


Common Orthopedic Injuries in the Pediatric Population

Julieanna Jad Sahouria-Rukab MD
Pediatric Emergency Medicine
Base Hospital Medical Director,
Valley Children's Hospital
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Goals & Objectives

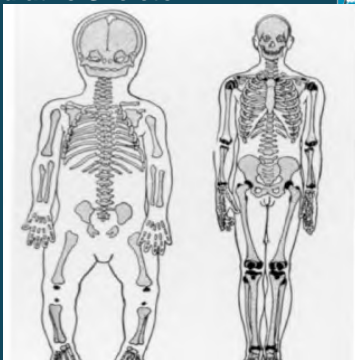


- Review the pediatric skeleton
- Review classic fracture patterns
- Review the principles of fracture immobilization and types of splints

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The Pediatric Skeleton





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Why are bones so important



- Provide a framework for the body
- Allows movement – along with ligaments/tendons
- Protects organs
- Generates hematopoiesis

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Orthopedic Problems



- Congenital
- Acquired

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Congenital Orthopedic Problems



- Failure of Formation – missing parts of the arm
- Failure of Separation – webbed or fused parts of the hand
- Duplication – extra parts present in the hand
- Constriction Band Syndrome – undergrowth or overgrowth of parts of the hand

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Bone Anatomy

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Pediatric skeleton

- Long bones are less dense and more porous than adult bones
 - Less strength
 - Bend, buckle
- Thicker periosteum – more rapid healing
- Remodeling potential is great

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Acquired

- Due to injury
- Due to developmental process

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Epidemiology of pediatric fractures



- Orthopedics injuries account for approximately 15% of the 5.3 million annual pediatric ED visits
- Annual occurrence of fractures in children aged 0-19 was 9.47 per 1000
- MC site of fracture: forearm, finger, wrist
- Males>females
- The majority of fractures are treated on an outpatient basis

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Phases of healing



- Inflammatory: 5-7 days: Hematoma forms at the site of the fracture. Inflammatory cells migrate to the region
- Reparative: 4-40 days: Granulation tissue converts into cartilaginous callus that then calcifies, becoming radiographically evident
- Remodeling: > 1 year: Periosteal callus converts into mature bone. Unnecessary callus is resorbed

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Clavicle fracture after 1 year



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Pediatric Fractures



- Consider trauma vs bone disease
- Always investigate for the potential of non accidental trauma

- Ligaments and tendons are stronger than bone in young children
- Bone tends to break with force
- Many childhood fractures involved the physis
 - About 20%
 - Can disrupt bony growth

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Humeral fracture through cyst



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Physeal Fractures



- Account for about 30% of all childhood fractures

- Most common
 - Distal radius, humerus, fibula, tibia, ulna
 - Proximal humerus, distal femur, proximal tibia, fibula

- 30% of these physeal fractures result in premature closure of the growth plate, asymmetric growth and subsequent deformity

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Salter Harris Classification








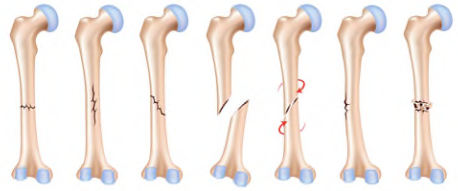


Table 1. Salter-Harris Classification (from „Caffey's Pediatric Diagnostic imaging”, Mosby Elsevier, 2007).

Type I	Type II	Type III	Type IV	Type V
				
A transverse fracture through the growth plate, sparing the epiphysis and metaphysis.	A fracture through the growth plate and the metaphysis, with its fragment adhering to the growth plate.	A fracture through the growth plate and the epiphysis.	A fracture through the growth plate, metaphysis, and epiphysis.	The growth plate is compressed, without any fracture of the epiphysis or the metaphysis.

