Orthopedic Pearls and Pitfalls

Many ED visits are for orthopedic injuries. The presenter will describe the mechanisms of injury and the recognition of pertinent physical findings in the diagnosis of subtle orthopedic injuries that, if missed, may result in long-term problems. Common errors in the early management of several injuries will be identified and the appropriate treatment outlined. Learn the “pearls” that will help you save time, decrease frustration, and avoid poor patient outcomes.

- Discuss the mechanisms involved with high-risk, subtle orthopedic injuries.
- Discuss the efficient and appropriate orthopedic examination.
- Identify common management errors and potential complications.
- Discuss potential complications, both short-term and long-term.
- Identify the take-home pearls related to each pitfall.

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Orthopedic Pearls and Pitfalls in Emergency Medicine

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Course Objectives:
1) To discuss high-risk orthopedic injuries.
2) To identify common management errors and potential complications.
3) To elucidate clinical pearls to avoid pitfalls and complications.

Case 1:
19 cyclist who missed a small jump, complains of left ankle pain.  
Exam: Gross deformity at the ankle, pulses are intact.

ANKLE DISLOCATION:
- Usually posterior
- Often associated with fracture and ligamentous injury
- Reduction:
  - Pull foot anteriorly from the heel

Pearl: Put the knee in a slightly flexed position (20-30 degrees) during the reduction to tension at the ankle.

Case 2:
45 year old female in MVA complains of hip pain.  
Exam: L hip flexed, internally rotated.

HIP DISLOCATION:
- Usually posterior
- Complications:
  - Fracture (approximately half)
    - Pelvis, acetabulum, femoral head/neck
  - Avascular necrosis, femoral head
    - Time matters!
    - Reduction recommended in <6 hours if possible
Reduction Pearl:
“Captain Morgan” technique:
1) Place patient supine, flex hip and knee to 90 degrees
2) “Fix” pelvis to stretcher (belt, strap, sheet, etc)
3) Place your foot on stretcher, with knee behind patient’s
4) Hold down patient’s ankle, and lift with your calf.

Case 3:
A 4 year old male was pulled by the right arm by his big brother.
Refuses to use right arm.
Exam: Elbow slightly swollen, held in a slightly flexed, pronated position.

NURSEMAID'S ELBOW:

- Subluxation of the immature radial head from annular ligament.
- Ages 1-5, most often age 2-3.
- Forceful traction on pronated arm (pulling child by the arm).
- PE: elbow slightly flexed, wrist pronated.
- Radiographs are not necessary when the history is clear.

Reduction:
1) Supination / Flexion: Place thumb over radial head, grab wrist, supinate forearm, flex elbow. —OR—
2) Hyperpronation: Place thumb over radial head, grab wrist, slowly pronate.

Macias, Pediatrics, 1998¹
Prospective, randomized, 90 kids under 6 yo
Supination/flexion vs Hyperpronation, repeat at 15 mins
Hyperpronation better (95% vs 77% successful first attempt)
Of 6 crossovers from supination, 5 reduced by hyperpronation

McDonald, Academic Emergency Medicine, 1999²
Prospective, randomized, 135 patients
Supination/flexion vs Hyperpronation
Hyperpronation better (80% vs 69% successful first attempt)
Physicians rated less pain with hyperpronation
Case 4:
20 year old male twisted his ankle while “snowboarding”
Exam: Ankle is swollen, diffusely tender, and plain films are negative.

Ankle Sprain:
- R.I.C.E. (rest, ice, compression, elevation)
- Functional immobilization
  - ACE, AirCast, taping, etc
- Crutches
  - Weight-bearing as tolerated
- Follow up exam
  - Approximately two weeks after injury
  - Repeat physical exam for ligamentous damage
  - Most patients will be much improved
  - A few may have persistent pain, swelling, and joint effusion, suggesting the possibility of occult fracture.

When should I consider CT or MRI for occult ankle fracture?

