GUIDELINES TO PREVENT INFECTION IN COMBAT-RELATED INJURIES

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Supersedes:	This is a new CPG and must be reviewed in its entirety		
☐ Minor Changes ***(or)***		☐ Changes are substantial and require a thorough reading of this CPG ***(or)***	
☐ Significant Changes			

1. Goal. To provide rationale and guidance for the prevention of infection after combat-related injuries.

2. Background. Infection has been a complication of war wounds throughout history. Infection control techniques in combat injuries, first widely practiced by Florence Nightingale in the Crimean War, have advanced significantly. Challenges unique to the theater include significant patient transfers between hospitals and teams, the challenging environment of theater medical care, and the difficulties arising during aeromedical evacuation. Infection control practices must be able to effectively adapt to these challenges and support the prevention of spread of infection.

3. Guidelines

a. Follow the general infection control practices noted below to the extent allowed by the operational environment to reduce nosocomial infections.

Related CPGs: Ventilator-Associated Pneumonia, Irrigation of War wounds and VAC of wounds.

i. Standard Precautions: CANNOT BE OVER-EMPHASIZED

(1) Hand washing: Use soap and water or alcohol based sanitizer before and after each patient contact, even if gloves were worn. Monitor all personnel; ensure compliance. Of note, alcohol-based sanitizers are NOT effective against *C. difficile* spores.

(2) Gloves: Use when contact with non-intact skin or body fluids is anticipated. Gloves should be used for ALL dressing changes.

(3) Gowns: Use when changing dressings on open wounds or performing invasive procedures.

(4) Masks and eye protection: Use based on anticipated exposure.

(5) Contact Precautions: Gloves and gowns should be worn with all patients suspected or know to have multi-drug resistant organisms (MDROs) or *C. difficile*-associated diarrhea. Note: US personnel with skin and soft tissue infections presenting with abscess or furnuncles should be assumed to have community-associated MRSA.

(6) Cohorting: Separate long-term (>72 hours) and short term (<72 hour stay) patients when possible to reduce the risk of cross-contamination with resistant hospital-associated organisms. Patients with known or suspected MDRO infections (i.e., *C. difficile*, MRSA, should be separated from the non infected patients.

(7) Skin care for patients: ICU patients should undergo a daily SAGE "bath". The reduction of skin flora with antimicrobial agents such as the chlorhexidine SAGE skin wipes in one theater ICU was associated with a 25% decrease in Acinetobacter skin colonization of arriving patients to Germany. (See APPENDIX A, Sage Antiseptic Body Cleaning.)

(8) Antibiotic Control:

(a) Avoid unnecessary empiric use of broad spectrum antibiotics.

(b) When available, use local antibiogram to guide empiric therapy.

(c) Limit duration of antibiotic therapy. Several well-controlled studies have shown benefit to shorter courses of antibiotic therapy for common infectious problems (e.g. pneumonia.) There is no evidence that prophylactic antibiotic therapy continued longer than 72 hours results in decreased infection. Unfortunately, in major war wounds, the presence of persistent necrotic tissue and foreign bodies complicates decision making regarding discontinuation of antibiotic therapy and may require a more prolonged use of antibiotics.

b. Care at Point of Injury (Level I)

i. Evacuate to surgical care within 6 hours

ii. Bandage wound with sterile dressing; stabilize fractures with splint for evacuation to Level IIb/III

iii. Single dose of oral or IV/IM antibiotics (within 3 hours of injury) should be given if evacuation is expected to be delayed. Drugs from APPENDIX B should be given in preference to TCCC antibiotics if available. TCCC recommendations:

(1) If able to take PO: Moxifloxacin, 400 mg PO one a day, or

(2) If unable to take PO (shock, unconsciousness): Ertapenem, 1 g IV/IM once a day

c. Patient Care without Surgical Support (Levels I and IIa)

i. Level I (BAS)

(1) Evacuate to surgical evaluation within 6 hours

(2) Primary wound management consists of high volume irrigation to remove gross contamination, use normal saline, sterile water, or potable water; under low pressure with no additives

(3) Bandage wound with sterile dressing (avoid pressure dressings over eyes).

