



BOTTOM LINE RECOMMENDATIONS:

Pediatric Fractures

DIAGNOSIS AND INITIAL MANAGEMENT¹

MANAGE THE CHILD'S PAIN

- » Rate the pain using the [TREKK Recommendations for Pain Management](#).
- » Splint the injured limb.
Analgesia: depending on route of administration (orally/PO, intranasal, IV), allow time for analgesia to take effect before imaging or examination.

MILD-MODERATE PAIN

- » First line: Ibuprofen PO 10 mg/kg/dose (max 600 mg) **ALONE OR IN COMBINATION WITH** acetaminophen PO 15 mg/kg (max 1000 mg).
- » For persistent moderate pain, consider adding an immediate-release **oral** opioid: Oxycodone PO 0.1-0.2 mg/kg/dose (max 10 mg) **OR** HYDROmorphone PO 0.03–0.06 mg/kg/dose (max 2 mg).

SEVERE PAIN (OR REQUIRES QUICK ONSET ANALGESIA FOR EXAMINATION/IMAGING)

- » Consider intranasal (IN) fentanyl (1-2 mcg/kg/dose; max 100 mcg) for expeditious pain management while establishing intravenous access (IV).
- » Morphine **IV** 0.05-0.1 mg/kg/dose (max 10 mg) **OR** Fentanyl **IV** 1-2 micrograms/kg (maximum 50 micrograms per dose) **OR** HYDROmorphone **IV** 0.01-0.02 mg/kg (maximum 1 mg per dose).

ESTABLISH TIMING AND MECHANISM OF INJURY

EXAMINE THE INJURED AREA

For extremity injuries, examination should also include:

- » Examination above and below the injury on the same limb
- » Comparison with the uninjured opposite limb
- » Examination of neurovascular status
- » Assessment for an open fracture

For fractures that will need procedural sedation for reduction or further operative management:

- » Keep the child NPO (nothing by mouth)

DIAGNOSTIC IMAGING

- » At a minimum, all children's injuries that demonstrate focal swelling, focal pain, deformity, or change in status of using a limb should receive x-ray imaging to rule out a fracture.
- » The exception is ankle or knee injuries where you can apply clinical decision rules to aid in imaging decisions. These include the following musculoskeletal imaging rules ^{2,3,4}:
 - i. [Ottawa Ankle Rules](#)
 - ii. [Low Risk Ankle Rules](#)
 - iii. [Ottawa Knee Rules](#)
- » Ensure imaging includes all recommended views for the specific body part and that you review x-ray imaging **after** you have examined the patient.
- » If there is a fracture, identify the specific bone(s) injured, location of fracture (proximal, middle, distal), type of fracture (spiral/oblique, transverse, comminuted, buckle, greenstick, growth plate, avulsion), and degree of displacement and/or angulation.
 - » [Salter-Harris classification of growth plate fractures](#)

PERFORM ASSESSMENT FOR POTENTIAL EVIDENCE OF NON-ACCIDENTAL INJURY

Triggers for non-accidental injury could include (but are not limited to) fractures with the following features:

- » Non-ambulatory child with any fracture
- » Higher risk fractures: femur, humerus (especially spiral, non-supracondylar), metaphyseal, and axial fractures
- » Non-mobile infant with bruising
- » Developmental history not consistent with proposed mechanism of injury
- » Injury not consistent with mechanism
- » Significant delay in seeking care
- » Other evidence of trauma (e.g., multiple fractures)
- » Features of failure to thrive or neglect



MANAGEMENT OF SPECIFIC FRACTURE TYPES⁵

- » Please refer to your site's specific protocols.
- » Clinically suspected distal fibular Salter-Harris I fractures are more often ligamentous injuries.
- » Distal forearm buckle fractures and minor distal fibular fractures (avulsion, non-displaced Salter-Harris I/II) can be treated with a removable device (wrist splint/ankle brace) and self-regulated return to activities.
- » A user-friendly pediatric fracture management guideline can be found at <http://www.rch.org.au/clinicalguide/fractures/>

EMERGENT (<1 HOUR) ORTHOPEDIC CONSULTATION

- » Fractures associated with vascular compromise (pulseless)
- » Fractures with signs or symptoms of compartment syndrome

URGENT (<4 HOURS) ORTHOPEDIC CONSULTATION

- » Open fracture or impending open fracture (skin tenting)
- » Fractures with associated nerve injury
- » Fractures associated with vascular compromise (reduced pulse with good perfusion to extremity)
- » Fractures associated with deformity
- » Growth plate fractures classified as Salter-Harris III, IV, V

NON-URGENT OUTPATIENT ORTHOPEDIC CONSULTATION

- » Closed, stable, uncomplicated fractures without deformity (except those detailed below which are appropriate for primary care physician follow up).

