazolin 2 gm IV PLUS Metronidazole 500 mg IV was initiated at the first role of surgical care on patients with penetrating brain injury.

- Sage antiseptic body cleaning was performed on ICU patient daily.


10. Milstone AM, Passaretti CL, Perl TM; Chlorhexidine: Expanding the Armamentarium for Infection Control and Prevention; CID 2008:46; 274-281
References


Appendices

- **Appendix A**: Recommendations to Prevent Infections Associated with Combat-related injuries based on Role of Care
- **Appendix B**: Post-injury Antimicrobial Agent Selection and Duration Based upon Injury Pattern
- **Appendix C**: Post Exposure Management of Personnel after Occupational Percutaneous and Mucosal Exposure to Blood or Any Body Fluids
- **Appendix D**: Sage Antiseptic Body Cleaning
- **Appendix E**: Additional Information Regarding Off-label Uses in CPGs
Contributors

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Photos are part of the JTS image library unless otherwise noted.