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Types of Bone Fractures

Transverse Linear Oblique, nondisplaced Oblique, displaced Spiral Greenstick Comminuted

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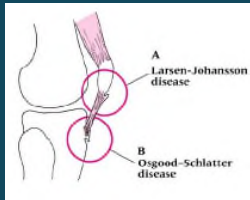

Apophyseal injuries



- Sever disease – posterior calcaneus
- Osgood-Schlatter – tibial tuberosity
- Sinding-Larsen-Johansson – Inferior patella
- Little-league elbow – humeral medial epicondyle
- Tennis elbow – lateral epicondyle
- Iselin disease – base of the 5th metatarsal


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Apophysitis of tibial tuberosity & inferior patella



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Sever's Disease



Growth Plate

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Little league elbow



Medial Epicondyle

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Pediatric healing



- Increased chance for bone remodeling
- Children tend to heal faster
 - Shorter immobilization times

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Basic definitions



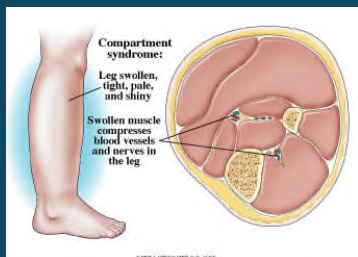
- Joints – connection of two bones
- Ligaments - tough, flexible fibrous connective tissue that connects two bones or cartilage or holds bones together at a joint
- Tendons – flexible but inelastic cord of strong fibrous collage tissue attaching a muscle to a bone

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Compartment syndrome



- Pain
- Paralysis
- Pulselessness
- Purple
- Pallor
- Pressure



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Sprains



- R: Rest
- I: Ice
- C: Compression
- E: Elevation

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Splint



- Temporarily immobilize bone
- Splint the joint above and below the fracture
- Decreases pain but immobilization injury
- Reduces further risk of damage
- Controls bleeding

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Types of splints



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Clavicle Fractures



- Result of indirect or direct trauma
- Account for 10% of pediatric fractures
- 90% occur in the middle third of the clavicle
- Neonatal clavicle fractures as a result of birth trauma occurs with an incidence of 0.5%-1.6%
- Birth risk factors:
 - Instrumental delivery, shoulder dystocia, spontaneous

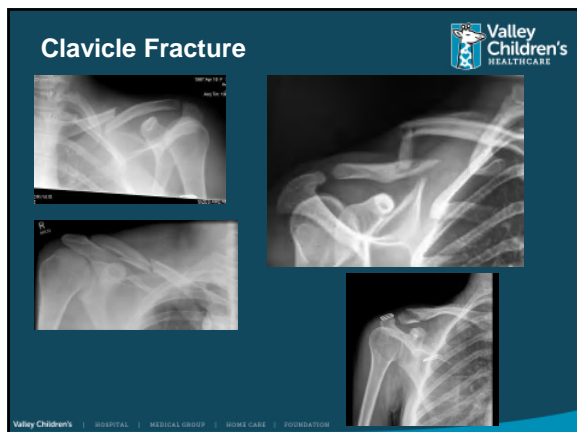
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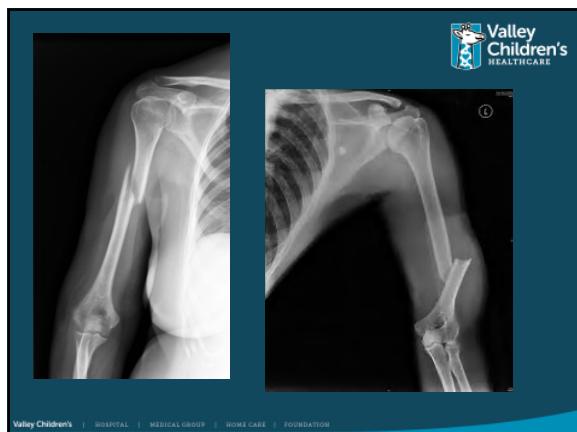


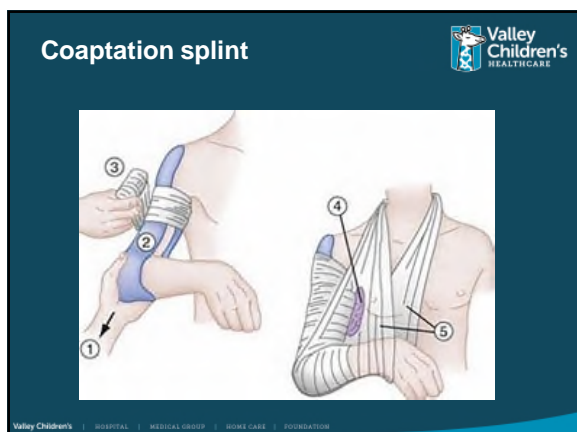
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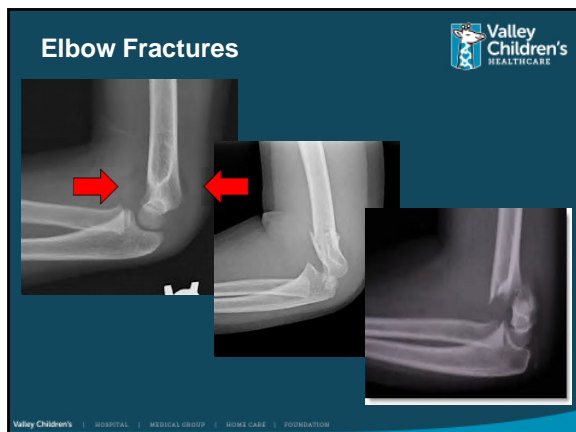


