FRACTURES of the CLAVICLE & SCAPULA

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St Helier Hospital
Clavicular fractures

- Anatomy
- Birth fractures
- Epidemiology
- Assessment & Treatment
- Lateral third fractures
- Complications
- Results
Clavicle - Anatomy

• S-shaped strut linking upper extremity to axial skeleton  
• Joints & strong ligaments at each end  
• Mid third is junction of two curves  
• Subject to high stresses both bending & torsional  
• Little cancellous bone or muscle cover of mid third  
• Proximity to neurovascular structures & viscera
Birth Injuries - clavicular fractures

- 0.2-0.7% of all vaginal deliveries
- 40-50% of all birth injuries
- Greenstick mid third fracture (may be complete, oblique or transverse)
- Risk factors: large birth weight, shoulder dystocia
Birth fractures

- Present with “pseudoparalysis” and pain on handling
- Greenstick not apparent until callus palpable
- 5% with clavicular fracture will have brachial plexus palsy

Oppenheimer et al 1990
Differential diagnosis

• Upper humeral osteomyelitis / epiphyseal separation

• Congenital pseudarthrosis of clavicle
  – if unilateral on opposite side to the heart (usu right)
  – no callus or tenderness
  – smooth bone ends on X-ray
Birth fractures - treatment

- Explanation
- Symptomatic
- Careful handling
- Sling if very displaced
Clavicle fractures - epidemiology

- 4% of all fractures (Malmo)
- 64 / 100 000 population
- Mid third children & adolescents
- Lateral third middle aged
- Medial third elderly

Nordqvist & Peterson CORR 1994
Assessment

- Making diagnosis not difficult
- Additional injuries not common but often missed
  - Neurovascular
  - Head & neck
  - Thoracic
Assessment - radiographs

- AP view
- $45^0$ cephalic tilt
- Axillary view for lateral third
- CT for medial end
## Classification

- **Allman 1967**

<table>
<thead>
<tr>
<th>Group</th>
<th>Location</th>
<th>Percentage</th>
</tr>
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<tbody>
<tr>
<td>Group I</td>
<td>Mid third</td>
<td>76%</td>
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<tr>
<td>Group II</td>
<td>Lateral third</td>
<td>21%</td>
</tr>
<tr>
<td>Group III</td>
<td>Medial third</td>
<td>3%</td>
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</table>
Classification - outer third

- **Neer 1963**
  
  **Type I**  Undisplaced
  
  **Type II**  Displaced with ruptured coracoclavicular ligaments
  
  **Type III**  Intra-articular
Type I
Type II
Type III
Non Operative Treatment

- Broad Arm Sling or Figure of Eight Brace?

In adults:
No advantage with of figure of eight

More supervision
Less comfortable

Anderson et al Acta Orthop Scand 1987
Operative Treatment - indications

- Neurovascular compromise
- Open fractures
- Multiple injuries / floating shoulder
- Displaced outer third fractures
- Symptomatic non union
- Symptomatic mal union
Method of Fixation - mid third

- 3.5 mm DCP or reconstruction plate
- Never third tubular plate
- Superior surface
- Infraclavicular incision
- Post operative numbness
- Plate removal
Method of Fixation - mid third (alternatives)

- External fixators
- Intramedullary K wires
Lateral third fractures

- Coracoclavicular ligament rupture allows displacement

- Medial fragment displaces upward & posteriorly allowing soft tissue interposition

- Displaced fractures (Type II) high incidence of non union if treated conservatively
Lateral third fractures
Edwards, Kavanagh & Flannery 1992

- Non operative treatment
  - 30% non union
    5/6 pain  1/6 lump
  - 45% delayed union (>3 mth)
  - Only 25% satisfactory healing

- Operative group 100% union within 6-10 weeks
Lateral third fracture fixation

- Options
  - Cerclage wire
  - Reconstruction / T-plate
  - K wires + tension band
  - Slings & Tapes
  - Coracoclavicular screw
Coracoclavicular screw

- **Gerber**
  Reported excellent results for lateral third fractures
  “Relatively easy and safe technique”

- **Difficulties**
  Shape of coracoid
  Thick periosteum
  Screw cuts out if not removed
Complications of clavicular fractures

- Vascular injury
- Nerve injury
- Non union
- Malunion
Nerve injury

Acute

• Bony fragments
• Rare <1% of all brachial plexus injuries
• Fracture usually *incidental* to traction injury of plexus

Barbier JBJS 1997

Early decompression
Nerve injury

• Chronic
  - Hypertrophic callus
  - Non union
  - Malunion

• Treatment
  - Resection of callus
  - Clavicle
  - 1st rib
Non union

- 0.1 - 2.4% closed treatment
- 4% open reduction
- Usually atrophic
- Presentation
  - Pain
  - Loss of motion
  - Compression of adjacent structures
Non union

Factors

• Soft tissue damage - high energy, severe displacement

• Inadequate immobilisation

• Primary open reduction

• Refracture
Non union - management

- Plate & bone graft (94% success)
- Corticocancellous or tricortical iliac crest graft
  - Jupiter & Leffert JBJS(US) 1987
- 3.5mm Reconstruction plate
  - Bradbury & Colton
Non union - management