(4) IV antibiotics within 3 hours of injury; IV is preferred over IM in hemodynamically compromised patients.

(5) Antibiotic choice per APPENDIX B, Prophylactic Antibiotic Use at Level IIb/III Use.

(6) Tetanus immunoglobulin and toxoid as appropriate.

ii. Level IIa (medical company)

(1) Same as Level I (BAS)

(2) For minor wounds, consider treating at the local facility with a single dose of antibiotics, without surgical evaluation for small retained fragments that only involve soft tissue injury (x-ray confirmation of no bone involvement, no joint or vascular involvement, and no penetration of pleura or peritoneum), wound entry/exit lesion less than 2 cm in maximal dimension, wound not frankly infected.

iii. Care with Surgical Support (Levels IIb and III)

(1) Casualties should undergo surgical evaluation within 6 hours of injury; surgical intervention may be delayed past 6 hours based on tactical reasons.

(2) Do not obtain routine pre- or post-procedure microbial cultures; cultures should be obtained only when there is clinical evidence of infection.

(3) Wounds should be aggressively surgically debrided with removal of all necrotic tissue and foreign bodies that can be easily reached; eye and spine injuries without neurologic compromise can await surgical debridement until surgical expertise is available; cerebral foreign bodies may remain if removal would cause excess damage.

(4) Wounds should be irrigated until clean. Irrigation fluids can include normal saline or sterile water; potable water may be used in the event that these solutions are not available. Fluid additives are not recommended.

(5) Antibiotics should be infused within 3 hours of injury; avoid overly broad-spectrum antibiotics and minimize duration. (See APPENDIX B.)

(6) Adjunct therapy includes tetanus immunoglobulin and toxoid as necessary; immunization against encapsulated organisms after trauma for patients who have their spleen removed (See splenectomy CPG).

(7) Infection Control questions can be fielded by the following established AKO teleconsultation program (infect.cntrl.consult@us.army.mil).

(8) Ideally, Level II and III facilities should have a designated Infection Control Officer (ICO) as an additional duty or a full-time position if supported by current manning levels. The "Infection Control in the Deployed Setting" course is currently being conducted ad hoc through OTSG and local Command support at Brooke Army Medical Center (BAMC) and is recommended for anyone who is/will be designated as the unit ICO.

(9) The Sage Antiseptic Body Cleaning Washcloths will be used on all Intensive Care Unit OIF/OEF patients unless a patient declines or has any known sensitivities to ingredients. (See APPENDIX A.)

(10) Follow guidelines for prophylactic antibiotics (See APPENDIX B).

4. Responsibilities. The facility trauma team leader, along with his or her infection control team, will ensure compliance with this CPG.

a. All Health Care Providers will:

i. Become familiar with the guidelines for infection control.

ii. Use recommended standard precautions

iii. Provide feedback on these guidelines and suggestions for changes to the CPG to the JTTS.

5. References.

[1] Hospenthal DR, Murray CK, Andersen RC, et al. Guidelines for the Prevention of Infection after combat related injuries. J Trauma 2008; 64:S211-S220.

[2] Landrum M, Murray C: Ventilator Associated Pneumonia in a Military Deployed Setting: The Impact of an Aggressive Infection Control Program. J Trauma. 2008 Feb;64(2 Suppl):S123-7; discussion S127-8.

[3] *Emergency War Surgery,* 2004, Third US Revision, Ch 10, Infection

[4] Beilman GJ, Dunn DL, Surgical Infections, in Schwartz Principles of Surgery, 9th ed., 2009.

