



Pediatric Orthopedic Fractures Management and Referral Guideline

Provided by



Pediatric Orthopedic Fractures Management and Referral Guidelines

Please contact the Transfer Center at 512.324.3515 upon the decision to transfer or if you need assistance in the decision to transfer.

For non-emergent care and follow up, please have the family contact Central Texas Pediatric Orthopedics at 512.478.8116.

General Guidelines:

Plan for immediate transfer any child up to 15 years old with the following:

- All open fractures
- Any fracture with neurovascular compromise
- Any fracture with displacement involving the growth plate
- Fractures around the elbow with displacement
- Pelvic Fractures
- **Upper and lower extremity dislocations** with neurovascular compromise or skin tenting.
- Tibial shaft fractures should raise a high index of suspicion for potential compartment syndrome and if any concerns please transfer.

*The extremity should be appropriately immobilized prior to transfer as outlined below.

If any concerns please contact us at the above telephone numbers to ensure appropriate transfer and treatment.

Open Fractures:

- All open fractures should receive intravenous antibiotics per current American College of Surgeons recommendations within one hour of presentation:
- See Appendix A from the Dell Children's Evidence-Based Outcome Center or the following website for recommended antibiotics:
<http://intranet.seton.org/v2/trauma-services-at-dcmccf/files/2014/10/Orthopedic-Open-Fracture-Antibiotic-Treatment-Guideline-1.pdf>
- Parents should be asked about tetanus immunization and a booster provided if not given within last 5 years
- Please do **NOT** try to reduce open fractures prior to transfer. Simple saline soaked gauze and splint for stability should be applied
- Keep the patient NPO upon transfer

Upper Extremity Injuries:

*Splinting instructions

- Position of comfort, well padded
- Do not overstretch Ace bandage – (The Ace bandage does not stabilize the fracture, it merely holds the splint to the extremity). This can and will result in increased pain and swelling, and can lead to *compartment syndrome*.

- Splint arm at 30 degrees shy of extension



Dislocations of Joints:

- Simple dislocations without neurovascular compromise and without fractures can be reduced by ED provider if they feel comfortable. Appropriate splint application and referral to Central Texas Pediatric Orthopedics within 3 days is appropriate.
- Dislocations with fractures can be reduced prior to transfer but communication between the ED provider and orthopedic provider should take place prior to reduction and transfer.
- Dislocations with skin tenting and neurovascular compromise can be reduced prior to transfer, but communication between the ED provider and orthopedic provider should take place prior to reduction and transfer.

Specific Upper Extremity Fractures:

A non-displaced / occult fracture of the upper extremity may be immobilized and referred to pediatric orthopedics within 3 to 5 days.

Finger Fractures: Displaced closed fractures of phalanges can be buddy taped with paper tape and splinted and seen in clinic within 3 days. Please have the family contact the above clinical number for follow up appointments.

Tuft fractures: At the comfort level of the ED provider, these can be handled by that provider with the following recommendations:

- If the bone is exposed and /or the nail has been disrupted, then intravenous antibiotics should be given and the wound irrigated.
- **Absorbable** sutures should be placed (**Chromic 5-0 or 6-0 preferable**).
- The nail can be reinserted to keep the eponychial fold open, but does not need to be sewn in place.
- Next, vaseline or bacitracin can be applied over the repair and wound, and a simple Telfa pad or gauze applied. Splint and follow up within 3 days.
- Discharge with PO antibiotics for 7 – 10 days depending on wound.
- If any concern about the finger viability, then transfer should be initiated expeditiously.

Distal Radius / Ulna fractures:

- Splint in position of comfort, **loosely** apply ACE bandage (The bandage is to keep the splint in place, not to hold a reduction. Often the bandage is placed too tight and causes more pain and swelling).

- Follow up within 3 to 5 days.

Forearm fractures: may be reduced and referred to clinic within 3 to 5 days **unless:**

- The fracture is open,
- There is neurovascular compromise,
- And /or the ED physician feels uncomfortable with reduction.
- Or if there is difficulty at your site to deliver adequate analgesia and anxiety control for the procedure through procedural sedation.

