Central Connecticut State University
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Objectives

- Understand the pathoanatomy of common and uncommon joint dislocations
- Understand the concepts of reduction techniques
- Awareness of the potential sequella of joint dislocations over time

Making the complex simple…

Complexity of Dislocations

Robert S. Waskowitz MD
Orthopedic Surgery & Sports Medicine

"I've got a lot of years to live after baseball and I would like to live them with the complete use of my body."

Sandy Koufax

Functional Stability

Essential joint mobility hinges on the balance of *stability* vs. *force*

- Stability
  - Dynamic
    - Muscular control of agonists & antagonists
  - Static
    - Ligamentous restraints with fixed points of range
- Force
  - F=ma
  - Velocity
  - Acceleration
  - Deceleration
  - Axis of rotation
  - Load to failure

Mechanical Failure

- Force exceeds capability of the joint to dissipate energy or to compensate by displacing load to another site
  - Something has to give, resulting in:
    - Subluxation
    - Dislocation
    - Fracture dislocation

Joint Dislocation

Injury severity range

- Sublime
  - Subtle injury may appear "minor" with athlete desiring an immediate return to play
- Gruesome
  - Major occurrence can be limb threatening with associated long-term consequences

Any Joint is Susceptible

- Number of joints in the body
  - Variable 250-350
    - 86 skull
    - 66 thorax
    - 76 spine & pelvis
    - 32 each upper limb
    - 31 each lower limb
- Types
  - Fibrous
    - Synarthrodial
  - Cartilagenous
    - Synchondroses or symphyses
  - Synovial
    - Diarthrosis

Synovial Joint

- Hinge
  - Flexion/extension
- Pivot
  - Rotation of one around the other
- Ball & Socket
  - Flexion/extension/adduction/abduction/internal & external rotation
- Saddle
  - Flexion/extension/adduction/abduction/circumduction
- Condyloid
  - Flexion/extension/adduction/abduction/circumduction
- Gliding
  - Gliding movements
- Ellipsoid
  - Similar to ball & socket less motion

Epidemiology of Dislocations

- Gleno-humeral joint
  - 45% of all dislocation visits to the ER
  - Anterior dislocation 96-98%
    - (Khiami, F.; Gérometta, A.; Loriaut, P. "Management of recent first-time anterior shoulder dislocations". *Orthopaedics & Traumatology: Surgery & Research*. **101** (1): S51–S57.)
  - High recurrence rate associated with age, hyperlaxity and associated greater tuberosity fx
    - (Olds, M.; Ellis, R.; Donaldson, K.; Parmar, P.; Kersten, P. (2015-07-01). "Risk factors which predispose first-time traumatic anterior shoulder dislocations to recurrent instability in adults: a systematic review and meta-analysis". *Br J Sports Med*. **49** (14): 915–922.)

Epidemiology of Dislocations

- Patello-femoral joint
  - 3% of knee injuries are acute traumatic patellar dislocations
    - (Hsiao, Mark; Owens, Brett D.; Burks, Robert; Sturdivant, Rodney X.; Cameron, Kenneth L. (2010-10-01). "Incidence of Acute Traumatic Patellar Dislocation Among Active-Duty United States Military Service Members". *The American Journal of Sports Medicine*. **38** (10): 1997–2004.)
  - High re-dislocation rate: 15%
    - (Fithian, Donald C.; Paxton, Elizabeth W.; Stone, Mary Lou; Silva, Patricia; Davis, Daniel K.; Elias, David A.; White, Lawrence M. (2004-07-01). "Epidemiology and Natural History of Acute Patellar Dislocation". *The American Journal of Sports Medicine*. **32** (5): 1114–1121.)

Epidemiology of Dislocations

- Elbow
  - 90% postero-lateral dislocations

Epidemiology of Dislocations

- Wrist
  - Lunate and perilunate dislocations most common

Epidemiology of Dislocations

- Finger
  - Interphalangeal (IP), metacarpophalangeal (MCP)
    - Male incidence: 17.8/100,000 person years
    - Female incidence: 4.65/100,000 person years
    - Average age group: 15-19 years old

- (Golan, Elan; Kang, Kevin K.; Culbertson, Maya; Choueka, Jack. "The Epidemiology of Finger Dislocations Presenting for Emergency Care Within the United States". *HAND*.)

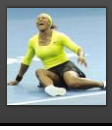
Epidemiology of Dislocations

- Hip
  - Posterior 90%; anterior 10%
  - High impact: MVA's (sports, fall from height)
  - 95% associated injury to another body part

- (Clegg, Travis E.; Roberts, Craig S.; Greene, Joseph W.; Prather, Brad A. 'Hip dislocations—Epidemiology, treatment, and outcomes', Injury. 41 (4): 329-334.)