[5] Murray CK, Hsu JR, Solomkin JS, Keeling JJ, Andersen RC, Ficke JR, Calhoun JH Prevention and Management of Infections Associated with Combat-Related Extremity injuries, J Trauma. 2008:64:S239-S251

[6] TCCC Guidelines, 4 Feb 2009 and Tactical Field Care, PHTLS, 7th Edition

[7] Mellor SG, Cooper GJ, Bowyer GW: Efficacy of delayed administration of benzylpenicillin in the control of infection in penetrating soft tissue injuries in war. J Trauma 1996; 43(Suppl): S128-S134

[8] O'Connor K, Butler FK: Antibiotics in Tactical Combat Casualty Care 2002, Mil Med 168(11):911, 2003

Approved by CENTCOM JTTS Director and Deputy Director and CENTCOM SG

Opinions, interpretations, conclusions, and recommendations are those of the authors and are not necessarily endorsed by the Services or DoD

APPENDIX A

SAGE ANTISEPTIC BODY CLEANING

(Adopted from LRMC Policy)

POLICY: The Sage Antiseptic Body Cleaning Washcloths will be used on all Intensive Care Unit OIF/OEF patients unless a patient declines or has any known sensitivities to ingredients.

PURPOSE: To reduce the risk of hospital associated infection by decreasing bacterial colonization that can cause skin infection.

APPLICABILITY: The Antiseptic Body Cleaning Washcloths policy is applicable to all healthcare workers assigned to provide bedside bathing to patients in the medical facility.

RESPONSIBILITY: It is the responsibility of the Nursing Managers to ensure that this policy is implemented correctly and consistently.

Exclusion: Avoid facial area, open wounds, and areas of 2nd or 3rd degree burned skin.

PROCEDURE:

1. When the patient arrives to the unit first bathe patient with soap/water add 30 cc of hibiclens 4 % to the basin and bathe patient to remove all visible dirt.
2. Wait 6 hours after initial bath and bathe patient with Antiseptic Body Cleaning Washcloths once a day.
3. Warming the Antiseptic Body Cleaning Washcloths (if warmer not available)
   a. Warm package in the dedicated microwave settings: 1000 watts for 30 seconds.
   b. Consult package for complete indications, ingredients, and warnings.
4. Bathing a Patient with Antiseptic Body Cleaning Washcloths.
   a. Wash hands prior to the procedure and don a pair of gloves and a gown.
   b. Explain the procedure to the patient.
   c. Ensure the patient has privacy. Have patient remove gown or assist in the removal as needed. Use a towel or sheet to cover the patient appropriately.
   d. Peel back the label on the package and test the temperature by touching the top washcloth. Remember, gloves diminish your sensitivity to heat. If temperature is acceptable, proceed to the next step.
   e. Remove #1 washcloth.
      (1) Test washcloth to back of patient's hand or inside wrist/forearm area.
      (2) Ask patient if the temperature is acceptable.
         (a) If acceptable, proceed with next step.
         (b) **If NOT** acceptable, **STOP** the procedure until temperature is acceptable to the patient.

(c) Continue to monitor patient's comfort level with the temperature as the bath progresses.

KEY POINTS:

- Follow the bathing procedure in sequential order, shown in the following table, while gently rubbing in a back and forth motion on the skin. This reduces the chance of cross-contamination by providing a clean cloth for separate areas of the body, while maximizing appropriate use of the product to prevent waste.
- Use caution around dressings and intravascular lines.

WASH CLOTHS	AREAS*	ACTION
**** DO NOT USE ON FACE***		
1	Both arms and chest	Discard
2	Perineum	Discard
3	Right Leg	Discard
4	Left Leg	Discard
5	Back	Discard
6	Buttocks	Discard

Table 1. Wash Cloth Sequence

f. For incontinence care, clean using terrycloth towels, soap and water, followed by wiping the involved skin with as many chlorhexidine cloths as necessary.

g. Apply clean gown, reposition and cover the patient.

h. Discard all disposables as general waste.

Do not flush Antiseptic Body Cleaning Washcloths in the toilet!

i. Document procedure in progress notes.

