

1 **EXCERPT FROM: USACHPPM TECHNICAL GUIDE 273**

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3 **STANDARD PRECAUTIONS AND ISOLATION PROCEDURES**

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6 To aid in the fight against nosocomial transmission of infectious agents, a combination of  
7 standard precautions and isolation procedures has been established. The following is a  
8 summarization of the basic guidelines advocated by the CDC as an effective strategy to reduce  
9 the incidence of nosocomial infections in health care settings. A basic premise of these  
10 guidelines is that all patients, regardless of their diagnosis, are to be treated so as to minimize the  
11 transmission of microorganisms from patient to health care worker (HCW), HCW to patient, and  
12 patient to HCW to another patient. These guidelines describe the use of a two-tiered approach:

- 13 1) Standard precautions must be used when caring for all patients. Standard precautions  
14 entail a list of basic hygiene procedures that are designed to prevent contact with moist body  
15 surfaces and thereby reduce the risk of transmission of bloodborne pathogens.  
16 2) When caring for patients with highly transmissible or epidemiologically important  
17 pathogens or with poor hygiene, extra barrier or isolation precautions may be necessary.  
18 These precautions will help in interrupting contact, droplet, or airborne transmission of these  
19 pathogens. There may be instances when more than one extra barrier precaution will need  
20 to be implemented.

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22 **Standard Precautions**

23 These precautions apply when contact is possible with ruptured skin or mucous membranes,  
24 blood, all body fluids, secretions, or excretions except sweat. Hand hygiene among HCWs is the  
25 most effective means of preventing nosocomially transmitted infections. Hand hygiene consists  
26 of washing hands when soiled or disinfecting hands when possibly contaminated, irrespective of  
27 whether gloves were worn. These actions should take place immediately after gloves are  
28 removed, before and between patient contacts, and any time secretions, excretions, blood, or  
29 body fluids or contaminated items or equipment are handled. Gloves should be worn if touching  
30 mucous membranes, broken skin, contaminated objects, blood, body fluids, secretions, or  
31 excretions. These gloves must be changed between patients and before touching clean sites on  
32 the same patient. During procedures that are likely to result in splashing of blood, body fluids,  
33 secretions or excretions, the HCW should wear a mask, eye protection and a gown to protect  
34 mucous membranes, skin and clothing. All visitors, patients and HCWs must not be exposed to  
35 contaminated materials or equipment. This means that all reusable equipment must be cleaned  
36 and sterilized before reuse. Soiled linen should be transported in a double bag. HCWs must be  
37 careful when handling sharp instruments such as needles. This will minimize the risk of  
38 bloodborne contamination. Never recap needles. If recapping is unavoidable, use a mechanical  
39 device or the one-handed technique. HCWs must ensure that puncture-resistant containers are  
40 designated and used for all used sharps instruments. Patient and treatment rooms, cubicles, and  
41 bedside equipment should be appropriately cleaned. The hot water and detergents in hospitals  
42 are sufficient to decontaminate food service materials therefore no special precautions are  
43 needed.

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45 The tables below list examples of conditions necessitating isolation precautions and summarize  
46 the measures to be taken for the different isolation precautions.

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Indications for Standard and Isolation Precautions	
Precaution category	Condition
Standard	All patients
Airborne	Pulmonary or laryngeal (suspected) tuberculosis, measles, varicella; disseminated zoster
Contact	Hemorrhagic fever such as Ebola, Lassa, and Marburg, (risk for) colonization or infection with multiresistant bacteria, <i>Clostridium difficile</i> infection, acute diarrhea in incontinent patient, RSV infection, croup or bronchiolitis in young infants, skin infections like impetigo , major abcess, cellulites or decbiti, staphylococcal furunculosis, pediculosis, scabies or cutaneous infections with <i>Corynebacterium diphtheriae</i> , Herpes simplex virus, zoster
Droplet	Meningitis, (suspected) invasive infection with <i>Haemophilus influenzae</i> type B or <i>Neisseria meningitides</i> , diphtheria, <i>M. pneumoniae</i> , pertussis, influenza, adenovirus, mumps, Parvovirus B19, rubella, streptococcal pharyngitis, pneumonia, scarlet fever in young children