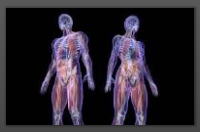
Epidemiology of Dislocations

- Foot and ankle
  - Most common injury: ankle *sprain* involving anterior talofibular ligament (ATFL)
    - (Ringleb, Stacie I.; Dhakal, Ajaya; Anderson, Claude D.; Bawab, Sebastain; Paranjape, Rajesh (2011-10-01). "Effects of lateral ligament sectioning on the stability of the ankle and subtalar joint". Journal of Orthopaedic Research. 29 (10): 1459-1464.)
  - Tibio-talar joint
  - Lisfranc's joint



Common Dislocations in Sports

- Shoulder
- Elbow
- Finger
- Hip
- Knee
- Patella
- Ankle



Sports Health. 2014 May; 6(3): 246-255.
In-game Management of Common Joint Dislocations
Nathan W. Skelley, MD,† Jeremy J. McCormick, MD,† and Matthew V. Smith, MD*†

Shoulder Dislocations

- Most commonly dislocated joint
  - *(Benjamin HJ, Hong BT. Common acute upper extremity injuries in sports. Clin Pediatric Emerg Med. 2007;8(1):15-30)*
- Accounts for 54.9% of sports-related dislocations in High School athletes
  - *(Kerr ZY, Collins CL, Comstock D. Epidemiology of dislocations/separations among US high school athletes. Injury Prev. 2011;16(suppl 1):A255-A256)*
- Majority are anterior inferior direction
  - *(The unstable shoulder in the adolescent athlete.Walton J, Paxinos A, Tzannes A, Callanan M, Hayes K, Murrell GA, Am J Sports Med. 2002 Sep-Oct; 30(5):758-67.)*

Shoulder Dislocations

- Anatomy
  - Large sphere on shallow socket
  - Capsuloligamentous restraints
  - Muscular forces of RC *(SS/IS/TM/SS)*
- MOI
  - Forceful ABD & ER

Shoulder Dislocations

- Load to failure
  - HH drives forward ⟶
  - Capsuloligamentous restraint fails ⟶
  - HH translation ⟶
  - Subluxation ⟶
  - Dislocation

Shoulder Dislocations

- Evaluation
  - Adducted "cradle" or "droop" position of arm
  - Feel humeral head anterior/inferior/medial position
  - Feel dimple or soft-spot inferior to acromial arch
  - *Check axillary nerve function*

Shoulder Dislocations

- Injury
  - Labrum
  - Humeral Head
  - Glenoid
  - Articular cartilage
  - Ligamentous restraints
  - Neurovascular structures

Shoulder Dislocations

- Reduction technique
  - Traction/counter-traction
    - Longitudinal traction with progressive abduction while manipulating humeral head
    - Scapular rotation
    - Prone positioning with gentle traction
    - (Benjamin HJ, Hang BT. Common acute upper-extremity injuries in sports. Clin Pediatric Emerg Med. 2007;8(1):17–30)
  - Delayed reduction difficult because of muscular spasm

Shoulder Dislocations

- Long term sequela
  - Recurrent instability
  - Osteoarthritic joint progression

Elbow Dislocations

- Second most commonly dislocated joint
  - *(Sideline management of common dislocations.Hodge DK, Safran MRCurr Sports Med Rep. 2002 Jun; 1(3):149-55.)*
- Postero-lateral dislocation in 90%

Elbow Dislocations

- Anatomy
  - Unique trochoginglymus joint
    - Hinge point
      - Humero-ulnar articulation
    - Rotational point
      - Humero-radial articulation
  - Capsuloligamentous restraints
  - Muscular insertion points
- MOI
  - Extension overload

Elbow Dislocations

- Load to failure
  - Extension
  - Hyperextension
  - Rotatory instability
  - Joint disruption
  - Progressive translation
    - Stable
    - Perched
    - Dislocation
- (The unstable elbow, O'Driscoll SW, Jupiter JB, King GJ, Hotchkiss RN, Morrey BFInstr Course Lect. 2001; 50():89-102.)

