

**Abstract:**

Pediatric orthopedic injuries are commonly seen in emergency departments, and each injury has a unique management plan that differs from interventions in the adult population. This is largely attributed to the open physes in skeletally immature children, creating a “weak link” for fracture sites to occur. With advancements in the evaluation and management of traumatic orthopedic emergencies, it is important to review current management trends. This review focuses on changes seen in neurological compromise, vascular compromise, acute compartment syndrome, open fractures and fractures requiring urgent reduction. Overall, it is best to consult orthopedic surgery early in the course with any of these injuries, though timing of specific interventions has changed over the years. We have reviewed the current literature and best practices for each topic and provide an overview of the findings, current recommendations, and consensus of management as well as our recommendations if no standard management exists.

**Keywords:**

Pediatric orthopedic injury; management; neurovascular injury; open fracture; compartment syndrome; pediatrics

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# Traumatic Pediatric Orthopedic Emergencies: An Approach to Evaluation and Management

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Orthopedic injuries are a common reason for an emergency department (ED) visit in the pediatric population, representing approximately 10 to 15% of ED visits.<sup>1-4</sup> The greatest incidence of fractures is in children <14 years of age with an equal gender predilection, after which there is a higher incidence in male adolescents.<sup>1,2,5</sup> Of those presenting to the ED, approximately 11% will require hospitalization and/or surgical management, including open reductions in the operating room.<sup>1,2,4</sup> There is a seasonal variation to the fracture patterns, with an increased incidence in summer months most likely related to the larger number of outdoor activities in the warmer summer months as well as vacation from school.<sup>1,2</sup> Still, there are a wide variety of fractures and injuries throughout the year within this specific population, each with a unique management plan that differs from that in the adult population. The differences in management between children and adults are largely due to the open physes in skeletally immature children; this active

growth and maturation allows for extensive remodeling.<sup>3</sup> Open physes also represent the “weak link” in the musculoskeletal chain, making physeal fractures more likely than ligament sprains in young children.<sup>3</sup> With continuing advancements in the evaluation and management of traumatic orthopedic emergencies, it is important to review current management trends. We will discuss the approaches to neurological compromise, vascular compromise, acute compartment syndrome, open fractures and fractures requiring urgent reduction.

## NEUROLOGICAL COMPROMISE

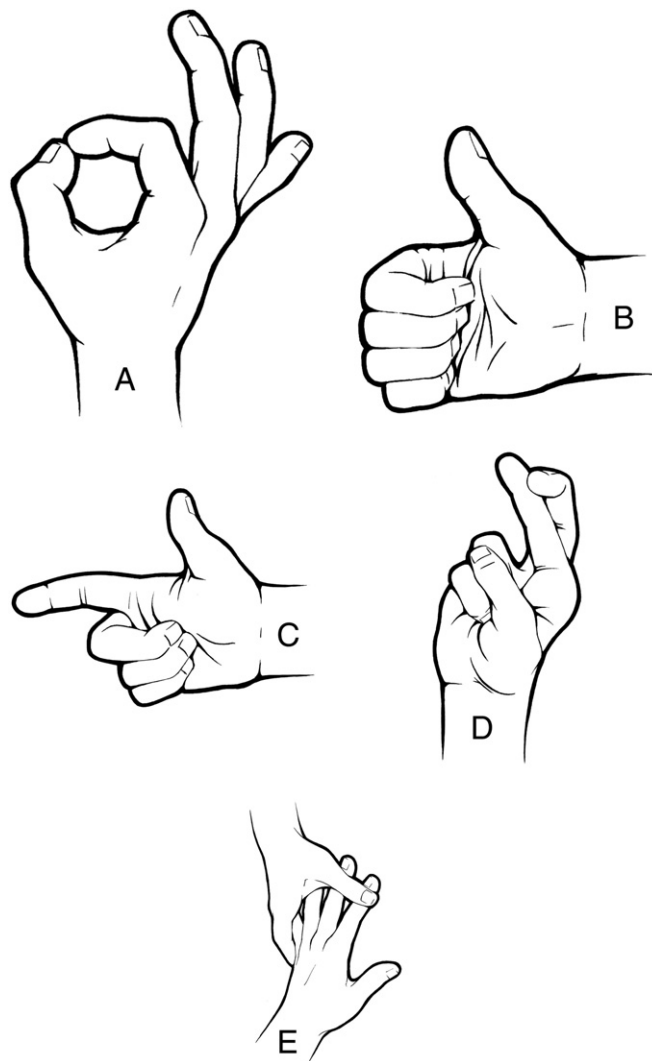
With any pediatric fracture, especially those with an obvious deformity on initial inspection, it is critical to evaluate for any neurological deficit to prevent

further injury. A complete neurological exam on the affected limb is crucial, as the signs of compromise can be subtle, even to the seasoned practitioner.

The distal forearm is the second most common pediatric fracture site (40-50%), after the clavicle.<sup>1-3,5</sup> Although the risk of neurological injury is <1% with distal forearm fractures, careful assessment of distal neurological function should be performed when examining the patient.<sup>6,7</sup> A quick yet thorough evaluation of the associated upper extremity nerves can be performed at the bedside:

Motor function: (Figure 1).

- Anterior interosseous nerve (AIN): a branch of the median nerve assessed by flexion of the thumb interphalangeal joint (IP) and index finger distal IP joint; OK sign (Figure 1A);



**Figure 1.** Motor function assessment of the upper extremity. A, OK sign to assess AIN function; B and C, thumbs up and gun sign to assess PIN function; D and E, crossing of fingers and digit number 5 with opposition to check strength and assess ulnar nerve function. AIN, anterior interosseous nerve; PIN, posterior interosseous nerve.

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