Reference:

[1] Michael O. Vermon, DrPH; Mary K. Hayden, MD et al. Chlorhexidine Gluconate to Cleanse Patients in a Medical Intensive Care Unit. The effectiveness of Source Control to Reduce the Bioburden of Vancomycin-Resistant Enterococci. Archives of Internal Medicine. Volume 166, February 13, 2006

[2] Author: Robert Garcia, Enhanced Epidemiology © 2004 Enhanced Epidemiology

[3] Modified: Guilene Derisma RN BSN, LRMC Infection Prevention and Control Department October 2006

APPENDIX B

PROPHYLACTIC ANTIBIOTIC USE AT LEVEL IIB/III USE

General Tips:

1. Defer to more serious injury / longer time course
2. Beware using multiple beta-lactam antibiotics – they will antagonize each other – choose broadest if several indications
3. Unasyn not recommended for routine prophylaxis in hopes it will be effective for Acinetobacter infections
4. When choosing alternates for CNS prophylaxis, consider penetration into CNS

INJURY	RECOMMENDED ANTIMICROBIAL PROPHYLAXIS LRMC RULES FOR ENGAGEMENT	ALTERNATE ANTIMICROBIAL	PENICILLIN ALLERGIC PATIENT	DURATION
SKIN, SOFT TISSUE, BONE				
Skin, soft tissue, no open fractures	• If effective I&D already performed – none • If dirty, Cefazolin, 1g IV q8H until I&D , then ≤24 hours ***unusual to need this continued more than 72H after time of injury***	Clindamycin 900mg IV q8H	Clindamycin 900mg IV q8H	
Skin, soft tissue, with open fractures, exposed bone, open joints	***Grade I and II***			
	Cefazolin 1g IV q8H	Clindamycin 900mg IV q8H	Clindamycin 900mg IV q8H	24 hours
	Grade III			
	Cefazolin 1g IV q8Hr	Clindamycin 900mg IV q8H	Clindamycin 900mg IV q8H	Until covered or 72 hours maximum

INJURY	RECOMMENDED ANTIMICROBIAL PROPHYLAXIS LRMC RULES FOR ENGAGEMENT	ALTERNATE ANTIMICROBIAL	PENICILLIN ALLERGIC PATIENT	DURATION
SKIN, SOFT TISSUE, BONE (Continued)				
Potential Gram Negative Contamination with fracture	Levofloxacin 750mg IV/PO q24hr	aminoglycoside or other gram negative coverage		72 hours maximum
CHEST				
Penetrating chest injury	Cefazolin 1g IV q8Hr	N/A	N/A	24 hours
Blunt chest injury, with chest tube	None	N/A	N/A	
ABDOMINAL				
Open Abdomen	None	N/A	N/A	
Penetrating abdominal injury with suspected hollow viscus injury & soilage; may apply to rectal injuries as well	Antibiotics with activity against enteric gm negs, skin flora, and anaerobes. Options: ertapenem 1 gm iv q D, piperacillin/ tazobactam 3.375 gm IV q 8 h, ticarcillin/clavulanate 3.1 g iv q 6 h	Levofloxacin 750 mg IV once daily, or ciprofloxacin 400 mg IV q 8-12 h and metronidazole 500 mg IV q 6h, ertapenem 1 gram IV q 24 h, or moxifloxin 400 mg IV (monotherapy)	Levofloxacin 750mg IV q24H [or Ciprofloxacin 400mg IV q8-12] ***AND*** Metronidazole 500mg IV q6H	24 hours post operative

INJURY	RECOMMENDED ANTIMICROBIAL PROPHYLAXIS LRMC RULES FOR ENGAGEMENT	ALTERNATE ANTIMICROBIAL	PENICILLIN ALLERGIC PATIENT	DURATION
MAXILLOFACIAL INJURY, OPEN				
CLOSED Oral cavity/bony fractures WITHOUT foreign body or fixation device	None	N/A	N/A	
OPEN Oral cavity fractures, or oral cavity fractures with foreign body or fixation device	Clindamycin 900mg IV q8H	Piperacillin/tazo 3.375g IV q6H [OR Ticarcillin/tazo 3.1g IV q6H]	See Primary Recommendation	Continue until 24 hours post fixation
Sinus cavity compromised	Levofloxacin 750mg IV/PO q24hr	Piperacillin/tazo 3.375g IV q6H [OR Ticarcillin/tazo 3.1g IV q6H]	See Primary Recommendation	72 H post wash-out (or may maintain until nasal packs removed if these are in place)
Both oral cavity with foreign body and sinus	Clindamycin 900mg IV q8H AND Levofloxacin 750mg IV/PO q24h	Piperacillin/tazo 3.375g IV q6H [OR Ticarcillin/tazo 3.1g IV q6H]	See Primary Recommendation	72 H post fixation (or until nasal packs out)

