

Guideline: ORTHOPAEDIC TRAUMA, ADULT, INPATIENT

Updated: February 4, 2022

Clinical guideline summary

PATIENT POPULATION AND DIAGNOSIS:

Adult orthopaedic trauma patients with injuries that include:

- Open long-bone extremity fractures ([Appendix A](#))
- Pelvic fractures with hemodynamic instability ([Appendix B](#))

APPLICABLE TO: Big Rapids, Gerber, Ludington, Pennock, Reed City, SH GR Hospitals, United/Kelsey, Zeeland

BRIEF DESCRIPTION: This guideline is intended to create a standard place to reference guidelines specific to orthopaedic trauma care. Injury specific guidelines in their entirety are attached in appendices. This is not an all-inclusive list of potential orthopaedic trauma injuries.

OVERSIGHT TEAM LEADER(S): Dr. Todd Conlan, Dr. Gable Moffitt

OWNING EXPERT IMPROVEMENT TEAM (EIT): Trauma provider section meeting

MANAGING CLINICAL PRACTICE COUNCIL (CPC): Orthopaedic CPC

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OTHER TEAM(S) IMPACTED: Trauma

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Clinical pathways clinical approach

Appendix A:

Title: Care of the adult trauma patient with open long-bone extremity fractures

Purpose

- ❖ Open fractures constitute a major source of morbidity and mortality associated with trauma. This guideline is created to identify the expectations regarding timing and type of antibiotic prophylaxis and time to debridement specific to open fracture type. The goal of this guideline is to reduce mortality and morbidity associated with open fractures.

General Management for All Open Fractures

- ❖ Orthopaedic response within 30 minutes of patient arrival time¹
- ❖ Evaluate all patients for Tetanus prophylaxis
 - Pregnancy Recommendations: administer ONE dose of Tdap vaccine during each pregnancy (preferred during 27 through 36 weeks gestation) regardless of number of years from prior Td or Tdap vaccination.
 - Adult patients (including persons 65 years of age and older): One dose of Tdap indicated if patient has never received Tdap or vaccine status unknown and then boost with Td every 10 years.
 - Tetanus immune globulin should be administered to patients with high risk wounds who have received fewer than three doses of tetanus toxoid or whose immunization status is uncertain

Washout

- ❖ Poke hole open fractures to be debrided at surgeon discretion. Otherwise, washout time indicates a debridement in Operating room and excludes Emergency Department washout which is considered insufficient

Wound Closure

- ❖ Wounds should be closed within 5 days of definitive fracture treatment

Antibiotics²

- ❖ **Antibiotics should be initiated immediately.** MTQIP requires administration within 1 hour of hospital arrival
- ❖ See below for special antibiotic recommendations for those with contaminated wounds (fecal, soil, standing water, etc.)
- ❖ Metronidazole should not be used in patients with acute alcohol intoxication. Clindamycin may be substituted for metronidazole until alcohol intoxication resolves.
- ❖ Discontinue antibiotics 48-72 hours after injury or 24 hours after wound closure; whichever is shorter

1) Regional hospitals should contact orthopaedic surgeon on call or transfer center if no orthopaedic coverage available within 30 minutes of patient arrival.

2) Excludes distal phalanx fractures of the hand and foot, Antibiotic Route/Dose/Necessity should be managed based on amount of contamination and patient risk factors.

Recommendations for Antibiotic Type, Timing to Antibiotic Prophylaxis, & Time to Debridement by Open Fracture Classification

Open Fracture Classification	Characteristics of Gustilo Grade Open Fracture	Time to Antibiotic Administration	Time to OR Debridement (Washout)	Recommended Antibiotic/Antibiotics*
Type I	Clean wound smaller than 1 cm in diameter, simple fracture pattern, no skin crushing	ASAP < 1 hour after arrival	Less than 24 hours * Poke hole open fractures at surgeon discretion	Cefazolin <i>Severe Penicillin Allergy- Use Clindamycin^a</i> <i>Severe Penicillin Allergy Alternative: Vancomycin^a</i> Discontinue 24 hours after wound closure
Type II	Laceration larger than 1 cm but without significant soft tissue injury, including no flaps or degloving. Fracture pattern may be more complex	ASAP < 1 hour after arrival	Less than 24 hours	Cefazolin <i>Severe Penicillin Allergy- Use Clindamycin^a</i> <i>Severe Penicillin Allergy Alternative: Vancomycin^a</i> Discontinue 24 hours after wound closure
Type III	An open segmental fracture or a single fracture with extensive soft tissue injury. Also included are injuries older than 8 hours. Type III injuries are subdivided into three types	ASAP < 1 hour after arrival	Less than 12 hours	Ceftriaxone <i>If Severe Penicillin Allergy- Clindamycin + Gentamicin^a</i> Discontinue 48-72 hours after injury or 24 hours after wound closure; whichever is shorter

*See "Antibiotic Specific Recommendation" below for wound contamination antibiotic guidance

^a Severe Penicillin Allergy: an immediate type penicillin allergy (angioedema, shortness of breath, wheezing, or urticaria/hives)

Open Fracture Classification	Characteristics of Gustilo Grade Open Fracture	Time to Antibiotic Administration	Time to OR Debridement (Washout)	Recommended Antibiotic/Antibiotics*
Type III A	Adequate soft tissue coverage of the fracture despite high energy trauma or extensive laceration or skin flaps	ASAP < 1 hour after arrival	Less than 12 hours	Ceftriaxone <i>If Severe Penicillin Allergy- Clindamycin + Gentamicin^a</i> Discontinue 48-72 hours after injury or 24 hours after wound closure; whichever is shorter
Type III B	Inadequate soft tissue coverage with periosteal stripping. Soft tissue reconstruction is necessary	ASAP < 1 hour after arrival	Less than 12 hours	Ceftriaxone <i>If Severe Penicillin Allergy- Clindamycin + Gentamicin^a</i> Discontinue 48-72 hours after injury or 24 hours after wound closure; whichever is shorter
Type III C	Any open fracture that is associated with an arterial injury that requires repair	ASAP < 1 hour after arrival	At time of vascular repair/ immediate	Ceftriaxone <i>If Severe Penicillin Allergy- Clindamycin + Gentamicin^a</i> Discontinue 48-72 hours after injury or 24 hours after wound closure; whichever is shorter

*See "Antibiotic Specific Recommendation" below for wound contamination empiric antibiotic regimen

^a Severe Penicillin Allergy: an immediate type penicillin allergy (angioedema, shortness of breath, wheezing, or urticaria/hives)

Antibiotic Specific Recommendations

❖ **Type III Contaminated Wounds Empiric Regimen**

- Soil or fecal material: concern for Clostridial contamination, i.e. farm injuries
 - **Ceftriaxone + Metronidazole**
 - If severe Penicillin allergy and unable to tolerate cephalosporins:
 - Levofloxacin + Metronidazole
- Free-standing water: concern for Pseudomonas/Aeromonas, i.e. lake injuries
 - **Levofloxacin + Metronidazole**
 - If severe Fluoroquinolone allergy:
 - Piperacillin-Tazobactam

❖ **Adult Dosing Considerations**

- **Cefazolin**: Initial dose 2g if <120 kg, 3g if >120 kg
 - Subsequent dose is 2 gram IV every 8 hours
 - Dosage adjustment may be indicated in renal impairment
- **Clindamycin**: 900 mg IV every 8 hours
- **Ceftriaxone**: 2g every 24 hours
- **Gentamicin**: Pharmacy Dosing Service must be consulted for all Gentamicin orders at the time of initial order
 - Gentamicin 5mg/kg IV every 24 hours (Max dose 500mg)
 - Use actual body weight (ABW) for dosing. If ABW is 30% greater than ideal body weight (IBW), use adjusted body weight
- **Levofloxacin**: 750mg every 24 hours
- **Metronidazole**: 500mg IV every 8 hours
- **Piperacillin-Tazobactam**: 4.5g IV every 6 hours; Dosage adjustment may be indicated in renal impairment
- **Vancomycin**: Pharmacy Dosing Service must be consulted for all Vancomycin orders at the time of initial order
 - Dosage adjustment may be indicated in renal impairment

DISCLAIMER: These guidelines were prepared by the Department of Trauma Services, Spectrum Health Butterworth. They are intended to serve as a general statement regarding appropriate patient care practices based upon the available medical literature and clinical expertise at the time of development. They should not be considered to be accepted protocol or policy, nor are intended to replace clinical judgment or dictate care of individual patients.