MINOR FRACTURES THAT CAN BE FOLLOWED BY THE PRIMARY CARE PHYSICIAN

- » Distal radius buckle (with or without associated ulnar buckle/styloid) fractures
- » Minor non-displaced distal fibular fractures: Salter-Harris I, Salter-Harris II, avulsion fractures⁶
- » Uncomplicated mid-shaft clavicle fractures

DISCHARGE INSTRUCTIONS

- » Ibuprofen (10 mg/kg/dose, max 400 mg) PO every 6-8 hours as needed is as effective as morphine in children with non-operative upper extremity fractures.⁷ Ibuprofen is also more effective than acetaminophen with codeine in children with extremity fractures. Codeine is **not** recommended for children.⁸
- » Fractures requiring reduction and other more complex injuries may require a short-course of adjuvant opioids post-discharge to adequately manage pain and function.
- » Provide information on management of injury that includes home care of immobilization device, anticipatory guidance on recovery and participation in sports, scheduled follow up with a physician.
- » Provide information on reasons to return to the emergency department prior to scheduled physician visit - e.g. increased pain, swelling, fever, cold fingers/toes, cast too tight or other concerns.

The purpose of this document is to provide healthcare professionals with key facts and recommendations for the diagnosis and treatment of fractures in children. This summary was produced by the fracture content advisors for the TREKK Network, Dr. Kathy Boutis and Dr. Mark Camp of the Hospital for Sick Children, and uses the best available knowledge at the time of publication. However, healthcare professionals should continue to use their own judgment and take into consideration context, resources and other relevant factors. The TREKK Network is not liable for any damages, claims, liabilities, costs or obligations arising from the use of this document including loss or damages arising from any claims made by a third party. The TREKK Network also assumes no responsibility or liability for changes made to this document without its consent. This summary is based on:

1. Flynn JM, Skaggs DL, Waters PM. [Rockwood and Wilkins' Fractures in Children](#). 8th Ed. Philadelphia, PA: Lippincott Williams & Wilkins; 2014.
2. Dowling S, Spooner CH, Liang Y, et al. [Accuracy of Ottawa Ankle Rules to Exclude Fractures of the Ankle and Mid-foot in Children: A Meta-Analysis](#). *Acad Emerg Med*. 2009;16(4):277-287.
3. Boutis K, Grootendorst P, Willan A, et al. [Effect of the Low Risk Ankle Rule on the frequency of radiography in children with ankle injuries](#). *CMAJ*. 2013;85(15):E731-738.
4. Bulloch B, Neto G, Plint A, et al. [Validation of the Ottawa Knee Rule in children: a multicenter study](#). *Ann Emerg Med*. 2003;42(1):48-55.
5. Boutis K. [Common Pediatric Fractures Treated with Minimal Intervention](#). *Ped Emerg Care*. 2010;26(2):152-157.
6. Boutis K, Plint A, Stimec J, et al. [Radiograph-Negative Lateral Ankle Injuries in Children: Occult Growth Plate Fracture or Sprain?](#) *JAMA Pediatr*. 2016;70(1):e154114.
7. Poonai N, Bhullar G, Lin K, et al. [Oral administration of morphine versus ibuprofen to manage post fracture pain in children: a randomized trial](#). *CMAJ*. 2014;186(18):1358-1363.
8. Clark E, Plint AC, Correll R, Gaboury I, Passi B. [A randomized, controlled trial of acetaminophen, ibuprofen, and codeine for acute pain relief in children with musculoskeletal trauma](#). *Pediatrics*. 2007;119(3):460-467.

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