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Summary of Transmission-based Precautions			
Precaution	Contact	Droplet	Airborne
Patient room	Private	Private	Private with specific ventilation requirements
Gloves	Before entering room		Standard precautions
Hand hygiene	Standard precautions, with hand antisepsis		
Gown	If direct contact with patient or environment	Standard precautions	
Masks	Standard precautions	Within 1 meter of patient	Before entering room special requirements
Other	Limit patient transport		

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Excerpted from: Wenzel, Richard P., Timothy F. Brewer and Jean-Paul Butzler, (editors). A Guide to Infection Control in the Hospital, 3<sup>rd</sup> Edition. International Society for Infectious Diseases. Boston, Massachusetts. 2004. pp. 38-42.

## RESISTANT BACTERIA / IN-THEATER NOSOCOMIAL INFECTIONS

Increasing bacteria resistance is noted throughout the world. Multi-drug resistant bacteria (*Acinetobacter baumannii*, *Pseudomonas aeruginosa*, *Klebsiella pneumoniae*) have been recognized among casualties returning from OIF/OEF. Although resistance is often associated with nosocomial infections, the recognition of bacteria from the community with innate resistance is increasingly being reported. Community-acquired methicillin resistant *Staphylococcus aureus* (CA-MRSA) is a well known example.

### CA-MRSA

- Colonizes approximately 3% of healthy soldiers.
- Often carries a gene that is associated with more aggressive and invasive infections.
- Rarely recognized in cultures of battlefield wounds near the time of injury.
- Typically remains susceptible to trimethoprim-sulfamethoxazole, clindamycin, tetracycline, rifampin, and fluoroquinolones.
- Prevention
  - Routine personal hygiene.
  - Consider as the infectious etiology if skin and soft tissue infections do not respond to traditional therapy (cefazolin, cephalothin, nafcillin, dicloxacillin, amoxicillin/clavulanate).
  - If infection likely, recommend therapy with trimethoprim-sulfamethoxazole or clindamycin.
  - Consider decontamination
    - Nasal mupirocin ointment (2%) BID for 5-7 days.
    - Chlorhexidine-based soap shower for 5-7 days.

### Multi-drug resistant bacteria

- Recognized among casualties injured in OIF/OEF.
- Etiology unknown but includes
  - Skin colonization - colonization with these bacteria has been described but resistance to multi-drugs is not usually present.
  - Inoculation at the time of injury - possible colonization of wound occurs at the time of the injury but preliminary work from wound cultures and evaluation of infections upon return to CONUS medical facilities implies this less likely.
  - Horizontal transmission - increasing data supports this as the likely source of infection.
- Prevention
  - Minimize empiric broad spectrum antibiotics (such as carbapenems) in the empiric therapy of battlefield wounds or other infections that occur in theater.
- Infection Control
  - Minimal interventions include frequent hand washing, frequent use of alcohol hand gel, and/or wearing surgical gloves with changing them between patients.
  - Equipment that comes into direct contact with a patient should be cleaned between patients.
  - Consider cohorting those patients undergoing long-term in-hospital care.

### In-theater nosocomial infections

Personnel receiving prolonged medical care in echelon III U.S. MTFs are at risk of developing nosocomial infections. A nosocomial infection is defined as a new infectious syndrome, such as pneumonia, bacteremia, or urinary tract infection, after 72 hours of hospitalization. These infections often involve multi-drug resistant bacteria (*Acinetobacter baumannii*, *Pseudomonas aeruginosa*, *Klebsiella pneumoniae*, MRSA).

#### Management

- Initial empirical institution of broad spectrum antimicrobial agents.
  - Vancomycin when gram-positive pathogens are likely.
  - Carbapenems (meropenem or imipenem/cilastatin) and amikacin when gram-negative pathogens are likely.

1 Tailoring of antimicrobial therapy should be guided by the results of bacterial culture  
2 and susceptibility data, if available.  
3 For echelon III facilities without this real-time capability, consider batch-testing  
4 cultures at another facility that does have that capability, in order to establish  
5 local susceptibilities and resistance trends.  
6 Emphasize infection control measures as mentioned under Multi-drug resistant bacteria.