Elbow Dislocations

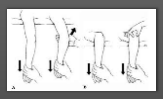
- Evaluation
  - Exquisite pain
  - Obvious deformity
  - Skin dimpling
  - Neurovascular exam

Elbow Dislocations

- Injury
  - "Ring" of soft tissue restraints surrounding joint are disrupted
    - Lateral collateral ligament
    - Anterior capsule
    - Medial collateral ligament
  - Associated coronoid fx
  - Neurovascular structures

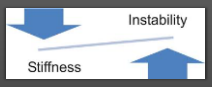
Elbow Dislocation

- Reduction technique
  - Can be difficult
    - Anatomy of joint
    - Muscular contraction
  - Degree of elbow flexion with traction to "jump" humerus over coronoid/olecranon into fossa
  - Two-person



Elbow Dislocations

- Long term sequela
  - Recurrent instability
  - "Contracture"
  - Osteoarthritic joint progression

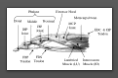


Finger Dislocations

- Common, often "under-reported"
- 9% of all sports injuries
  - (Sideline evaluation and treatment of bone and joint injury.*Schupp CM, Curr Sports Med Rep. 2009 May-Jun; 8(3):119-24.)*
- Hand & wrist injuries commonly associated with finger injuries
  - (Safran MR, Hodge DK. Sideline management of common dislocations. In: Bull RC, Roberts W, editors, , eds. Bull's Sports Injuries Handbook. 2nd ed. New York, NY: McGraw-Hill Professional; 2004:59-72)

Finger Dislocations

- Anatomy
  - DIP
  - PIP
  - MCP



- MOI
  - Out-stretched position, open-hand & grabbing techniques
    - Extension
    - Hyperextension
    - Axial load

Finger Dislocations

DIP	PIP	MCP
Collateral ligaments	Collateral ligaments	Inter-metacarpal ligaments
Dorsal or volar "lip" fx	Dorsal or volar "lip" fx	Dorsal or volar "lip" fx
	Central slip	Volar plate
	Volar plate	



Finger Dislocations

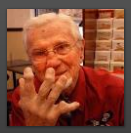
- Evaluation
  - Pain, deformity
  - Neurovascular exam
  - Often will reduce by athlete "grabbing" their own finger and pulling

Finger Dislocations

- Reduction technique
  - Distraction
  - Recreate deformity
  - Axial traction
  - Counter pressure
  - Reduce into alignment

Finger Dislocations

- DIP sequela
  - Swelling
  - Stiffness
  - Compromised ROM

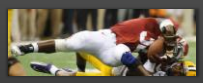


Finger Dislocations

- PIP sequela
  - Swelling
  - Stiffness
  - Compromised ROM
  - Central slip injury
    - Boutonniere Deformity
  - Retinaculum & collateral ligament overpull
    - Swan Neck Deformity

Hip Dislocations

- Rare injury pattern in sports
- Extremely important to recognize
- Require emergent identification and transport to a facility for proper treatment
  - (Sideline management of common dislocations. *Hodge DK, Safran MRCurr Sports Med Rep. 2002 Jun; 1(3):149-55.)*
  - (Hip instability. *Smith MV, Sekiya JKSports Med Arthrosc. 2010 Jun; 18(2):108-12.)*

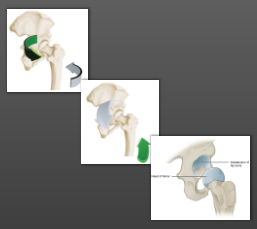




Hip Dislocations

- Anatomy
  - Contained ball & socket
  - Deepened by labrum
  - Significant muscle layers
- MOI
  - High energy impact with hip & knee flexed
  - Posterior displacement from anterior to posterior directed force

Hip Dislocations

- Load to failure
  - Hip in flexed position ⟶
  - Anterior ⟶ posterior force
  - Capsulolabral failure ⟶
  - Possible acetabular fx ⟶
  - Dislocation posteriorly often "locked" over posterior rim of acetabulum

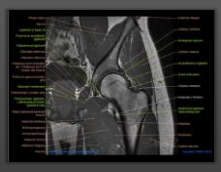


Hip Dislocations

- Evaluation
  - Hip held in flexed and internally rotated position
  - Affected leg appears shorter than contralateral side
  - Painful limited ROM especially any attempt to externally rotate leg

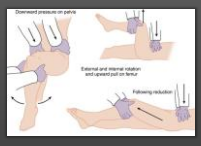
Hip Dislocations

- Injury
  - Capsulolabral tear
  - Posterior acteabular rim fx
  - Femoral head shear fx (Pipkin)
  - Sciatic nerve injury
  - Vascular supply to femoral head



Hip Dislocations

- Reduction technique
  - Supine position, knee flexed to 90
  - Axial traction on leg
  - Downward counter pressure on pelvis/ASIS
  - Gradual traction to reduce femoral head over acetabular rim into acetabulum
  - *Appropriate facility and sedation*



Hip Dislocations

- Long term sequela
  - Avascular necrosis (AVN) of femoral head
    - AVN rates variable reports, ranging from 10-30%
    - Osteoarthritic progression

- (Hip Instability.Smith MV, Sekiya JKSports Med Arthrosc. 2010 Jun; 18(2):108-12.)
- (Sideline management of common dislocations.Hodge DK, Safran MRCurr Sports Med Rep. 2002 Jun; 1(3):149-55.)