Elbow fractures:

Displaced fractures around the elbow should be transferred for definitive care. Most of these fractures will require surgical stabilization with pins. In most cases, stabilization within 24 hours is recommended.

- Do NOT attempt to provisionally reduce the fracture. This can delay care and does not provide a clinical benefit
- Splint in slight extension
- Keep the patient NPO

Humeral shaft fractures:

- Displaced fractures should be transferred so that coaptation splint can be applied effectively.
- Nondisplaced fractures can be placed into swing and swathe and follow up within 3 days.

Proximal humerus fractures and clavicle fractures:

Unless open and / or grossly displaced, these can usually follow up within 3 days. Sling and swathe for can be used for comfort and pain control. Figure of 8 bandages are not required and often cause significant discomfort.

Lower Extremity Injuries:

*Splinting instructions – Lower extremity:

Make sure to stabilize fracture appropriately by splinting across joints above and below fracture site. Failure to do so will lead to increasing pain and swelling.

- Pad the heel and bony prominences well to avoid pressure ulcers
- No walking in splints (No weight bearing). Provide crutches if age appropriate.
- Hare traction splint only for femoral shaft fractures. In addition, the traction should only be used to transfer the patient. It should not remain in place for more than 6 hours as this has led to skin breakdown in certain circumstances.
 - Do **NOT** use Hare traction for femoral neck, proximal femur growth plate fractures, or distal femur growth plate fractures.
- Skin tenting due to a displaced fracture or dislocation, needs to be transferred to alleviate the skin tension in hopes to prevent skin breakdown and compartment syndrome.
- Tibial shaft fractures should raise a high index of suspicion for potential compartment syndrome.

Appropriate imaging / radiographs:

Hip fractures in children can have serious consequences, such as bone death. If a hip fracture is suspected, then a simple AP pelvis should be performed for review. If a femoral neck fracture is confirmed, a cross table lateral is preferred (**NOT a frog leg – as this can displace the fracture and is painful to the child**). Following this, the patient needs to be transferred to higher level of care for stabilization. Time to fixation can make a difference.

- If there is concern for a growth plate fracture around the hip (Slipped Capital Femoral Epiphysis), then one should obtain frog leg pelvis to better assess degree of Slipped Capital Femoral Epiphysis (SCFE).
- If AP pelvis and frog leg are clear, then respective lower extremity imaging should be performed, typically above and below the injured part.

Dislocations of Joints:

- **Simple dislocations** (excluding hips) without neurovascular compromise and without fractures can be reduced by ED provider if they feel comfortable. Appropriate splint application and referral to pediatric orthopedics within 3 days is appropriate.
- **Hip dislocations in children younger than 15 years of age should be transferred without attempted reduction.** These are typically reduced under general anesthesia so as not to create a femoral head fracture. Other dislocations with fractures can be reduced prior to transfer but communication between the ED provider and orthopedic provider should take place prior to reduction and transfer.
- **Dislocations with skin tenting and neurovascular compromise** can be reduced prior to transfer, but communication between the ED provider and orthopedic provider should take place prior to reduction and transfer.

Specific Lower Extremity Fractures:

A non-displaced / occult fracture of the lower extremity may be immobilized and referred to pediatric orthopedics within 3 to 5 days.

Foot fractures:

Swollen, painful feet with diagnosed fractures should be placed into a boot or well-padded splint and placed non-weight bearing until seen by the pediatric orthopedic specialist. These can be seen within 5 days.

Ankle Fractures:

A common injury and like all injuries, there is a spectrum of severity. Most are low energy mechanisms and can be splinted (boot or well-padded splint) and seen in clinic within 3 – 5 days. Crutches and non-weight bearing are recommended.

- Most of these injuries are physeal injuries, as the growth plate is mainly cartilage and is weaker than the surrounding bone and ligaments.
- Swelling will occur and can cause skin breakdown (fracture blisters) and worsening pain. Instructions on elevation are important as well as making sure not to apply the Ace bandage too tight.
- Fractures with skin tenting and neurovascular compromise need to be transferred for higher level of care.