INJURY	RECOMMENDED ANTIMICROBIAL PROPHYLAXIS LRMC RULES FOR ENGAGEMENT	ALTERNATE ANTIMICROBIAL	PENICILLIN ALLERGIC PATIENT	DURATION
CENTRAL NERVOUS SYSTEM				
Penetrating brain/CNS injury	Cefazolin 1g IV q8H (consider addition of Metronidazole 500mg IV q6H if suspicion risk for anaerobic infx high)	Cefazolin 1g IV q8H + aminoglycoside or other gram negative coverage (consider addition of Metronidazole 500mg IV q6H if suspicion risk for anaerobic infx high) Or Cefuroxime 1.5g IV q8H	Vancomycin 1g IV q12H (or 15mg/kg IV q12h) + aminoglycoside or other gram-negative coverage (consider addition of Metronidazole 500mg IV q6H if suspicion risk for anaerobic infx high)	72 hours
Penetrating injury in association with sinus involvement	Above + Levaquin 750mg po daily	Cefazolin 1g IV q8H + aminoglycoside OR Meropenem 1g IV q8H	Vancomycin for the Ceftriaxone, + Levaquin per primary recommendation	5 days
Craniectomy or craniotomy performed to relieve edema/pressure WITHOUT penetrating injury/fragments	Antibiotics for the peri-operative period only. Continue abx only if ventriculostomy or lumbar drain placed as below	Antibiotics for the peri-operative period only. Continue abx only if ventriculostomy or lumbar drain placed as below	Antibiotics for the peri-operative period only. Continue abx only if ventriculostomy or lumbar drain placed as below	
Fiberoptic ICP Monitor (ie Codman)	None	N/A	N/A	

INJURY	RECOMMENDED ANTIMICROBIAL PROPHYLAXIS LRMC RULES FOR ENGAGEMENT	ALTERNATE ANTIMICROBIAL	PENICILLIN ALLERGIC PATIENT	DURATION
CENTRAL NERVOUS SYSTEM (Continued)				
Ventriculostomies OR Lumbar drain	Cefazolin 1g IV q8H	Vancomycin 1g IV q12H (or 15mg/kg IV q12h)	Vancomycin 1g IV q12H (or 15mg/kg IV q12h)	NS provider dependent; (most prefer for duration device is in)
CSF leaks	Usually no ABX required for leaks for < 5 day, especially minor leaks Consider Ceftriaxone 2g IV q24 H +/- Levofloxacin 500mg IV/PO until addressed by ENT and/or NS and plan made (Data is stronger for rhinorrhea than otorrhea)	Vancomycin 1g IV q12 hours [+/- Levofloxacin 750mg IV/PO q24 hours]	Vancomycin 1g IV q12H (or 15mg/kg IV q12h) [+/- Levofloxacin 750mg IV/PO q24]	
EYE				
Eye injury, burn/abrasion	Bacitracin ophthalmic ointment	N/A	N/A	

INJURY	RECOMMENDED ANTIMICROBIAL PROPHYLAXIS LRMC RULES FOR ENGAGEMENT	ALTERNATE ANTIMICROBIAL	PENICILLIN ALLERGIC PATIENT	DURATION
EYE (Continued)				
Eye injury, penetrating	**Systemic**: Levofloxacin 750 mg IV/PO q24 H or Ciprofloxacin 400mg IV q12H X 5 days (usual duration – Ophthalmology staff dependent – coordinate with them) **Topical**: Moxifloxacin ophthalmic drops and d/c Lacrilube once repaired (or decrease frequency per Ophthalmology)	No literature – defer to Ophthalmology	See Primary Recommendations	
OTHER MISCELLANEOUS				
Burns	No systemic antibiotics, see topical treatment in burn guidelines	N/A	N/A	
Fasciotomies	No systemic antibiotics, see topical treatment guidelines	N/A	N/A	
Splenectomy	Vaccines (Hflu, Pneumococcal, Meningococcal)) **Optimal timing of vaccines may be several weeks post-splenectomy, but JTTS has recommended earliest administration to prevent "missing" during transfers**			

