

Emergency Department Evaluation and Treatment of Pediatric Orthopedic Injuries



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KEYWORDS

• Pediatric orthopedics • Salter-Harris • Physis • Growth plate • Fracture

KEY POINTS

- The pediatric skeleton is unique compared with adults because of the growth plates, strong periosteum, and dynamic growth state.
- Fractures involving the physis (growth plate) must be evaluated thoroughly to avoid interfering with bone growth.
- Supracondylar fractures are high-risk injuries that may be associated with brachial artery injury and potential ischemia or compartment syndrome of the forearm.
- The child with hip pain requires a thorough evaluation to rule out septic arthritis.
- Always consider nonaccidental trauma as the source of the child's injuries with a focus on those high-risk injuries.

INTRODUCTION: NATURE OF THE PROBLEM

Orthopedic injuries in children are unique because of the dynamic state of growth and development of children. The biochemical and physiologic differences of the child's skeleton from that of the adult lead to distinctly different mechanisms of injury, fracture patterns, healing, and treatment needs that are crucial for the emergency medicine practitioner to understand. Moreover, infants and children of different ages are susceptible to unique fracture patterns. In this country, unintentional injuries are the leading cause of death and disability in children, and up to one-half of all Emergency Department (ED)-related visits are orthopedic in nature.¹ In the ED, providers should know how to diagnose and treat children with orthopedic injuries, with particular attention to the age, growth, and development of the child.

The authors have no financial disclosures.

The authors have no conflicts of interest.

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Emerg Med Clin N Am 33 (2015) 423–449
<http://dx.doi.org/10.1016/j.emc.2014.12.012>

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PEDIATRIC ORTHOPEDIC BASICS

Children's bones have structural properties that allow them to withstand greater force. In addition, fractures in children heal more rapidly than those in adults. The child's remarkable remodeling potential allows for some longitudinal misalignment and greater degrees of angulation. New bone remodels according to local forces, especially in the plane of motion of the joint. If a child has at least 2 years of growth remaining, a fracture adjacent to a hinged joint will remodel acceptably if the angulation is less than 30° in the plane of motion.² Precise anatomic reduction is required, however, for fractures with rotational deformities, excessive degrees of angulation, or those that are intra-articular and displaced. The pediatric periosteum is thicker and stronger than mature periosteum, which results in diminished fracture displacement, fewer open fractures, and more stability as well as an osteogenic potential that makes nonunion rare.

The more porous and pliable pediatric bone allows for 4 unique types of fractures seen in children: (1) plastic deformity, (2) torus (buckle) fractures, (3) greenstick fractures, and (4) fractures involving the physis. In plastic deformity, the bone is deformed beyond its ability to recoil, but not to the point at which an actual fracture occurs. The remainder of the fracture types is described later.

PHYSEAL FRACTURES

The most significant difference between the skeleton of a child and an adult is the presence of the physis or growth plate. Composed of cartilage, the physis represents the "weak link" in pediatric bone. The physis will separate or fracture before disruption or "spraining" of an adjacent strong and flexible ligament. Injuries that produce sprained ligaments or even joint dislocations in adults usually result in physeal injuries in children. Physeal injuries, which are most common during times of rapid growth, represent up to 18% of pediatric fractures.²

Although physeal injuries generally heal in one-half of the time of long-bone injuries, they are the fractures in which anatomic alignment is most critical for optimal growth and minimal deformity. If the injured child is tender at the physis, the physician should suspect a fracture and not a sprain, even in the presence of normal radiographs.

In 1963, Robert B. Salter and W. Robert Harris³ classified epiphyseal plate (physis) injuries in terms of clinical treatment and prognosis. Salter-Harris fractures are numbered I through V, with the higher numbers corresponding to an increased risk for growth disturbances.

Salter-Harris Classification

Type I

- This injury involves a fracture through the physis only (**Fig. 1**).
- If the radiographs appear normal, the injury can be a nondisplaced fracture.
- Point physeal tenderness on examination is the most common finding.
- If the patient has point tenderness over the physis, even in the presence of an otherwise normal examination (including radiographs), one should treat this with cast or splint immobilization.
- The prognosis for this fracture is excellent.³

Type II

- This injury is a fracture through the physis and metaphysis, with a fragment of the metaphysis remaining attached to the epiphysis.

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