Tibial shaft fractures:

In general, these fractures should be transferred for definitive treatment as well as monitoring

for compartment syndrome.

- Toddler's fractures (with displaced fracture in age < 3 years) should be splinted in well-padded long leg splint and transferred for definitive treatment, usually a split long leg cast. **Children should NOT be permitted to walk in splints, as heel ulcers are common in these instances.** Children under age 3 years with a non-displaced fracture should follow up in clinic within 1 – 2 days. **If non-accidental trauma is suspected, the child should be transferred to DCMC for appropriate workup.**
- Displaced mid-shaft tibia fractures should be transferred. Prior to transfer, a well-padded posterior leg splint should be applied from foot to above the knee. Failure to incorporate the knee, does not allow for adequate immobilization. This can lead to worsening pain and swelling.
- Patients should be kept NPO when transferring.

Proximal Tibia fractures:

Displaced tibial tubercle and proximal tibial fractures should all be transferred for higher level of care. There is an increased risk for compartment syndrome with these fractures. Well-padded splint above and below the knee should be used.

- Non-displaced proximal tibial fractures in young children can be immobilized in a long leg splint and made non-weight bearing. Follow up within 3 days.

Femur Fractures:

These should all be transferred for higher level of care. Depending on age and size of child, a long leg splint can be placed prior to transfer. If the child is big enough, hare traction type devices can be used for **isolated femoral shaft fractures** to stabilize the leg for transport.

Hip Fractures:

These should all be transferred for higher level of care. See above note regarding imaging and radiographs. Keeping the leg in a position of comfort is appropriate and timely transfer is critical. Communication with ED providers and orthopedic providers is strongly recommended in order to facilitate timely surgical intervention. Keep NPO.

- **Hip dislocations** in children should also be transferred without attempted reduction. Cases of femoral head fracture through the growth plate have been documented after attempted reductions in the ED. We recommend general anesthesia for reducing dislocated hips in children under age 15 years.
- A CT scan is typically performed after reduction to confirm concentric reduction as well as evaluate for additional injuries and / or fractures.

Pelvic Fractures:

For high energy mechanisms, pelvic stabilization is recommended prior to transfer. Different devices are available commercially (pelvic binders) and can be used or simpler means, such as a sheet wrapped around the pelvis and secured to itself with towel clips. Communicate with trauma surgeons on transferring the patient.

Please contact the Transfer Center at 512.324.3515 upon the decision to transfer or if you need assistance in the decision to transfer.

For Questions regarding content of this guideline please contact the pediatric orthopedic specialists at Central Texas Pediatric Orthopedics @ 512.478.8116.



Appendix A

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DELL CHILDREN'S MEDICAL CENTER EVIDENCE-BASED OUTCOME CENTER ORTHOPEDIC OPEN FRACTURE ANTIBIOTIC TREATMENT GUIDELINE

1.0 Definition:

- Open fractures occur when a fractured bone is exposed to contamination from the external environment through a disruption of the skin and subcutaneous tissues increasing susceptibility to infection. Patients with open fractures should receive intravenous antimicrobials within one hour of presentation to reduce the risk of infection. Antibiotics should be administered for no longer than 24 hours after a surgical procedure. In cases of severe contamination, antibiotics may be continued for as long as 72 hours after a surgical procedure.

2.0 Incidence:

- More than 60 percent of injuries involve the musculoskeletal system, and more than half of hospitalized trauma patients have at least one musculoskeletal injury that could be life threatening, limb threatening, or result in significant functional impairment. These orthopaedic injuries are often associated with significant health care costs, decreased productivity in the workplace, and, in some cases, long-term disability.

3.0 Etiology:

- The American College of Surgeons (ACS) Resources for the Optimal Care of the Injured Patient, 2014 includes several key hospital and provider-level orthopaedic trauma criteria that must be met in order to attain American College of Surgeons trauma center verification.
- The optimal management of trauma patients with orthopaedic injuries requires significant physician and institutional commitment.

