Rhode Island Hospital
Hasbro Children's

Orthopedic Antibiotic Prophylaxis in Open Fracture Injuries (Adult and Pediatric)

Table of Contents

Introduction & Considerations	
Introduction	Beta-Lactam Allergy
Open Fracture Grading System	
Gustilo-Anderson Classifications	
Recommendations	
Adult Antimicrobial Prophylaxis	Pediatric Antimicrobial Prophylaxis
References	

Table of Contents

Introduction

The purpose of this guideline is to provide appropriate antibiotic prophylaxis for patients with an open fracture injury to reduce risk of infection, define the grading system for open fracture, and provide guidance for the appropriate antibiotic management for patients based on type of open fracture. **This guidance document is not applicable to either cranial or spinal fractures.**

These recommendations are not intended to replace clinical judgement but are intended to serve as a tool for decision-making.

- An open fracture is defined as "any fracture accompanied by a break in skin that communicates with the fracture or its associated hematoma".
- The choice of antibiotics and treatment duration depends on the type of open fracture (refer to Classification Grades, Adult Antimicrobial Prophylaxis, or Pediatric Antimicrobial Prophylaxis).
- Prophylactic antibiotics should be started as soon as possible, ideally within one hour of the patient's arrival. Additional antibiotics may be given based on further evaluation of injury. Prophylactic administration of antibiotics can decrease the incidence of infection, shorten hospitalization and reduce overall costs attributable to infections.
- Antibiotics should be discontinued 24 hours after initial debridement and definitive wound closure, unless there is a documented infection. Prolonged use of antibiotics has not been shown to improve patient outcomes and has been associated with increased risk of adverse events including *Clostridioides difficile* infection.
- In addition to prophylactic antimicrobials, assess the need for tetanus and/or rabies prophylaxis depending on exposure contamination to the open fracture.

Table of Contents

Beta-Lactam Allergy

Cephalosporins are the preferred agents for prophylaxis in most orthopedic surgical procedures. Cefazolin does not share a similar side chain with other cephalosporins. Patients allergic to any cephalosporin except cefazolin can most likely receive cefazolin. Thorough review of the patient's allergy history should be completed prior to the procedure.

Table 1: Allergy Risk Stratification.

Allergy Risk Stratification	Appropriate Antibiotic Selection
Negligible Risk: • Reaction was an intolerance (e.g., headache, isolated GI symptoms, fatigue, chills) • Family history of allergy only	**History Inconsistent with Allergy:** Any penicillin or cephalosporin can be used.
Low-Risk Allergy: • Rash • Urticaria • Unknown	**Low-Risk Penicillin Allergy:** Any cephalosporin can be used. **Low-Risk Cephalosporin Allergy:** Any penicillin or cephalosporins with dissimilar side chains can be used. **Cefazolin does not share any side chains with other cephalosporins and can be used.** Groups with shared side chains: Group A: Cefaclor, cefadroxil, cefprozil, cephalexin Group B: Cefepime, ceftriaxone, cefotaxime, cefpodoxime Group C: Ceftazidime, cefiderocol
High-Risk Allergy: • Anaphylaxis • Bronchospasm • Laryngospasm • Hypotension • Angioedema	**High-Risk Penicillin Allergy:** Cephalosporins with dissimilar side chains can be used. Any carbapenem can be used. The only cephalosporins with identical side chains to penicillin are cefaclor, cefadroxil, cefprozil, and cephalexin. **All other cephalosporins (e.g., cefazolin) do not share identical side chains and can be used.** **High-Risk Cephalosporin Allergy: Cephalosporins with dissimilar side chains can most likely be used.** Cefazolin: **Cefazolin can be used except if allergic to cefazolin.** If allergy is to cefazolin, refer to severe beta-lactam allergy column. Ceftriaxone: If allergy is to ceftriaxone, refer to severe beta-lactam allergy column.
Severe non-IgE Allergy: • Serum sickness • Stevens-Johnson syndrome (SJS) • Toxic epidermal necrolysis (TEN) • Drug fever • Organ damage (i.e., kidney, liver)	**Severe Beta-Lactam Allergy: Avoid penicillins, cephalosporins, and carbapenems. Refer to severe beta-lactam allergy column.** **Aztreonam** can be used **except** if allergic to ceftazidime or cefiderocol

Table of Contents

Gustilo-Anderson Classification System

- The Gustilo-Anderson classification system is the most commonly used grading system for open fractures. Fractures are designated as one of three types based on wound size, soft tissue involvement, contamination, and fracture pattern.
- Grade I and II open fractures are most likely to be infected with Gram-positive organisms. Grade III open fractures are associated with Gram-negative and Gram-positive organisms.
- Farm-related injuries are categorized as Grade IIIA at minimum.

Table 2: Grades and Definitions.

