Overview

• A lot of focus on proximal humerus fractures
• General knowledge is good on injuries that are clearly often nonoperative
  – Non-displaced fx
  – Clavicle fractures
  – Scapular body fractures
• Very poor understanding of operative indications
  – Most should be treated non-operatively

  • KEY IS NOT MISSING THOSE THAT SHOULD BE FIXED
Overview

• Scapular fractures
  – Body
  – Glenoid neck
  – Glenoid cavity
  – Acromion
  – Coracoid
• Midshaft Clavicle Fractures
• Distal Clavicle Fractures
Scapular Fractures
Scapular fractures

• 1% of all fx, 3% of all shoulder girdle fx
• Low incidence – protected by rib cage and muscles; mobility allows dissipation of forces
• Scapular fx
  – Body 50%
  – Glenoid neck 25%
  – Intraarticular glenoid 10%
  – Acromion 7%
  – Coracoid 7%
Scapular Fractures

- Often associated with other injuries – high energy; diagnosed and treated late
- Direct trauma; Indirect muscle avulsion
- Examination – complete neuro exam; axillary nerve sensation and palpate deltoid contraction
- Radiographs – shoulder series; CT scan with 3D reconstructions
Treatment

• Majority treated nonoperatively
  – Almost all body fractures; majority of neck and fossa injuries
  – Short term immobilization for pain control only
  – May want to protect nondisplaced avulsion fxs longer until healing – usually at 6 weeks – with interval XRAYs to insure they remain nondisplaced

• Operative indications
Scapular body fractures

- Most common
- High incidence of associated injury – look for scapulothoracic dissociation, pneumothorax
- Tx – sling for comfort and early motion at 1 – 2 weeks, pulleys at 4 weeks, active motion and progressive strengthening at 6 weeks; takes 12 weeks to recover
- Only possible operative indication is displaced fracture of inferior angle with inferior fragment displaced deep to superior fragment – prevent scapthoracic crepitus
Glenoid Fossa Fractures

• Rim or Fossa fx?
  – Rim occur with laterally directed force drives head into glenoid margin – usually very small
  – Some have indicated fixation if > 10mm of displacement and large to prevent instability
  – My recommendations for surgery for Rim fx
    • Instability – unable to keep joint reduced
    • Subluxation humeral head on axillary or CT
Treatment of Glenoid Rim Fractures

• Nonoperative – Sling for 4 weeks
  – Allow pendulums, passive supine elevation and active assisted ER at side starting at 2 weeks.
  – Limit Abduction and external rotation and active elevation over 90 degrees for first 6 weeks

• Operative –
  – Usually anterior
  – If Bankart fracture, consider arthroscopic repair
  – Usually anterior, standard deltopectoral approach, subscap split or takedown, open anterior instability repair with anchors or bone tunnels
  – Postoperative course – same as instability repair
Glenoid Fossa Fractures

• Laterally directed force driving humerus into glenoid fossa
• Transverse fracture that propagates
• How much displacement is too much?
  – Kavanagh, Cofield JBJS 1993. Displacements ranged between 4 – 8 mm
  – Soslowsky CORR 1992. Ave. cartilage thickness 5 mm
• Relative indication
  – 5 mm
  – Highly comminuted – would probably lean towards nonop/ bag of bones
• Absolute indication
  – 1 cm intraarticular displacement
  – Humeral head subluxation or instability
  • Gerber C. JBJS Br. 2007
Ideberg classification – determines approach
Operative Results of Glenoid Fossa fx:

- Schandelmaier, Krettek. JBJS Br 2002
  - 22 displaced fossa fractures
  - Mean 10 year followup
  - ORIF for fx with 5 mm or more displacement
  - 16 posterior approach, 6 anterior approach
  - Mean Constant 79%
  - Score < 50% in 4 patients
  - 148 degrees forward elevation
Glenoid Neck Fractures

• Direct blow, fall on outstretched arm, fall on superior aspect of shoulder

• If superior support structures (clavicle- AC joint – acromion or coracoid – CC ligaments), then displacement is likely

• ***Ada and Miller. CORR 1991. Eval of 113 scapular fractures. Of the 16 fractures with displacement greater than 1 cm or 40 degrees of angulation in coronal or axial plane; 20% decreased motion, 50% had pain, 40% had weakness, 25% popping
Glenopolar angle

30 to 45 degrees normal

AP of bilateral clavicles on same Film with arms at side and palms supinated
Glenoid Neck Fractures

- Glenopolar angle –
  - Romero et al. Orthop Trauma Surg 2001. < 20 degrees is indicative of severe rotational malalignment and denotes inferior displacement
    - GPA < 30 affected Constant score in floating shoulder
    - 18 patients – Ave. constant score of GPA > 30 = 83; Ave. Constant score of GPA < 30 = 75 (P = 0.05)
Glenoid Neck Fractures

- Radiographs, CT with 3-D images
- Fracture patterns – anatomic neck (exits lateral to coracoid), surgical neck (exits medial to coracoid)
- Watch out for fractures through inferior glenoid neck that runs along or through inferior border of scapular spine to exit the medial or superior border of the scapula --- treat nonop as scapular body fracture
Glenoid Neck Fractures

- Independent of other injuries
- **Consider ORIF for** –
  - 2 cm of medial displacement
  - Angulation greater than 40 degrees
  - GPA < 30
Operative approach

- Anterior – Standard Deltopectoral
- Posterior approach –
  - Extensile Judet Approach
    - Neck/fossa fractures that have significant involvement of the body
    - Elevate entire infraspinatus from the fossa
  - Limited posterior approach
    - My preferred technique for neck and fossa fractures
    - Be liberal taking down posterior deltoid, repair through bone tunnels
    - Watch for circumflex scapular artery and axillary nerve
Floating Shoulder

- 0.1% of fractures
- Definition
- Superior shoulder suspensory complex (SSSC)
- Acromion, coracoid, distal clavicle, glenoid, CC ligaments, AC joint
- Williams et al. JBJS 2001. CA ligament part of complex
Floating Shoulder

• Double fracture, neck and single ligament or double ligament
• Equally divided between op and non-op
• Edwards et al. JBJS 2000.
  – 20 patients; < 5mm displacement of scapula equal to surgical results; Also patients w/ 5 – 10 mm of scap displacement/ 10 of clavicle do well
• Ramsey et al.
  – > 25 mm of glenoid medialization had less elevation
Floating

- Some say fix clavicle alone (Rikli et al, Herscovici et al); some say fix both
- Egol et al. JBJS 2001. Compared op and nonop and found no difference in outcomes

- Tashjian Recommendations:
  - Treat the fractures individually – If clavicle is displaced 2 – 3 cm of shortening/comminution then fix; if neck displaced > 2 cm or angulation > 40 degrees
Acromial Fractures

- One of 2 mechanisms – downward direct blow, superior displacement of head
- With downward blow, usually min. displaced – if displaced r/o plexus injury
- With superior displacement, r/o cuff injury
- Kuhn – type I – min. displaced or displaced without subacromial narrowing; type II – displaced with subacromial narrowing
Acromial fx

- 90% nonop – make sure not Os (get x-rays of opposite side; 60% bilateral)
- Operative –
  - young, active patient with < 50% apposition of fragments and/or cuff tear
  - Kuhn indications
  - Usually at posterolateral corner of acromion just behind ac joint extending posterior and laterally
  - Fix with tension band if more lateral or plate if more medial along the spine of scapula
Coracoid Fractures

- Commonly occur with AC dislocation, GH dislocation, and clavicle fx
- Very limited reports
- Ogawa et al. Reported on 67; Type I between glenoid and CC ligaments; Type II distal to CC ligaments – rec. ORIF of Type I with good results
- Indications – Type I with glenoid involvement with glenoid displacement > 5 mm; Maybe Type I with < 5 mm of subcoracoid space; Type I with AC separation
Clavicle Fractures
Midshaft Clavicle Fractures

• Clavicle fractures – 2.6% of all fractures (64 per 100,000 per year); midshaft 80%; lateral 17%

• Bimodal distribution - young males; older females

• Historical data – nonunion and malunion rates are very low; < 5%

• More recent data support increased risk for nonunion based upon subgroups
  – Age; sex; amount of displacement/comminution; smoking; location of injury
3 Questions Driving Clavicle Fx Management

• Historical non-operative – most did well – some didn’t nonunion/malunion
  – 1.) Are malunions clinically important?
  – 2.) Do operatively treated fractures in general do better than nonoperative?
    • Metrics– Clinical outcomes; fracture healing
  – 3.) If union is the only thing that matters, what factors are associated with nonunion?
1.) Are malunions clinically important?

- Is healing the only thing that matters or does deformity affect function
- Mckee MD et al JBJS Am 2003
  - 15 patients with malunion after midshaft clavicle fracture
  - Average 3 cm shortening
    - (1.6 cm to 4 cm)
  - DASH from 32 to 12
  - Shortening improved from 2.9 to .4
Do malunions exist?

- Probably…but very rare
- Figueiredo et al BMC Musculoskeletal Disord 2015
  - 59 patients midshaft fx treated nonop
  - Mean shortening 1 cm
  - Range – 0 – 3 cm
  - Final DASH – 8.2; vas pain 0.8
  - No correlation between DASH and shortening
  - In patients > 2 cm shortening, no effect on limb function
2.) Do operatively treated fractures do better than nonoperatively treated?

- Canadian Orthopaedic Trauma Society. JBJS Am 2007
  - Multicenter, randomized clinical trial
  - 132 patients; displaced midshaft clavicle fractures
  - Randomized to nonop vs plate fixation
  - Union – 28 wks nonop vs 16 wks op
  - 11% nonunion nonop vs 3% op
  - 3 infections
  - DASH better by 10 points with ORIF; **JUST AT THE MCID** (but includes all patients with non-unions)
....but 10 years later...

- Woltz et al. JBJS Am 2017
  - Multicenter prospective randomized trial
  - ORIF vs nonop of displaced midshaft fractures
  - 160 patients randomized
  - Nonunion higher in nonop vs op (23% vs 2.4%)
  - Secondary surgery higher for operative vs nonop (27% vs 17%)
  - No difference Constant or DASH scores at 1 year

So, primary reason to fix is increase chance to heal
3.) What factors are associated with nonunion w/nonop tx?

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**Age, sex, displacement, comminution**

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**Displacement, comminution, smoking**

*Brinker et al JBJS 2005*  
*Murray et al JBJS 2013*
So Why Fix Midshaft Clavicle Fractures?

• Answer – Reduce the risk of nonunion...period.

• Can discuss malunion but risk is very rare unless severe shortening (3 – 4 cm)

• Reason to operate – reduced the risk of nonunion to < 1%

• *Give patient option based upon risk factors and risk reduction and let them decide* – Incur risks of surgery to reduce risk of nonunion
Lateral Clavicle Fractures

- Neer – I – CC ligaments intact, II – CC ligaments disrupted, III – intraarticular
- 20 – 30% of II fail to heal; even if they do heal – take very long, up to 3 months
- Nonop for type I and III
- Operative for II; some others say nonop for all and treat delayed II like AC separations
- Multiple techniques – Hook plate, transacromial fixation, distal radius plate
- Preferred – CC fixation with suture + figure 8 suture fixation of fracture
THANK YOU

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