## MANAGEMENT OF BATTLEFIELD WOUNDS

Modern warfare's use of body armor and rapid evacuation has allowed a larger percentage of trauma casualties to survive until they reach medical care. A greater emphasis is now required on avoiding complications of severe trauma, including infections. The environment of war leads to grossly contaminated battlefield wounds due to numerous factors, including foreign bodies (projectile fragments, clothing, dirt), high-energy projectiles (devitalized tissue, tissue ischemia, hematoma), and delays in casualty evacuation. Wounds will likely become infected unless rapid, appropriate treatment is initiated.

Common microorganisms causing battlefield infections.

Gram-positive cocci - *Staphylococcus* species, *Streptococcus* species.

Gram-negative rods (bacilli) - *Escherichia coli*, *Proteus*, *Klebsiella* species.

Anaerobic gram-positive and gram-negative rods- *Clostridium*, *Bacteroides*, *Prevotella* species.

Nosocomial transmission - *Pseudomonas*, *Enterobacter*, *Acinetobacter* species.

Patterns of infection are dictated by area of injury.

Skin, soft tissue, muscle and bone - *Staphylococcus*, *Streptococcus*, *Clostridium* species.

Intracranial injuries - *Staphylococcus* and gram-negative rods.

Orofacial and neck injuries - gram-positive cocci and mouth anaerobes.

Thoracic cavity - staphylococcal empyemas and pneumonias due to *Staphylococcus*, *Streptococcus* and *Pseudomonas* species especially with prolonged intubation.

Intrabdominal injuries - *Enterococcus*, gram-negative rods, and anaerobic bacilli.

General principles of treatment focus on:

Treatment within 6 hours of injury.

Surgical debridement.

Copious irrigation.

Tetanus prevention:

Administer 0.5 mL IM of tetanus toxoid if prior tetanus immunization is uncertain, less than 3 doses, or more than 5 years since last dose.

If the immunization status is uncertain or less than 3 doses were received, 250 units IM of tetanus immune globulin in a separate syringe and at a separate site from the toxoid is given.

Recommended antibiotics:

General principles-

Simplicity of use, including ease of transport, reconstitution, and administration; safety; duration of activity; and spectrum of activity all impact drug selection especially in tactical combat casualty care or those undergoing frequent evacuations to higher echelons of care.

Further tailoring of antimicrobial therapy should be guided by the results of bacterial culture and susceptibility data, if available.

For echelon III facilities without this capability, consider batch-testing cultures at a facility with that capability to establish local susceptibilities and resistance trends.

Tactical antibiotics - field administration, echelon I or echelon II without surgical support (see table). For simplicity in a tactical environment, consider gatifloxacin 400 mg orally daily for all wounds except penetrating abdominal injuries, patients in shock, or those unable to tolerate oral antibiotics. For those patients, consider cefotetan 2 gm IV/IM every 12 hours.

Medical treatment facility - echelon II with surgical support and echelon III facility (see table).

Avoidance of broad spectrum antibiotics (imipenem, meropenem, piperacillin/tazobactam, etc.) for therapy of drug resistant bacteria (*Klebsiella*, *Pseudomonas* and *Acinetobacter* species), as these bacteria are not

frequently found in fresh wounds and drug pressure may increase the development of resistance at a later date.

#### Infection Control

It appears most resistant bacteria are acquired by patients through horizontal transfer from other patients, through HCW or device contact, and thus every attempt should be made to adhere to infection control practices.

Minimal interventions include frequent hand washing, frequent use of alcohol hand gel, and/or wearing surgical gloves with changing them between patients.

Equipment that comes into direct contact with a patient should be cleaned between patients.

Consider cohorting those patients undergoing long-term in-hospital care.

Special battlefield wounds that may not require evacuation for surgical debridement.

Soft tissue injuries meeting all of the following criteria:

Non-mine injuries (due to potential contamination).

Absence of fracture.

Entrance and exit wounds measuring less than two centimeters in maximum dimension.

Pleura or peritoneum not breached.

No major vascular injury.

No evidence of frank infection.

Treat with copious irrigation along with a dose of intravenous antibiotic (cefazolin) or oral fluoroquinolone followed by 4 days of oral therapy or monitoring without oral antibiotics.

Table. Antimicrobial prophylaxis of battlefield wounds. These recommendations are for empiric therapy of those with acute battlefield wounds and do not apply to wound infections that develop in personnel receiving long term medical care at echelon III facilities.

