

# Guideline



## CCHMC Trauma Service Guidelines

Title: Orthopaedic Response and Management

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### 1.0 SCOPE

- 1.1. Care of the Trauma Services Patient at CCHMC.
- 1.2. This guideline provides the minimum standard of care and guideline for the pediatric orthopaedic surgeons expected response times and treatment recommendations that best meet the patient's needs and promotes best outcomes.
- 1.3. Orthopaedic injuries are rarely life threatening; however, they are commonly encountered in children with multiple injuries and can be a cause for long-term morbidity. The treatment of children with multiple injuries should follow the principles of Advanced Trauma Life Support (ATLS), and orthopaedic care must never precede the treatment of more serious life threatening injuries.

### 2.0 DEFINITIONS

- 2.1. **Wash out of open fracture-** surgical management and cleaning within the operating room

### 3.0 GUIDELINE

- 3.1. **Open Fractures-** Open fractures comprise about 2% of all fractures and 10% of fractures in children with multiple injuries.[1-9] Wound irrigation, debridement, and appropriate timing of wound closure, as well as antibiotics are well-established methods of decreasing infection.
  - 3.1.1. **ED Management:** Sterile dressing should be applied to cover the wound. Gross contamination (i.e. grass, dirt) should be removed before reducing the bone ends through the skin wound to avoid introducing contamination in the deep tissues. If the wound is declared a small Grade I open fracture, ED only management may be an option once discussed with the Orthopaedic Attending.
  - 3.1.2. **Surgical Timing:** Open fractures are usually classified according to degree of associated soft tissue injury using the modified Gustilo classification. Recent level II research does not support the widely accepted standard of operating within six hours from injury. At CCHMC, timing of treatment is based on grade of injury. Emergent surgery is not necessary for grade I and II open fractures if the patients have received early antibiotics.[11] For this population, operative management should be within 24 hours. [12] Grade III open fractures should be operatively treated within 6 hours due to high level of probably contamination[5].
  - 3.1.3. **Antibiotics:** recommended the first dose of antibiotics (see Table 1) should be given within 3 hours of the injury (*Recommendation Strength: Strong*)
    - 3.1.3.1. Check with referring hospital for any antibiotics given
    - 3.1.3.2. Check with transport/ambulance if antibiotics given
    - 3.1.3.3. Verify what type of surface the incident occurred on. It is suggested that ANY farm, grass, or synthetic surface, be managed as a Type III. (*Recommendation Strength: Weak*)
    - 3.1.3.4. Use Table 1 for antibiotic selection and duration and Table 2 for dosing (see bullets for evidence grades)
      - 3.1.3.4.1. Gram positive coverage with cefazolin is strongly recommended for all grades (*Recommendation Strength: Strong*)
      - 3.1.3.4.2. Extended gram-negative coverage is strongly recommended for Gustillo grade III fractures (*Recommendation Strength: Strong*)
      - 3.1.3.4.3. Clindamycin is recommended as an alternative to Cefazolin for patients with allergy or another contraindication (*Recommendation Strength: Moderate*)
      - 3.1.3.4.4. Once-daily aminoglycoside dosing is recommended for Gustillo grade II and III fractures (*Recommendation Strength: Strong*)
      - 3.1.3.4.5. Aztreonam is suggested as an alternative agents for patients with allergy or a contraindication to aminoglycosides (*Recommendation Strength: Weak*)
      - 3.1.3.4.6. High dose penicillin is strongly recommended in cases where fecal or clostridial contamination is present such as farm-related injuries (*Recommendation Strength: Strong*)
    - 3.1.3.5. **Duration**