4.0 Guideline Inclusion Criteria:

- Patients presenting with known open fractures
- Patients who have an open fracture identified on exam

5.0 Guideline Exclusion Criteria:

- Patients presenting with fractures NOT exposed to contamination from the external environment through a disruption of the skin and subcutaneous tissues

6.0 Diagnostic Evaluation:

- 6.1 **History:** Assess for fractures in which bone is exposed to contamination from the external environment through a disruption of the skin and subcutaneous tissues and are susceptible to infection. Include where and how the injury occurred and what potential contaminants may be present.
- 6.2 **Physical Examination:** Once fracture site is visualized assess if open area exists that may communicate with the underlying bone or periosteum.
- 6.3 **Imaging Tests:** Diagnostic radiographs are indicated for identify fractures and injury severity. Consider angiography in the event of possible vascular injury.
- 6.4 **Laboratory Tests:** As with any pediatric trauma patient, consider CBC, PT/INR, PTT and Type & screen as indicated for concern for blood loss and coagulopathy.

7.0 Critical Points of Evidence

- Previous dosing recommendations for Gentamycin required multiple doses per day of this antibiotic. Currently literature supports, once daily dosing for pediatric patients of gentamicin without loss in efficacy.

8.0 Practice Recommendations and Clinical Management

8.1 Upon initial presentation:

- Assess the fractured extremity while maintaining fracture stabilization and adequate pain control.
- Visualize and evaluate any wounds associated with the fractured bone(s).
- If there is an open wound or puncture site please remove visible debris and cover with a sterile dressing prior to placing splint.
- Consult orthopedics.

8.2 If the patient has been transferred with a splint:

- The splint should be removed while maintaining fracture stabilization and adequate pain control.
- If there is an open wound or puncture site please remove visible debris and cover with a sterile dressing prior to replacing splint.
- Consult orthopedics.



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8.3 Once the suspicion of an open fracture is identified:

- Administer antibiotics as suggested in tables below; **the optimum time to antibiotics once an open fracture is identified is one hour.**
- Please provide antibiotic coverage immediately as consult delays are unavoidable at times and patients may not be scheduled for OR repair emergently.
- Patient with open fractures should be taken to the operating room for irrigation and debridement within 24 hours of initial presentation whenever possible (this is a guideline change from the previous time frame of 6 hours).
- Patients with severe fractures associated with gross wound contamination should be brought to the operating room more quickly, and as soon as clinically feasible, based on the patient's condition and resources available.

8.4 Duration of antibiotic treatment

- Scheduled dosing of antibiotics should be continued until surgical management is performed.
- After the surgical procedure, the duration of antibiotics is dependent on the level of contamination.
- A minimum of 24 hours of antibiotics should be administered from the start of the surgical procedure (generally, antimicrobials are discontinued 24 hours after the procedure).
- Continuation for up to 72 hours may be appropriate for highly contaminated wounds.
- Antibiotics should not be administered beyond 72 hours unless a second operative intervention occurs within that time period.

8.5 Antibiotic Recommendations:

	Type 1 open fractures‡	Type 2 open fractures‡	Type 3 open fractures‡
Standard regimen	Cefazolin	Cefazolin	Cefazolin + Gentamicin
If the patient has a history of TRUE allergy or SEVERE adverse reaction to penicillins and/or cephalosporins*	Clindamycin	Clindamycin	Clindamycin + Gentamicin
Soil or fecal contamination (e.g. farm injury)	Ampicillin/sulbactam	Ampicillin/sulbactam + Gentamicin	Ampicillin/sulbactam + Gentamicin
Patient with a history of an MRSA infection	Vancomycin	Vancomycin	Vancomycin + Gentamicin

*True allergy, e.g., urticaria, pruritis, angioedema, bronchospasm, hypotension, arrhythmia.

‡Per Gustillo Classification—used to classify open fractures involving skin disruption; incorporates extent of soft tissue injury and fracture into grading.