Injury	Potential pathogens	Tactical Antibiotic	MTF Antibiotic	MTF Alternatives
Abdominal, pelvic, upper thigh, gluteal region, HEENT wound or chest wound crossing mouth/esophageal/sinus mucosa	<ul style="list-style-type: none"> <li>• Gram positive (<i>Streptococcus</i> spp, <i>Staphylococcus</i> spp)</li> <li>• Gram negative (<i>E. coli</i>, Enterobacteriaceae)</li> <li>• Anaerobes (<i>Bacteroides</i> species, <i>Clostridium</i> spp)</li> </ul>	<ul style="list-style-type: none"> <li>• Cefotetan*<sup>^</sup> 1-2 gm IM/IV every 12 hours <b>or</b></li> <li>• Cefoxitin *<sup>^</sup> 1-2 gm IM/IV every 6-8 hours <b>or</b></li> <li>• Gatifloxacin 400 mg PO every 24 hours</li> <li>• Ertapenem 1 gm IV/IM Q 24 hours</li> </ul>	<ul style="list-style-type: none"> <li>• Cefotetan<sup>^</sup> 1-2 gm IM/IV every 12 hours <b>or</b></li> <li>• Cefoxitin *<sup>^</sup> 1-2 gm IM/IV every 6-8 hours <b>or</b></li> <li>• Ampicillin/sulbactam*<sup>^</sup> 1-2 gm IV every 6 hours <b>or</b></li> <li>• Ertapenem*<sup>^</sup> 1 gm IM/IV every 24 hours</li> </ul>	<ul style="list-style-type: none"> <li>• Fluoroquinolone† + metronidazole infusion 500 mg IV or PO every 6 hours or 1 gm every 12 hours*</li> </ul>
Extremity wound††, or HEENT wound or chest wound not crossing mouth/esophageal mucosa, penetrating brain injury	<ul style="list-style-type: none"> <li>• Gram positive (<i>Streptococcus</i> spp, <i>Staphylococcus</i> spp, Group A and anaerobic streptococcus)</li> <li>• Gram positive anaerobes (<i>Clostridium perfringens</i>, <i>Clostridium tetani</i>)</li> <li>• If water exposure, consider <i>Pseudomonas</i> spp, <i>Aeromonas</i> spp</li> </ul>	<ul style="list-style-type: none"> <li>• Cefotetan*<sup>^</sup> 1-2 gm IM/IV every 12 hours <b>or</b></li> <li>• Cefoxitin *<sup>^</sup> 1-2 gm IM/IV every 6-8 hours <b>or</b></li> <li>• Gatifloxacin 400 mg PO every 24 hours</li> <li>• Ertapenem 1 gm IV/IM Q 24 hours</li> </ul>	<ul style="list-style-type: none"> <li>• Cefazolin*<sup>^</sup> 1-2 gm IV push†† followed by oral fluoroquinolone, <b>or</b></li> <li>• Oral or IV fluoroquinolone†</li> <li>• Ertapenem 1 gm IV/IM Q 24 hours</li> </ul>	<ul style="list-style-type: none"> <li>• Clindamycin* 300-600 mg orally every 6 hours or 450-900 mg IV every 8 hours</li> </ul>

IM- intramuscular; IV- intravenous

\*Does not cover *Pseudomonas* spp. or *Acinetobacter* spp. Imipenem/cilastatin or meropenem are required to cover these organisms. Ciprofloxacin may be effective against *Pseudomonas*.

^Would not use in a casualty known to have a severe  $\beta$ -lactam allergy due to potential cross-reaction.

†Gatifloxacin 400 mg orally once a day, moxifloxacin 400 mg orally once a day, or levofloxacin 500 mg orally once a day.

†† Consider addition of enhanced gram-negative coverage (fluoroquinolone or aminoglycoside) for grade III open fractures due to possible excess infection.

**Duration of therapy:** intracranial involvement- 5 days; open fracture- 72 hours after the time of injury or not more than 24 hours after coverage of wound; perforated GI tract- continue for only 24 hours after surgery in the presence of injury to any hollow viscus, if no hollow viscus involvement single preoperative dose is adequate; oral cavity- 5 days.