1 **How to Triage Orthopaedic Care**

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2 **OBJECTIVES:**

- Define basic assessments skills needed to identify orthopedic injuries
- Differentiate when an orthopedic injury is a medical emergency
- Determine best level of care, when to refer to a higher level medical care, and which healthcare professional is the most appropriate (ER, UCC, PCP, or Specialist)
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3 **Skeletal Trauma**

- 10 to 15 % of all Childhood Injuries
- Physeal Injuries are ~ 15% of all Skeletal Injuries

4 **Immediate Referral for Musculoskeletal Injuries**

- Suspected Spinal Cord Injury
- Obvious Deformity - extremity is bent or bowed
- Dislocation of Joint
- Open Laceration
- Neurologic Injury
- Vascular Injury - be able to assess pulses and color of extremity

5 **Immediate Referral for Musculoskeletal Injuries**

- Neurologic Injury - especially loss of motor function
- Tingling or Numbness in a single extremity after injury is not an uncommon complaint - reassess and know how to do a Neurologic Exam of an Extremity - you have to develop your skills
- Assess by Doing a Motor and Sensory Examination
- Light touch, Pin prick ( use a paper clip)

6 **Immediate Referral for Musculoskeletal Injuries**

- Neurologic Injury
- Assess by Doing a Motor and Sensory Examination
- Light touch, Pin prick, and 2 point Discrimination
- Paper Clip helpful for Pin Prick and 2 point discrimination
- 2 Point Discrimination very helpful for hand injuries and lacerations

7 **Immediate Referral for Musculoskeletal Injuries**

- Vascular Injury - be able to assess pulses and color of extremity
- Capillary refill is variable
- If the environment is cold and having difficulty with vascular exam warm the extremity

8 **Immediate Referral for Musculoskeletal Injuries**

- Compartment Syndrome is swelling with in a Muscular Compartment that closes off the

capillary flow to the soft tissue of that compartment
- The Muscle Compartment is very firm, tense and painful to touch.
- This is a surgical emergency and needs immediate evaluation
- Can be associated with fractures, crush injuries or vascular injuries, or after extreme exertion

9 **Immediate Referral for Musculoskeletal Injuries**
- This is a surgical emergency and needs immediate evaluation
- It can happen acutely within an hour of injury or develop over several hours after injury
- Most commonly seen in leg (below the knee ) and forearm

10 **Immediate Referral for Musculoskeletal Injuries**
- Compartment Syndrome
- Pain out of Proportion - First sign is Pain on Passive Range of Motion
- Extreme Pain on Passive Motion of the Muscles in that Compartment - example severe pain on movement of fingers or toes after injury to the leg or forearm above
- Pulses are Intact early on!
- Neurologic Exam is Intact early on! (May have some some tingling )
- The Muscle Compartment is very firm, tense and painful to touch.

11 **Delayed Referral for Medical Evaluation**
- Persistent Swelling
- Persistent Loss of Range of Motion
- Difficulty with Ambulation
- Persistent Pain
- Constitutional Symptoms - fever, weight loss

12 **The History**
- How, When and Where ?
- Swelling?
- Ability to Ambulate?
- Did you hear or feel a Pop?
- Did you Relocate an Injured part?

13 **Extremity Examination**
- Learn How to Examine an Extremity
- Know the Vascular and Neurologic Examination - Study
- Know the Extremity Anatomy - Bone , Muscle, Ligament , Nerve, Vascular
- Dont be afraid to Reassess and Repeat your Examination
- Stay Calm

14 **Physical Exam**
- Visual Inspection for Swelling, Discoloration, Bruising, and Obvious Deformity ?
- Open Laceration or Wound?
- Range of Motion - can the injured area move - either with the patient moving it or examiner ?

- Stability of the Joint - may or may not be able to assess

15 **Physical Exam**

- Tenderness : Where is the maximal tenderness - over the Bone, Ligaments, Muscle or Joint ?
- Is the Patient able to Weight Bear ?
- Neurovascular Exam of the Extremity
- Are they able to Move the Injured Area

16 **The Physical Examination**

- Have the patient demonstrate the area of maximal tenderness
- Use one finger to localize tenderness
- Is the tenderness located over the bone or the soft tissues?
- Compare the 2 sides looking for swelling

17 **Orthopaedic Assessment**

- Palpate for Tenderness
- Deformity
- Evaluate Neurologic Status
- Evaluate the Vascular Status
- Assess the Soft Tissue Injury
- Understand the Mechanism of Injury

18 **Orthopaedic Resources**

- Rang's Childrens Fractures

19 **Extremity ExaminationResources**

- Hoppenfeld Physical Examination of Spine and Extremities

20 **Extremity Examination Resources**

- Hoppenfeld - Orthpaedic Neurology

21 **Extremity Examination Resources**

- Ciba Collection of Medical Illustrations Volume 8 Part 1 Anatomy , Physiology and Metabolic Disorders by Frank Netter

22 **Skeletally Immature Patients**

- Possess Unique Characteristics Compared to the Adults
- The Closer to Skeletal Maturity the more the Injury Patterns Mimic Adults