References

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Appendix B:

Title: Management of Pelvic Fractures with Hemodynamic Instability

Assessment/Evaluation:

- A. Management of patients with hemodynamic instability from pelvic fractures is challenging. **Mortality ranges from 18 to 40%. Death in first 48 hours is secondary to acute blood loss.**
- B. Fracture to pelvic ring requires significant force. **Must suspect intra-peritoneal, retro-peritoneal, and neurovascular injuries in conjunction with pelvic trauma.**
 - Follow ATLS guidelines for hemorrhage control.
- C. **Clinically suspect pelvic ring disruption when:**
 - Lower extremity shortening or rotation
 - Tenderness or palpable gaps in sacrum or posterior pelvis
 - Flank hematoma or ecchymosis
 - Blood at urethral meatus
 - Rectal or vaginal lacerations
 - Abnormal prostate exam
- D. AP pelvis radiograph and FAST should be performed;
CT reserved for hemodynamically stable patients with inconclusive plain films.
- E. If the patient is stable for CT (responder or transient responder with SBP greater than 90 - 100) and shows signs of contrast extravasation or blush, angioembolization is required. Helical CT has shown 98% accuracy for identifying patients that require embolization. **(Level II)**

- F. **Life-threatening hemorrhage is rarely due to pelvic arterial injury.** This is usually due to low-pressure venous plexus disruption or bleeding from cancellous bone surfaces.
- G. **Blunt trauma victims with a pelvic fracture and hemodynamically unstable;** should receive aggressive resuscitation. *Correction of coagulopathy, acidosis, and normothermia are the goals. Early use of Massive Transfusion Protocol (MTP) should be considered.*

Treatment/Interventions:

- A. **If the FAST is positive, patient should go to operating room for exploration.**
**** Pelvic fracture should be stabilized with Circumpelvic sheeting (CPS) prior to Laparotomy.**
- B. Damage control principles may be used if there are intra-abdominal injuries and continued pelvic bleeding.
- C. **If patient remains unstable with a negative FAST, external pelvis stabilization may be beneficial.** If the pelvis is unstable or x-ray shows widening of the posterior ring or pubic symphysis, a noninvasive external device should be used.
- D. Pelvic bleeding should be controlled with **immediate pelvic volume reduction.** (Open book fracture should be closed). **Vertical instability requires longitudinal traction and pelvic volume reduction maneuvers. (Level II)**
- E. Circumpelvic sheeting, secured with appropriate surgical clamps may be applied around the Greater Trochanteric level. **(Level II)**
- Circumpelvic sheeting should be placed by trauma or orthopaedic surgeon if possible
 - Stat pelvic x-ray should be obtained after placement
 - If sheet becomes dislodged, BP and pulse must be monitored every 10 minutes
 - Only trauma or orthopedic surgeon may remove the sheet
 - The sheet should not be left on for longer than 24 to 36 hours. Skin necrosis can occur over injured areas and the bony prominences.
- G. External fixators are another option.
- H. Patients with **unstable pelvic fractures and refractory shock after Circumpelvic sheeting;** should be transported to the operating room for **preperitoneal packing.**
- Pelvic hematoma is evacuated of blood and clot.
 - Three packs are placed lateral on both sides of the bladder down to the pelvic brim.
 - If bright red hemorrhage is identified during this procedure, emergency angiography with embolization should follow this procedure.
 - Exchange or removal of the pelvic packs should be performed in 24 to 48 hours.
 - There is an increased risk of abscess formation if left in place for a longer duration.
(Level II)
- I. **If patient remains unstable after packing, urgent pelvic angiography with angio-embolization is an option. (Level II)**

- J. If initial abdominal evaluation is negative and patient remains unstable, (transient responder) after external compression device (CPS); *urgent angiography with angio-embolization should be performed. (Level II)***
- K.** Angiogram- in the setting of pelvic hemorrhage, and aortogram with bilateral run-off is performed. This is followed by selective injections into both iliac systems. If extravasation of contrast is seen, elective embolization should be performed. Evidence of vessel spasm or abrupt cutoff are also signs of injury and should be considered for embolization.
- L.** For patients that stabilize after angio-embolization, the trauma evaluation should be completed including CT scans and any plain radiographs.

Stabilization/Transfer/Ongoing Treatment:

- A.** Once all procedures are complete and the patient is stabilized, admission to the ICU for continued resuscitation is completed.
- B. Patients with severe pelvic fractures and hemodynamic instability; should not be transported or transferred until stable for 8-12 hours, depending on other associated injuries.**
- C.** Open pelvic wounds communicating with the perineum, rectum, vagina, or buttocks require diverting colostomy maybe indicated within 48 hours.

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