- 3.1.3.5.1. 24 hours of therapy from wound closure is suggested for Gustillo grade I and II  
(*Recommendation Strength: Weak*)
- 3.1.3.5.2. 48-72 hours of therapy from wound closure is recommended for Gustillo grade III fractures  
(*Recommendation Strength: Moderate*)
- 3.1.4. **Tetanus prophylaxis** (Tdap) is suggested as needed (within 5 years) upon arrival as soon as possible  
(*Recommendation Strength: Weak*)
- 3.1.5. Cultures of tissue for aerobic, anaerobic, fungal and AFB are suggested if repeat washout is performed greater than 5 days after the initial injury. (*Recommendation Strength: Weak*)
- 3.1.6. Tissue or purulent material (from the anatomic site where infection is clinically suspected) submitted in a sterile specimen container has the highest microbiological yield
- 3.1.7. Swabs are acceptable as additional specimens from sites which cannot be reasonably or safely accessed for tissue culture as part of the planned procedure. At least one tissue specimen is suggested.
- 3.1.8. Cultures at the time of injury are not recommended.
- 3.1.9. **Open finger and toe fractures** (Tuft, Seymour, Pinkney), which requires a wash-out and repair in the Emergency Department, will receive 5 days of out-patient oral antibiotics and close follow up.
- 3.1.9.1. Gram positive coverage with Keflex is recommended.
- 3.1.9.2. Clindamycin is recommended as an alternative to Cefazolin for patients with allergy, another contraindication, or those that occurred in ANY farm, grass, or synthetic surface.
- 3.1.10. Those requiring OR fixation/repair will follow the intravenous in Table 1.
- 3.2. **Long Bone Fractures**-Long bone fractures are very common in the pediatric population. Treatment options include both operative and non-operative approaches and are primarily dependent on the child's age and weight.
- 3.2.1. **Surgical Timing:** Optimal timing and sequence for the treatment of long bone fractures in children is associated with lessened incidence of complications and improved outcomes. Priority block time for operative management is scheduled early on week days. There is strong evidence in the adult literature that long bone fractures should be stabilized within 24 hours to prevent pulmonary complications, particularly in the multiply injured patient. Based on the severity of the patient's condition, in collaboration with the attending trauma surgeon, the goal of the pediatric orthopaedic team is to provide treatment of these fractures within 24 hours of injury. [13, 14]
- 3.2.2. **Antibiotics:** To ensure adequate blood level at the time of surgical incision, it is recommended that a prophylactic antibiotic be given within one hour before incision.
- 3.3. **Pelvic Fractures** [15-17]-Pediatric pelvic fractures are more uncommon than in the adult population. [18] The evaluation and treatment are significantly different from the adult population, because of important anatomical differences between the two populations. Pediatric pelvic fractures are most frequently caused by high-energy mechanisms such as pedestrian collisions with moving vehicles and motor vehicle crashes. Therefore, when a pelvic fracture occurs in a child, there should be a high suspicion for associated head, thoracic, urologic and abdominal injuries.
- 3.3.1. **ED Treatment:** Blood loss after pelvic fracture has been found to occur less frequently in the pediatric population. [19, 20] When a displaced pelvic fracture is diagnosed in a hemodynamically unstable patient, a pelvic binder should be placed during the initial trauma evaluation for an unstable ring injury. This should decrease intra-pelvic volume and potentially tamponade off any bleeding from vessels and bone.
- 3.3.2. **Management:** The Torode and Zieg (1985) classification is the most widely used system for classification of pelvic fractures in children. A modified Torode classification of pediatric pelvic fractures was developed in 2012 and subdivides Type III pelvic fractures into 2 groups depending on the location of the fracture.[21] Rationale for this modification was the likelihood of type III-B injuries showing similar characteristics (i.e. blood requirement, operative management) to those children with type IV injuries.
- Type I – avulsion fractures
  - Type II – iliac wing fractures
  - Type III-A – stable anterior pelvic ring fractures
  - Type III-B – stable anterior and posterior pelvic ring fractures
  - Type IV – unstable pelvic ring injuries
- 3.3.3. The pediatric orthopaedic team, in association with the surgical team, will determine the severity of injury and the necessary treatment plan. Treatment is individualized based on patient age, fracture classification, stability of the pelvic ring, and extent of concomitant injuries. Treatment can differ significantly between skeletally immature and skeletally mature pelvic fractures. The most reliable method of deciding skeletal maturity is the status of the triradiate cartilage. After triradiate closure, injury patterns are close to that of an adult. On average, the triradiate cartilage closes at 14 years in boys and 12 year in girls.[15]
- 3.3.4. Most stable pelvic injuries in the pediatric population will be managed non-operatively with protected weight bearing and gradual return to activity. Patients that have an unstable ring fracture merits operative reduction and fixation, regardless of the patient's age or skeletal maturity.

3.4. **Acetabular Fractures** [15]- Overall, acetabular fractures are not common. Most pediatric acetabular fractures are in adolescents, with very few reported at less than 10 years of age. Fractures of the acetabulum may occur with less energy than adult acetabular fractures.

3.4.1. **ED Treatment:** After standard trauma evaluation, the most urgent situation to an acetabular fracture is a concomitant hip dislocation, which should be reduce urgently to attempt and preserve blood supply to the femoral head.

3.4.2. **Management:** Treatment of acetabular fractures will depend on the grade of injury. The nature of the developing hip joint necessitates an individualization of treatment for each pediatric acetabular fracture. Those cases requiring operative intervention will be managed in a timely fashion with the available assistance of an orthopaedic traumatologist. The consultation of the adult traumatologist will be obtained when in the opinion of the team, the adult institution expertise exceeds the pediatric expertise.

<b>Classification of Open Fracture</b>	<b>1<sup>st</sup> Line Antimicrobial</b>	<b>Alternative Antimicrobial<sup>1</sup></b>	<b>Duration Following Wound Closure</b>
Gustillo Type I & II	Cefazolin	Clindamycin	24 hours <sup>2</sup>
Gustillo Type III	Cefazolin <b>AND</b> Gentamicin <u>Fecal or Clostridial Contamination<sup>3</sup>:</u> <b>ADD</b> Penicillin G 400,000 IU IV Q6 hours	Clindamycin <b>AND</b> Gentamicin <b>OR</b> Aztreonam	48-72 hours

<sup>1</sup> Alternative agent recommended when a confirmed allergy to a first-line agent or another contraindication is present

<sup>2</sup> Up to 48 hours of therapy may be considered for patients with Gustillo Type II

<sup>3</sup> Suspect in any farm injury or bowel-contaminated injury

<b>Antimicrobial</b>	<b>Dose</b>	<b>Post-op dosing interval</b>	<b>Max Single Dose</b>
Aztreonam	30mg/kg	Every 6 hours	2g
Cefazolin	40mg/kg	Every 8 hours	2g <sup>1</sup>
Clindamycin	10mg/kg	Every 6 hours	900mg <sup>2</sup>
Gentamicin	4.5mg/kg	Every 24 hours	360mg
Penicillin G	65,000 IU/kg	Every 4 hours	3,000,000 IU

<sup>1</sup> 3 grams for patients >100kg

<sup>2</sup> Consult clinical pharmacy for patients weighing >150kg

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**5.0 APPROVALS**

All revisions of this guideline are approved by the Trauma Services Department. This guideline is reviewed every three years or sooner if deemed necessary. Authority for this document resides with the Trauma Services Department. This guideline is approved by the Trauma Services Manage and the Director of Trauma Services.

<b>HISTORY</b>	
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