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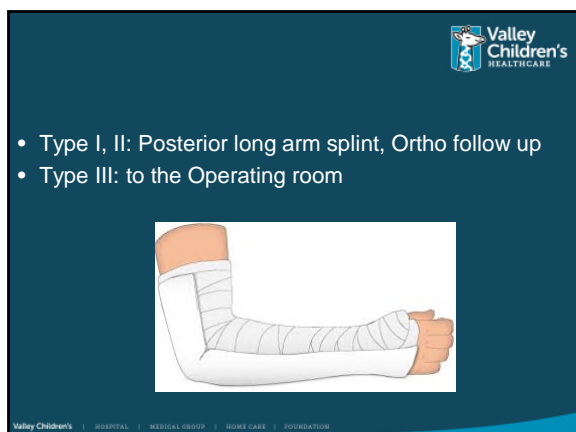












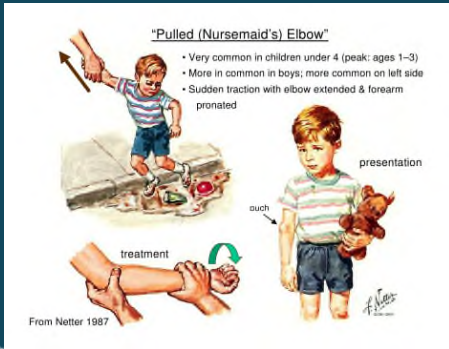
Radial head subluxation (Nursemaid)



- Occurs by abrupt longitudinal traction on a child's pronated arm
- Results in annular ligament to displace over the radial head
- MC upper extremity injury in children < 6 years of age; peak incidence around 2 years of age
- Recurrence rate: 39%

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Nursemaid's elbow



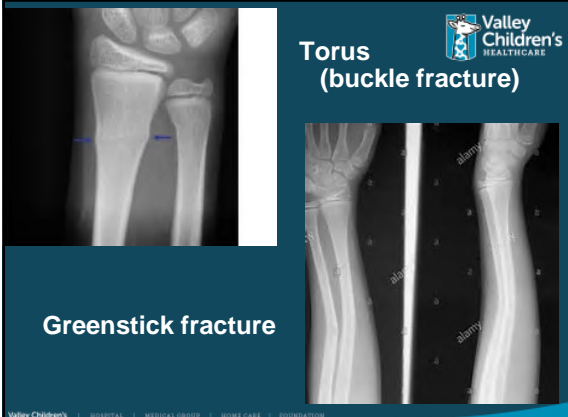
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Forearm Fractures



- MC fracture site in children is the forearm – 25%
- Fracture type varies by age: torus, greenstick, complete
- MC affect the distal third of the forearm
- Usually fall on an outstretched hand
- Typically the radius and ulna will be involved together

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Torus (buckle fracture)

Greenstick fracture

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This slide features two sets of X-rays. The top set shows a Torus (buckle) fracture of the radius and ulna, with blue arrows pointing to the characteristic bulging of the bone. The bottom set shows a Greenstick fracture, where the bone is partially broken and bent. The Valley Children's Healthcare logo is in the top right, and a footer with navigation links is at the bottom.

Monteggia & Galeazzi fracture

- Monteggia fracture – fracture/plastic deformity of the ulnar shaft, dislocation of the radial head
- Galeazzi fracture – fracture of distal radius with associated disruption of the radioulnar joint

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This slide contains text describing Monteggia and Galeazzi fractures. The Valley Children's Healthcare logo is in the top right, and a footer with navigation links is at the bottom.