Grade	Definition
Grade I	Open fracture with ≤ 1 cm long wound, low energy, without contamination
Grade II	Open fracture with 1-10 cm long wound, low energy, without significant soft tissue injury or contamination
Grade III	Open fracture associated with high energy trauma in addition to: A. >10 cm long wound with extensive soft tissue injury or any size with gross contamination B. Any size with inadequate soft tissue coverage, flap, severe comminution and stripping, and gross contamination C. Any size with inadequate soft tissue coverage and flap, severe comminution and stripping, and severe contamination, and vascular injury requiring repair

Table of Contents

Antimicrobial Prophylaxis by Open Fracture Grade

Table 3: Adult Antimicrobial Prophylaxis.

<table>
<tr><th>Grade</th><th>First-Line Therapy</th><th>Severe Beta-Lactam Allergy</th><th>Duration</th></tr>
<tr><td>Grade I and II</td><td>Cefazolin 2 g IV q8h*
If > 120 kg: cefazolin 3 g IV q8h*</td><td>Vancomycin 15 mg/kg x1,
followed by pharmacy-to-dose*</td><td>24 hours</td></tr>
<tr><td>Grade III</td><td>Ceftriaxone 2 g IV q24h</td><td rowspan="3">Levofloxacin 750 mg IV q24h*</td><td rowspan="3">24 hours after initial debridement and skin closure
No more than 72 hours from time of injury</td></tr>
<tr><td>Grade III
Standing Water Exposure</td><td>Piperacillin/Tazobactam 4.5 g IV q8h
extended infusion panel*</td></tr>
<tr><td>Grade III
Brackish/Sea Water Exposure</td><td>Piperacillin/Tazobactam 4.5 g IV q8h
extended infusion panel*
PLUS
Doxycycline 100 mg IV/PO q12h</td></tr>
<tr><td>Soil or Fecal Contamination</td><td colspan="2">Add Metronidazole 500 mg IV q8h°</td><td>24 hours</td></tr>
<tr><td>Documented MRSA history in past 12 months‡</td><td colspan="2">Add Vancomycin 15 mg/kg x1, followed by pharmacy-to-dose*</td><td>24 – 72 hours</td></tr>
</table>

*These antibiotics may require renal dose adjustments. Refer to Antimicrobial Dosing (Adult) and Vancomycin Dosing Guidelines.
°Additional anaerobic coverage is unnecessary if Piperacillin/Tazobactam is utilized.
‡ MRSA history = infection or colonization (positive MRSA nares)

Table 4: Pediatric Antimicrobial Prophylaxis.

<table>
<tr><th>Grade</th><th>First-Line Therapy</th><th>Severe Beta-Lactam Allergy</th><th>Duration</th></tr>
<tr><td>Grade I and II</td><td>Cefazolin 33 mg/kg/dose IV q8h*
(max: 2 g/dose)</td><td>Clindamycin 10 mg/kg/dose IV q8h
(max: 900 mg/dose)</td><td>24 hours</td></tr>
<tr><td>Grade III</td><td>Ceftriaxone 50 mg/kg/dose IV q24h
(max: 2 g/dose)</td><td rowspan="3">Levofloxacin 10 mg/kg/dose IV
Age ≥5 yr: q24h*
Age <5 yr: q12h*
(max: 750 mg/dose)</td><td rowspan="3">24 hours after initial debridement and skin closure
No more than 72 hours from time of injury</td></tr>
<tr><td>Grade III
Standing Water Exposure</td><td>Piperacillin/Tazobactam IV
q8h extended infusion panel*
(max: 4000 mg of piperacillin/dose)</td></tr>
<tr><td>Grade III
Brackish/Sea Water Exposure</td><td>Piperacillin/Tazobactam IV
q8h extended infusion panel*
(max: 4000 mg of piperacillin/dose)
PLUS
Doxycycline 2.2 mg/kg/dose IV/PO q12h
(max: 100 mg/dose)</td></tr>
<tr><td>Soil or Fecal Contamination</td><td colspan="2">Add Metronidazole 10 mg/kg/dose IV q8h (max: 500 mg/dose) °</td><td>24 hours</td></tr>
<tr><td>Documented MRSA history in past 12 months</td><td colspan="2">Add Clindamycin 10 mg/kg/dose IV q8h
(max: 900 mg/dose)</td><td>24 – 72 hours</td></tr>
</table>

*These antibiotics may require renal dose adjustments.
°Additional anaerobic coverage is unnecessary if Piperacillin/Tazobactam is utilized.
‡ MRSA history = infection or colonization (positive MRSA nares)

Table of Contents

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<table>
<tr><td>Antimicrobial Stewardship P&T Subcommittee Approval: 06/3/25</td><td rowspan="3">Originated: 12/24</td></tr>
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<tr><td colspan="2">Revision History:
12/24: Added pediatric dosing table
01/25: Reformatted to align with AMS guideline template
03/25: Reformatted pediatric section to align with adult recommendations; updated beta-lactam allergy guidance verbiage</td></tr>
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