Dosing:

Antibiotic	Dosing	Maximum dose
Cefazolin	33 mg/kg/dose IV every 8 hours	Maximum dose: 1 gram
Gentamicin	5 mg/kg/dose IV every 24 hours	No maximum dose
Ampicillin/sulbactam	50 mg/kg/dose IV every 6 hours (dose based on ampicillin component)	Maximum dose: 3000 mg total ampicillin-sulbactam OR 2000 mg ampicillin and 1000 mg sulbactam
Clindamycin	13 mg/kg/dose IV every 8 hours	Maximum dose: 600 mg
Vancomycin	15 mg/kg/dose IV every 6 hours	Maximum dose: 1000 mg



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Expanded Version of the Gustilo Classification System of Open Fractures^a

Feature	Fracture Type				
	I	II	IIIA	IIIB	IIIC
Wound size, cm	<1	>1	>1	>1	>1
Energy	Low	Moderate	High	High	High
Contamination	Minimal	Moderate	Severe	Severe	Severe
Deep soft tissue damage	Minimal	Moderate	Severe	Severe	Severe
Fracture comminution	Minimal	Moderate	Severe/segmental fractures	Severe/segmental fractures	Severe/segmental fractures
Periosteal stripping	No	No	Yes	Yes	Yes
Local coverage	Adequate	Adequate	Adequate	Inadequate	Adequate
Neurovascular injury	No	No	No	No	Yes
Infection rate	0%-2%	2%-7%	7%	10%-50%	25%-50%

Halawi MJ, Morwood MP. Acute Management of Open Fractures: An Evidence-Based Review. Orthopedics. 2015;38(11):e1025-33.



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References

1. American College of Surgeons, Committee on Trauma, Trauma Quality Improvement Program(TQIP). TQIP Best Practices in the Management of Orthopaedic Trauma 2015.
2. Bratzler DW, Houck PM, Surgical Infection Prevention Guidelines Writers Workgroup, et al. Antimicrobial prophylaxis for surgery: An advisory statement from the National Surgical Infection Prevention Project. Clin Infect Dis. 2004;38:1706-1715.
3. Pollak AN, Jones AL, Castillo RC, et al. The relationship between time to surgical debridement and incidence of infection after open high-energy lower extremity trauma. J Bone Joint Surg Am. 2010;92:7-15.
4. Jenkinson, et al. Delayed wound closure increases deep infection rate associated with lower grade open fractures. JBJS Am. March 5;96(5):380-386.
5. Bhattacharyya T, Mehta P, Smith M, Pomahac B. Routine use of wound vacuum-assisted closure does not allow coverage delay for open tibia fractures. Plast Reconstr Surg. 2008 Apr;121(4):1263-1266.
6. Gosselin RA, Roberts I, Gillespie WJ. Antibiotics for preventing infection in open limb fractures. Cochrane Database Syst Rev. 2004;1:CD003764.
7. Hull, Jenkinson, et al. Delayed debridement of severe open fractures is associated with a higher rate of deep infection. Bone Joint J. 2014;96-B:379-384.
8. Lack WD, Karunakar MA, Angerame MR, et al. Type III open tibia fractures: Immediate antibiotic prophylaxis minimizes infection. J Orthop Trauma. 2015;29:1-6.
9. American Academy of Pediatrics. Red Book: 2015 Report of the committee on infectious diseases. 30th edition. American Academy of Pediatrics; 2015.

The signatures below indicate support for the attached guideline, protocol and/or algorithm. The intent is not to be prescriptive but to provide a cohesive, standardized, and evidence-based (when available) approach to patient care. The physician must consider each patient and family's circumstance to make the ultimate judgment regarding best care.

By: <signature on file> _____ Date _____
Dr. Nilda Garcia, Trauma Medical Director, Trauma Council Chair

By: <signature on file> _____ Date _____
Dr. John Williams, Orthopedic Trauma Liaison

By: <signature on file> _____ Date _____
Dr. Robert Schlechter, Surgeon in Chief

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