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This slide features three X-rays. The left image shows a Monteggia fracture with a dislocated radial head. The right two images show a Galeazzi fracture of the distal radius. The Valley Children's Healthcare logo is in the top right, and a footer with navigation links is at the bottom.

Forearm fracture immobilization



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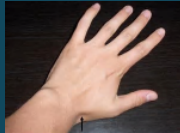
Volar Wrist Splint

PhotoBank.com

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Wrist fracture

- Carpal fractures are rarely seen in children
- Reason? Most of the carpal bones are still cartilaginous
- Scaphoid is the most commonly fractured
- Rarely seen in children < 10 years of age
- Sometimes, no radiographic evidence of injury is seen



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Thumb spica splint



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Hand Fractures



- Second most common site of fractures in children
- Comprises about 15% of fractures
- Phalanges are most frequently involved
- Crush injuries are also common

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Hand Anatomy



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Hand Anatomy

Hand Bones

Phalanges

Meta-carpals

Carpals

Radius

Ulna

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Metacarpal bone fractures

- Most common is the “boxer’s fracture”
- 5th metacarpal bone fracture

Ulnar Gutter Splint

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Hip fractures

- Hip fractures account for < 1% of all pediatric fractures
- Usually are due to bony deformities, high velocity accidents, or Non accidental trauma

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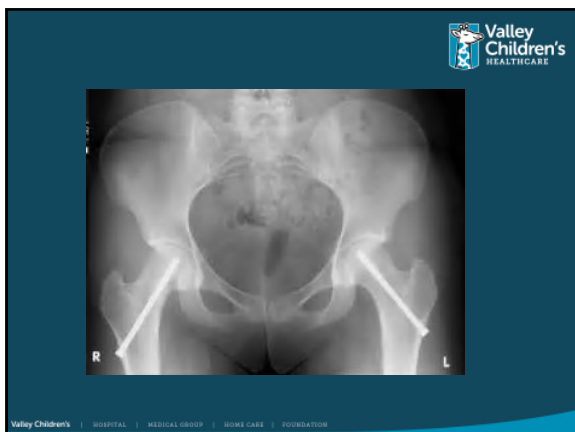
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Slipped Capital Femora Epiphysis (SCFE)

- Presentation is usually of an adolescent boy, usually around the age of 12, that presents with worsening limp
- Typical symptom is limp or knee pain
- Usually no history of trauma, but a traumatic event may cause significant worsening of symptoms

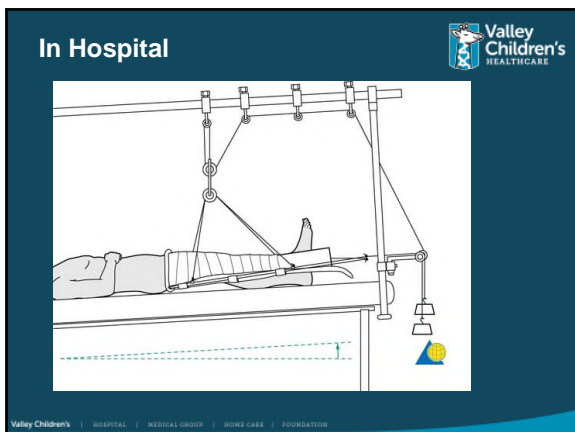
- Proximal femoral epiphysis is displaced from the metaphysis of the femur due to a weakening physis – Type I Salter Harris
- Often described as ice cream falling off of the cone



Femur Fractures

- Femoral shaft fractures account for <2% of pediatric fractures
- Early childhood, mid-adolescence
- In children < 4 years of age, 9-15% of femur fractures are due to Non accidental trauma







Ankle Fractures/Sprains

- These are the most common lower extremity injuries in children
- Account for about 5% of pediatric fractures
- MC pediatric injury of the ankle is the inversion injury
 - “I twisted my ankle”
 - “I stepped in a hole and it twisted my ankle.”

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Triplanar fracture



- Bone is fracture in 3 planes
 - SH IV of the anterolateral distal tibia
 - Sagittal, coronal, transverse



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Foot Fractures



- Less than 10% of pediatric fractures involve the foot
- Jones fracture - fracture of the 5th metatarsal



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Prehospital care



- Focus on stabilizing the injury
- Providing adequate analgesia
- Immobilization should be done with appropriate splint
 - Allows for increased comfort
 - Decreased chance of injury to surrounding structures
- Assess neurovascular status

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