Knee Dislocations

- Uncommon in sports
- Extremely significant injury
- High association with popliteal artery injury (20%-40%) and peroneal nerve injury

- (Surgical Management of Knee Dislocations.Harner CD, Waltrip RL, Bennett CH, Francis KA, Coe B, Irrgang JJ, J Bone Joint Surg Am. 2004 Feb; 86-A(2):262-73.)
- (Henrichs A, J Athl Train. 2004 Oct-Dec; 39(4):365-9.)

Knee Dislocations

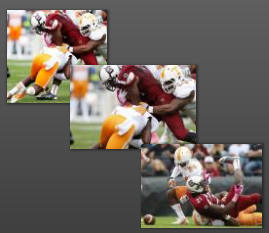
- Anatomy
  - Femoral & tibial articulation
  - Ligaments (ACL, PCL, MCL, LCL)
  - Popliteal artery trifurcation posterior
  - Peroneal nerve lateral
- MOI
  - Fixed foot position with anterior-to-posterior directed force
  - Land on extended knee with off-balance rotational axial load

Knee Dislocations

- Load to failure
  - Posterior force on tibia/axial load rotation of tibia under femur
  - Ligament failure
  - Subluxation
  - Dislocation

Knee Dislocations

- Evaluation
  - Mal-aligned/angular deformity of knee
  - Extreme pain
  - Neurovascular compromise



Knee Dislocations

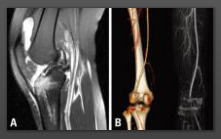
- Injury
  - Multiple ligament failure
  - Meniscus/cartilage injury
  - Posterolateral corner injury
  - Fx
  - *Popliteal artery*
  - *Peroneal nerve*

Knee Dislocations

- Reduction technique
  - Traction with anterior/posterior/medial/lateral translation depending on direction of dislocation
  - Reduce to extension
  - Neurovascular exam pre- and post-reduction

Knee Dislocations

- Warrants urgent evaluation to document vascular status
  - CT angiography
  - Vascular consult/serial vascular examination
- MRI
  - Determine soft tissue/ligament injury



Knee Dislocations

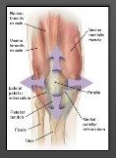
- Short term sequela
  - Vascular status of extremity: potentially limb threatening
  - Nerve injury: sensory paresthesias, motor weakness (footdrop)
- Long term sequela
  - Vascular compromise: amputation
  - Nerve injury: motor/sensory changes
  - Knee instability

Knee Dislocations

- Injury can auto-reduce
  - High index of suspicion if there is multi-planar instability on exam, or if neurovascular compromise is noted on the "reduced" knee

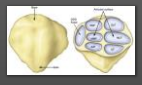
Patella Dislocations

- Patella is the largest sesamoid bone
- Unique anatomy/attachments
  - Quadriceps
  - Patellar tendon
  - Medial & lateral retinacula
  - Medial patellofemoral ligament (MPFL)



Patella Dislocations

- Anatomy



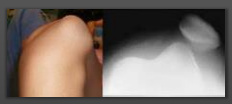
- Note: MPFL
- MOI
  - Acceleration/deceleration with foot planted and change of direction
  - Direct contact to medial or lateral side of knee

Patella Dislocations

- Load to failure
  - Foot plant
  - Quadriceps contraction loads knee (vector force)
  - Twist/rotation/contact
  - Lateral dislocation (most common)

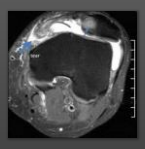
Patella Dislocations

- Evaluation
  - Knee held in flexion
  - Extreme pain
  - Patella located lateral to anterior knee
  - Heard or felt a "pop"
  - Hemarthrosis
  - Common spontaneous auto-reduction



Patella Dislocations

- Injury
  - MPFL tear
  - Medial retinacular disruption
  - Patellar shear fx
  - Patellar articular facet damage (chondral injury; loose body)



Patella Dislocations

- Reduction technique
  - Medially directed force with knee in extension

Patella Dislocations

- Long term sequela
  - Recurrent instability
    - Subluxation/dislocation
  - Patellofemoral joint osteoarthritic progression

Ankle Dislocations

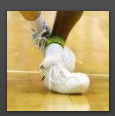
- Sprains: common; 45% of athletic injuries
- Dislocations: uncommon
  - (Traumatic foot and ankle injuries in the athlete. *Title CI, Katchis SD,Orthop Clin North Am. 2002 Jul; 33(3):587-98.)*

Ankle Dislocations

- Anatomy
  - Tibia-Fibula-Talus articulation
    - Mortise
  - Ligament stability
    - ATFL, CFL, Deltoid
- MOI
  - Foot planted, rotation, contact


Ankle Dislocations

- Load to failure
  - Axial load
  - Force translation
  - Rotation
  - Ligament disruption
  - +/- Fx
  - Dislocation

Ankle Dislocations

- Evaluation
  - Obvious deformity with malalignment and possible rotation or displacement of foot relative to tibia

Ankle Dislocations

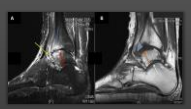
- Injury
  - Direction of dislocation determines structures that can be damaged
    - Ligaments
  - High association with fibula and/or medial malleolus fx

Ankle Dislocations

- Reduction technique
  - Firm grasp of heel in conjunction with stabilizing lower tibia
  - Recreate direction of injury with traction, attempting to reduce ankle under tibia
  - May be unstable if associated fx
  - May not be reducible on the field

Ankle Dislocations

- Long term sequela
  - Instability
  - Progressive osteoarthritic change



Complex Dislocations

My 2 cents…

- Dislocations are usually obvious

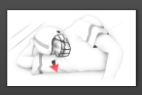
- Sometimes they aren't
  - Subtleties
    - *Something just doesn't seem right*
  - Nuances
    - *Mechanism of injury*

Complex Dislocations

Awareness & Diligence

- Lunate/Perilunate wrist injury

- Luxatio Erecta of the shoulder

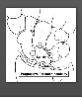


Lunate/Perilunate Injury

- MOI: Progressive rotatory instability with extension and axial load
- Limited ROM
- Vague pain in wrist
- ? Deformity
- Neurovascular compromise
  - Median nerve (carpal tunnel)

Lunate/Perilunate injury

- Mayfield classification



- X-ray evaluation

Carpal dislocations: pathomechanics and progressive perilunar instability. Mayfield JK, Johnson RP, Kilcoyne RK. J Hand Surg Am. 1980 May; 5(3):226-41.

Lunate/Perilunate Injury

- Reduction (urgent)
  - ER
  - Local/sedation
  - Distraction and/or rotation
  - Palmar pressure on lunate to rotate back into carpus

- Plan of care
  - Associated injuries
    - S-L ligament repair
    - Scaphoid fracture ORIF
    - Supplemental pins to stabilize associated ligamentous instability

Luxatio Erecta

- MOI: Forced hyper-abduction in traumatic fall
- Significant pain
- Limited ROM
  - "Touch Down" sign
- Unable to reduce in the field (do not attempt)
- Nero/vasc compromise
  - Axillary nerve palsy

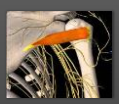
Luxatio Erecta

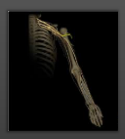
- X-ray evaluation

- Conscious sedation in ER for reduction

Luxatio Erecta

- Long-term sequela
  - Axillary nerve palsy
    - Decreased sensation lateral upper arm
    - Motor weakness





Complexity of Dislocations

There is nothing "routine" about joint dislocation & reduction

- Risk
  - Attempt at reducing dislocation may cause undue pain or complicate the injury
  - Understand the anatomy
  - Limited sideline imaging options and anesthesia
- Reward
  - Reduce pain
  - Minimize potential neurovascular compromise
  - Improve post-injury care

Comfort Zone

- Understand what "Scope of Practice" means
- No specific "rules" regarding acute treatment and/or reduction of joint dislocation
- ATCs and MDs should be aware of local guidelines and regulations (variations may exist from state to state)

Simplicity of Dislocations

- Comfort level is gained by
  - Understanding the anatomy
  - Knowledge of reduction techniques
  - *Experience*
- When in doubt
  - Stabilize
  - Splint
  - Send

Current Sports Medicine Reports
May 2002, Volume 1, Issue 3, pp 149–155| Sideline management of common dislocations
•Duncan K. Hodge
•Marc R. Safran

Sports Health. 2014 May; 6(3): 246–255.
doi: 10.1177/1941738113499721
In-game Management of Common Joint Dislocations
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Thank You