23 **<u>Unique Anatomy For Children and Implications for Injury</u>**

- Physis ("Growth Plates")
  1. Adds longitudinal growth of the bone
  2. Peak height velocity occurs later in boys (13 to 14) than girls (11 to 12)
  3. Periods of rapid growth put children at risk for injury as "growth plates" narrow near the end of growth

24 **Orthopedic Anatomy**

Parts of a growing bone

- Epiphysis
- Physis
- Metaphysis
- Diaphysis

25 **Anatomy**

- Epiphysis
-
- Physis
-
- Metaphysis
-
- Diaphysis

26 **Apophysis**

-
- Apophysis
  1. Growth Area of bone where a muscle tendon attaches
  2. Highest risk of injury during peak growth rate
  3. Best Known - Tibial Tubercle - Osgood Schlatter

27 **Tibial Tubercle is an Apophysis- Osgood Schlatter is inflammation of the tibial tubercle - Apophysitis**

28 **Injury Terms: Fractures**

- Fracture - Broken, Break, Crack etc.
- Open - soft tissue envelope open allowing contamination of bone to dirt and bacteria
- Closed - soft tissue envelope intact - no communication to outside world
- Comminuted - multiple pieces
- Compound - we do not use this term - it was primarily used to indicate an open fracture in older literature

29 **Injury Terms:**

Sprain vs Strain

30 **Sprains**

Severity:

- Grade I - min. structural disruption
- Grade II - partial disruption
- Grade III - complete disruption

31 **Strain vs. Avulsion Fracture**

–Ischial Apophysis Avulsion - pulled away by Hamstring Origin

32 **Pelvic Avulsion Fractures**

- Often preceding symptoms
- Multiple Apophyseal Sites in the Pelvis
- Sometimes occult
- Disabling and can be slow to heal

33

34 **Physeal Fracture Patterns**

35 **Salter Harris Classification System**

I. Separation
II. Above
III. Lower (beLow)
IV. Through
V. EveRything Ruined

36 **Salter II Fracture Distal Radius**

37 **Knee Anatomy**

38 **Physeal Anatomy and Knee Ligaments Insertion Sites in Children May Create Unique Injuries**

39 **Salter I Fracture Distal Femur**

40 **Salter I Fracture Distal Femur**

41 **Radius and Ulna Fractures**

42 **Radius and/or Ulna Fractures**

- This was an open fracture
- Immediate Referral
- Often will see Dark Blood and Fat Globules in the Blood Oozing from Wound
- Splint and Send

43 **Supracondylar Fractures**

- Most common type is Fall on Outstretched Elbow
- Marked Swelling around the Elbow
- Splint with long arm splint with comfortable position.

44

**Supracondylar Humerus Fracture**

- Marked Swelling around Elbow
- May Have Ecchymosis Anteriorly from the Proximal humerus tearing thru the Brachialis Muscle and Coming up to the Skin
- May even have “Dimpling” or “Puckering” of the Skin -which has been pulled back into the fracture
- Refer Immediately
- Splint in Position of Slight Flexion - 20 to 45 degrees

45 **Supracondylar Humerus**

- General
  - Typical age range 1-10 years
  - Males > females by 2:1
  - Peak incidence: 5 to 8 years
  - Approximately 1% are open
  - concurrent forearm fractures in ~5%

46 **Supracondylar Humerus**

- Arterial Injury:
  - Pink hand
    - Be highly suspicious of entrapment especially if:
    - Anterior puckering
    - Anterior medial ecchymosis
    - Median nerve injury

47 **Supracondylar Humerus Fracture**

- Examination
  - Always check for palpable pulses (Doppler pulse may be present in spite of complete of occlusion of the brachial artery)
  - Check compartments
  - Surgeons should Always document detailed neurovascular examination before any treatment !!

48 **Supracondylar Humerus Type III**

- Arterial Injury
- Brachial Artery Occluded
- 
- 
- 
- Reconstituted Flow by Collaterals Distally

49 **Supracondylar Humerus Fracture**

- Neurologic Examination
  - Nerve injury is present in about 8%
  - Of this 8%
    - Radial nerve 40%
    - Median nerve (complete) 35%
    - Ulnar nerve 22% (but most common with flexion supracondylar)
    - Anterior interosseous nerve is actually the most common (but requires detailed neuro exam)

50 **Deformity**

- This is a Femoral Shaft Fracture
- Note the Bowing of the Thigh

- Splint the Extremity
- If there are No Pulses and there is an Obvious Deformity Gently Straighten the Extremity and Splint prior to Transport
-
-
  - For Example if the Extremity is Rotated more than 90 degrees
  - For Example if the extremity is Bent more than 45 degrees and "Floppy" (Unstable)

51 ☐ **Symmetric Hand Closure**

52 ☐ **Patellar Dislocation**

53 ☐ **Anterior Thigh**

54 ☐ **Medial Thigh**

55 ☐ **Posterior Thigh**

56 ☐ **Anterior Lateral Leg**

57 ☐ **Posterior Leg**

58 ☐ **Posterior Leg**

59 ☐ **Anterior Leg**

60 ☐ **Posterior Leg**

61 ☐ **Upper Extremity**

62 ☐ **Dorsal Forearm**

63 ☐ **Volar Forearm**

64 ☐ **Volar Forearm**

65 ☐ **Hand and Finger Assessment**

66 ☐ **Hand Sensory Innervation**