APPENDIX C

SPECIFIC ANTIBIOTIC COVERAGE FOR THEATER SPECIFIC CONCERNS

CULTURE SPECIFIC RECOMMENDATIONS

CARBENEM-RESISTANT ACINETOBACTER:

1st Line (if sensitive): Tobramycin 5-7 mg/kg q day x 10-14 days (monitor troughs if capable, goal <2.0, o/w proceed to 2nd line drug if Cr increases > 0.5)

2nd Line: Colistin (dose dependent on preparation available)

3rd Line: Tigacycline 100 mg load, then 50 mg q day x 10 days

MRSA PNEUMONIA:

1st Line: Linelozid 600 mg IV/PO BID (Literature suggests Linelozid offers a treatment advantage over vancomycin)

2nd Line: Vancomycin 1-1.5 g IV, BID x 10-14 days

SEPSIS (Emperic treatment)

- Perform empiric cultures. Then initiate antibiotics within 4 hours:
- 1st line: Carbapenem with antipseudomonal coverage Imipenem 1 gm q 8 hr or Meropenem 1 gm q 6 hr) PLUS Amikacin or Tobramycin 5-7 mg/kg q day Consider Adding Vancomycin 1-1.5 g IV, BID if VAP is not suspected.

(**CRITICAL** – But this should be based on individual site antibiotigram)

APPENDIX D

ADDITIONAL INFORMATION REGARDING OFF-LABEL USES IN CPGs

A. Purpose.

The purpose of this Appendix is to ensure an understanding of DoD policy and practice regarding inclusion in CPGs of "off-label" uses of U.S. Food and Drug Administration (FDA)–approved products. This applies to off-label uses with patients who are armed forces members.

B. Background.

Unapproved (i.e., "off-label") uses of FDA-approved products are extremely common in American medicine and are usually not subject to any special regulations. However, under Federal law, in some circumstances, unapproved uses of approved drugs are subject to FDA regulations governing "investigational new drugs." These circumstances include such uses as part of clinical trials, and in the military context, command required, unapproved uses. Some command requested unapproved uses may also be subject to special regulations.

C. Additional Information Regarding Off-Label Uses in CPGs.

The inclusion in CPGs of off-label uses is not a clinical trial, nor is it a command request or requirement. Further, it does not imply that the Military Health System requires that use by DoD health care practitioners or considers it to be the "standard of care." Rather, the inclusion in CPGs of off-label uses is to inform the clinical judgment of the responsible health care practitioner by providing information regarding potential risks and benefits of treatment alternatives. The decision is for the clinical judgment of the responsible health care practitioner within the practitioner-patient relationship.

D. Additional Procedures.

1. Balanced Discussion. Consistent with this purpose, CPG discussions of off-label uses specifically state that they are uses not approved by the FDA. Further, such discussions are balanced in the presentation of appropriate clinical study data, including any such data that suggest caution in the use of the product and specifically including any FDA-issued warnings.

2. Quality Assurance Monitoring. With respect to such off-label uses, DoD procedure is to maintain a regular system of quality assurance monitoring of outcomes and known potential adverse events. For this reason, the importance of accurate clinical records is underscored.

3. Information to Patients. Good clinical practice includes the provision of appropriate information to patients. Each CPG discussing an unusual off-label use will address the issue of information to patients. When practicable, consideration will be given to including in an appendix an appropriate information sheet for distribution to patients, whether before or after use of the product. Information to patients should address in plain language: a) that the use is not approved by the FDA; b) the reasons why a DoD health care practitioner would decide to use the product for this purpose; and c) the potential risks associated with such use.