Consider CT or MRI in the setting of negative plain films, and:
- High clinical suspicion
- Persistent pain, swelling, effusion at follow-up

Important occult fractures of the ankle/foot:
- Talar dome
- Tillaux (lateral tibia)
- Calcaneus, Navicular
- Lateral process of the talus

Retrospective study, over 3 years
344 patients with a fracture on ankle / foot CT
CT’s ordered to delineate fracture, or to r/o occult fracture
Most common occult fx in ankle (not visualized on plain films):
- Calcaneus (20)
- Talus (15)
- Tillaux (7)

Calcaneus fracture:
- Calcaneus fractures most often occur in males (male:female = 5:1)
- Peak age: between 30 and 50 years.
- Associated injuries (Lumbar spine vertebral compression fractures)
- Treatment: Operative vs Casting

Talar Dome Fracture:
- Osteochondral lesion, articular surface
- CT and MRI both excellent to visualize lesion
• May be managed by cast (non-weight bearing), or by arthroscopic surgery if loose fragments in joint

Tillaux Fracture:
• Lateral tibia, involving articular surface
• Salter-Harris III fracture, mostly in adolescents
• Usually requires surgical fixation

Lateral Process of the Talus fracture:
Valderrabano, American Journal of Sports Medicine, 2005
Case series, 20 patients, snowboarders, lateral process talus fx
Mechanism: axial load, dorsiflexion, external rotation, eversion
2/3 treated surgically, good prognosis

Pearls:
1) CT helpful for:
   a. High suspicion (mechanism, exam)
   b. Poor recovery
2) High risk situations:
   a. Fall from height—Calcaneus
   b. Adolescent—Tillaux
   c. Snowboarding—Lat. process of Talus

Case 5:
A 75 year old female fell onto her right hip
Complains of pain and trouble bearing weight on her right leg.
Exam: No deformity noted.
Plain Radiograph are normal.

OCCULT HIP FRACTURE:
• Common, and clinically important
• Bone Scan (?) vs CT vs MRI
  o MRI is most supported by evidence
  o All three are superior to plain films
  o Local resources dictate choice

MRI:
Frihagen, Acta Orthopaedica, 2005
100 patients with hip trauma, negative plain films
All had MRI
46 had femoral neck or intertrochanteric fractures
27 had other fractures (mostly pelvic)
30 had surgery
MRI vs CT:

Lubovsky, Injury, 2005

6 patients with suspected hip fx, negative plain films
All had MRI and CT (2 or 4 slice)
5 of 6 patients had fx, but CT “misdiagnosed” three.
(showed greater tuberosity fx, when MR showed intertrochanteric)

- Can CT exclude hip fx?
  - Better than plain films
  - Rapid advances in technology
  - As good as MRI?
  - Future studies?

Pearls:
1) MRI is still more “hip” than plain films, bone scan, or CT
2) Question of MRI vs Newer generation CT remains unresolved

Case 6:
31 yo M struck by his martial arts instructor. Chief complaint is wrist pain.
Exam: Isolated snuffbox tenderness

SCAPHOID FRACTURE:

- One of the most frequently missed fractures in the ED
- Most common carpal fracture
  - 10-20% fractures are “occult”
- Distal blood supply
  - Worse prognosis for proximal fractures
- Significant long-term complications:
  - Non-union
  - Avascular necrosis

Frequent occult fractures + Frequent complications =
Thumb spica splint and follow up

Best imaging study for Occult Scaphoid fracture?
- Bone scan: Traditional, tried and true
- MRI: Better than bone scan, multiple studies
- CT: New technology, as good as MRI?
- U/S: Really?

CT vs Bone Scan:
- 51 patients with neg plain films (initial and repeated after 10 days)
  - All had Bone scan and 16 slice CT on day 10-14.
  - 14 had positive CT, 23 positive Bone scan.
  - However, no discordant case later had positive Xray, MRI, or pain.
  - Did CT miss true fractures? What is the gold standard?
  - Same author published report of fx missed by CT (seen on MRI)

MRI:

Brydie, *British Journal of Radiology, 2003* 8
- 195 pts with snuffbox tenderness, negative plain films
  - All had MRI within 2 weeks (75% within 3 days)
  - 37 (19%) had scaphoid fx, 37 (19%) had another fx detected
  - Recommended early MRI to forgo splint and follow up if negative

MRI vs CT:

Memarsadeghi, *Radiology, 2006* 9
- 29 pts, snuffbox tenderness, negative initial plain films
  - All had CT (4-slice) and MRI within 6 days
  - 11 scaphoid fx ultimately diagnosed
  - Gold std for dx: positive plain films at 6 wks
  - MR found 11/11, CT found 8/11
  - CT better at cortical fx, MR better at trabecular fx

CT:

Ty, *Hand, 2008* 10
- 28 pts with snuffbox tenderness, neg films
  - CT (slice?): 4 scaphoid fx, 10 others (radius, carpals)
  - Gold std: neg films at 6 wk f/u
  - 6/14 with neg CT had neg films at f/u
  - 8/14 lost to f/u. No missed fx

- 47 pts, snuffbox tenderness, neg films
  - CT (64 slice): 7 scaphoid fx, 10 others
  - Gold std: 2 wk f/u exam, plain films, MRI as needed (8 done)
  - MRI found one more fx (capitate)

**Remaining Questions:**
- Is it important to find non-displaced trabecular fractures?
  - Do “occult” fractures have same high complication rate?
- Is newer generation CT as good as MRI?
• Is it safe/better to order CT or MRI at initial evaluation, rather than splint and follow-up in 7-10 days?

_Pearls:_

1) MR remains the best test for occult fx.
2) Whether to obtain it initially, or only in those with persistent pain and negative films in 1-2 weeks, remains a question of resource utilization.

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**Case 7:**

A 56 year old male involved in a motor vehicle collision
Complains of pain in the left shoulder.
Exam: Shoulder is tender, slightly swollen, but not deformed.
Markedly limited range of motion
Normal distal neuro-vascular exam.

**POSTERIOR SHOULDER DISLOCATION:**

- Only 1-2% of shoulder dislocations
- Causes: Blunt trauma, Electrocution, Seizure
- 50% initially missed
  - Less deformity on physical exam
  - Not radiographically obvious on AP view (light bulb sign)

_Reduction techniques:_

- Little data in the literature for posterior dislocation.
- Techniques for anterior dislocation such as external rotation, milch, scapular manipulation, etc. may be less effective.
- Traction-countertraction often recommended for posterior.

_Pearls:_

1) Posterior dislocation is unusual, and easily missed due to the lack of obvious clinical and radiographic signs
2) The lateral (Y-scapula) view is extremely valuable in detecting it.

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**Case 8:**

20 yo football player struck in knee during a game.
Exam: L knee is swollen, deformed. PT and DP pulses weak but present.

**KNEE DISLOCATION:**
- Rare, potentially limb-threatening injury
- Direction of tibial displacement:
  - Anterior > Posterior > Medial or Lateral
- Causes:
  - Motor vehicle accident (>60%)
  - Falls
  - Sports injuries
- Major Vascular Injury in 10-30%! (Popliteal artery)

**Pearl:**
- Approximately half of knee dislocations present in a reduced position
- Beware of Bi-cruciate ligamentous injury with grossly unstable knee

Twaddle, *Journal of Orthopaedic Trauma, 2003*

60 knee dislocations
2/3 were in a reduced position on presentation
Ligamentous injuries:
- ACL 84%, PCL 87%, ACL+PCL 71%
- Fractures in 24%, Popliteal artery injury in 9 (14%)

**Reduction:**
1) Assistant places *slight* longitudinal traction on the leg
2) Physician keeps one hand on tibia and one on femur to lift femur anteriorly and guide it back into position.
3) Posterior splint, in 15° flexion.

**Vascular evaluation:**
- Traditional: knee dislocation = angiogram
- Selective Approach:
  - Careful PE, Arterial Pressure Indices (API)
  - Abnormal N/V exam or API:
    - Angiogram
  - No sign of vasc injury on PE or API:
    - Ultrasound
    - Serial exams/observation

*Caution is advised in this area. When a selective approach is used, it should be combined with orthopedic consultation. The role of Doppler ultrasound for patients with knee dislocation and normal vascular examination has yet to be defined, but may be a useful tool.
Evidence:

Hollis, *Journal of Trauma, 2005*¹³

Review of 39 patients with knee dislocation
All had angiograms, 19 abnormal, 7 required surgery
All 7 requiring surgical repair had abnormal physical exam.
Advocated selective approach to angio based on PE.

Klineberg, *Journal of Trauma, 2004*¹⁴

Maryland shock trauma.  55 knee dislocations, 7 years
Evaluated by PE, ABI (>0.8), selective angio, follow up.
32 had normal exam and ABI.  None required surgery.
23 had abnormal exam.  12 had injury on angio, 7 needed surgery.
Advocated selective approach based on PE and ABI’s.

Pearl:

1) Consider the possibility of a spontaneously reduced knee dislocation in the patient with severe, bicornuate ligamentous injury and an unstable knee.

References: