Indications for Surgery of the Clavicle

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Anatomy

• Clavicle
  – Growth plate fuses late (25 years old)
  – The clavicle acts especially as a fulcrum to enable the muscles to give lateral motion to the arm
  – The clavicle consists of cancellous tissue, enveloped by a compact layer, which is much thicker in the middle.
FORCE ON THE CLAVICLE
Areas of Injury

• AC Joint

• SC Joint

• Fractures
AC SEPARATION

- Anatomy
- Classification
AC SEPARATION

• DIAGNOSIS
AC SEPARATION - SURGERY
SC DISLOCATION
SC DISLOCATIONS - DIAGNOSIS
SC DISLOCATION – SURGICAL TREATMENT

INDICATIONS
Clavicle Fracture

- 81% midshaft
- 15% lateral third
- <4% - medial – often physeal fractures since growth plate closes 18-25
MECHANISM

• DIRECT TRAUMA
  – Bicycle hit/fall

• FALL OF OUT- STRETCHED ARM
HISTORICALLY
Mid-shaft

• NEER 0.1% NON-UNION
• ROWE 0.8% NON-UNION
Traditional indications for surgery

OPEN FRACTURE

IMPENDING OPEN FX

NEUROVASC. INJURY

ASSOC. GLENOID FX
Robinson et al. 1998

- 581 diaphyseal fractures
- 4.5% nonunion rate
- Uni-variate/multi-variate analysis: Risk increased by
  - advancing age
  - female gender
  - displacement of the fracture
  - presence of comminution
Displaced Diaphyseal Fracture

- Non-operative treatment - Supportive
  - 5-15% non-union
  - >50% non-union when all risk factors present
  - Malunion – up to 31% unhappy
  - Brachial Plexus compression
  - Dissatisfied with appearance
    - Up to 54%
  - Shoulder Dysfunction
    - >15mm shortening
Mid shaft Clavicle Fx- Surgery

• 2013 Indications:
  – Greater 2 cm displacement
  – Greater 2cm shortening
  – Women >50 years old (men too)
  – Comminution
  – Skin compromise
FIX ?
FIX ?
FIX ?
FIX?
FIX ?
2 months post-injury
Lateral Third

- **Type I** - Minimally displaced/interligamentous
- **Type II** - Displaced due to fracture medial to the coracoclavicular ligaments
  - **IIA** - Both the conoid and trapezoid remain attached to distal fragment
  - **IIB** - Either the conoid is torn or both the conoid and trapezoid are torn
- **Type III** - Fractures involving articular surface
- **Type IV** - Ligaments intact to the periosteum with displacement of the proximal fragment
- **Type V** - Comminuted
Lateral Third

• Non-unions – Neer (1968) – nearly 50% of all non-unions were lateral third – mostly Type II
• 30-33% nonunion (Oh 2011, Deafenbaugh 1990)

• Present recommendation is Type II surgical fixation – controversy is how
Lateral Third

- Type I – stable – non-operative
- Type III – excision, non-operative
- Type IV – Young patients – consider non-operative, otherwise can treat use Type II options – but take intact ligament into consideration
- Type V – case by case
Lateral Third

- Plates - Hook, Lateral third plate, transacromial
- Pins
- Ligament Reconstruction
- Tension Band Suturing / Wire
Lateral Third

- Plates –
  - Tiren (2012) Hook plate: 96% union
    - 32% impingment, 25% acromial osteolysis, 14% AC arthrosis (5% sx), 11% extra-ossification
  - Anderson (2011) Superior plating: 94% union – one peri-plate fracture/ one non-union
Lateral Third – Tension Band

• Tension Band Suturing – Badhe (2006)
  – 10 patients – all healed
Lateral Third - Pins

• Fann – 2004 China
  – 32 patients all healed with single trans-acromial k-wire

• Koa (2001 J Trauma)
  11-12 united with pins/ wires
Lateral Third Ligamentous Approach

- Dacron tape / Suture
- Huang 2009 10/10 union
Lateral Third Ligamentous Approach

• C-C Ligament reconstruction
  – Often discussed – literature sparse

• Weaver Dunn
  – Personal experience – well tolerated, simple, salvage procedure