- Oblique resection of non union + lag screw fixation

- Cancellous grafting

Boyer & Axelrod JBJS UK 1997
Malunion

• Children - not reported as a problem
• Adults cosmetic deformity
• Eskola 1986 statistically more pain (in 5%) if shortening >15mm at follow up
• Shave lump or osteotomy
• Possible sequelae of osteotomy
Results - conservative treatment

- Cosmetic deformity
- Generally good function (95%)

Recently challenged for subgroup of mid third fractures with complete displacement
Higher incidence of non union - 15%

- ORIF justified?
Scapular Fractures
Scapular Fractures

- Flat bone covered in muscle
- Mobile
- Mechanism
  - Direct
  - Indirect
- Associated injuries average 3.9
- 2% mortality
<table>
<thead>
<tr>
<th>Injury</th>
<th>Approximate incidence (%)</th>
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<tbody>
<tr>
<td>Rib fractures</td>
<td>25-50</td>
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<tr>
<td>Clavicular fractures</td>
<td>15-40</td>
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<tr>
<td>Pulmonary injuries</td>
<td>10-55</td>
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<tr>
<td>Skull fractures</td>
<td>25</td>
</tr>
<tr>
<td>Cerebral contusion</td>
<td>10-40</td>
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<tr>
<td>Humeral fractures</td>
<td>12</td>
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<tr>
<td>Brachial plexus</td>
<td>5-10</td>
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<tr>
<td>Tibial fractures</td>
<td>11</td>
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<tr>
<td>Major vascular injuries</td>
<td>11</td>
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<tr>
<td>Splenic rupture</td>
<td>8</td>
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</tbody>
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Classification

Anatomical

- Body
- Glenoid rim
- Glenoid
- Neck
- Acromion
- Spine
- Coracoid
Assessment

• Potentially life-threatening associated injuries (ATLS)

• Associated neurovascular injuries
  – Brachial plexus
  – Nerve to serratus anterior
  – Suprascaplar nerve
Radiographs

- Scapular AP
- Tangential scapular lateral
- Axillary
- Axial CT + reconstruction
- MRI
- Fluoroscopic EUA
Non-operative Treatment

- The majority
- Analgesia, sling & mobilise as pain subsides
- All undisplaced fractures (90% of glenoid)
- Body fractures NOT involving glenoid, coracoid, or acromion
- Type VI fractures
Scapular neck fractures

- Displacement uncommon with intact clavicle
- $>40^\circ$ angulation or $>1\text{cm}$ medial translation
- Posterior approach ± superior extension

- Malunion alters mechanics of rotator cuff
- Non operative treatment of displaced fractures - one third fair / poor
- Decreased ROM, pain, abductor weakness
Fractures of the Acromion

- Direct blow to superior angle of shoulder
  - uncommon because AC jt usually disrupts

- Indirect via superior displacement of humeral head
  - assoc rotator cuff damage (MRI)

- Stress fracture in longstanding cuff disease
Fractures of the Acromion

• NB Bipartite acromion in 3-8%
• Undisplaced
  – Early mobilisation
  – Excellent results

• Displaced
  – Elevation & fixation to prevent impingement
  – Repair of associated cuff damage
Coracoid fracture

- Isolated Direct blow to coracoid or point of shoulder
- AC jt disruption avulsion via intact coracoclavicular ligaments
- Avulsion of tip LHB / coracobrachialis
Coracoid fracture

- Cephalic tilt / Stryker notch view
- Undisplaced - non operative treatment
- Marked displacement - screw fixation
- Full function 6 weeks to 4mths
- Occasional painful NU
- Excision of fragment & reattach muscle origins - poor results
- Fix & graft better
Floating shoulder

- Ipsilateral scapular neck & mid third clavicle fractures
- Significant displacement possible
- ORIF of clavicular fracture
- Address glenoid neck fracture if displacement remains acceptable
- 14/15 operated good /excellent results

Leung et al JBJS 75A July 1993
Operative indications

- Neck fractures
  - $>40^\circ$ angulation
  - $>1$cm medial translation

- Neck fracture + clavicle fracture “floating shoulder”

- Displaced acromial fractures

- Displaced coracoid fractures

- Displaced (>5mm) glenoid fractures
  - instability
  - $>25\%$ of articular surface
Glenoid Fractures

- 10% of all scapular fractures
- 10% of glenoid fractures are displaced
- Displaced glenoid fractures 1/10 000

Experience small

- Goss JBJS 74A(2) Feb 1992
Intra-articular glenoid fractures

Modified Ideberg (Goss) Classification

Type Ia  Anterior glenoid rim
Ib     Posterior rim
II     Oblique fossa to axillary border
III    Transverse into supraspinous fossa
IV     Transverse exiting vertebral border
V      Complex mixtures of II, III & IV
VI     Severe comminution of glenoid
Glenoid fractures - preoperative planning

• Importance of accurate classification
• Placement of screws
  – scapular neck
  – coracoid
  – base of spine
  – axillary border
• Fixation
  – interfragmentary screws
  – 3.5mm reconstruction plates
Operative Approaches

- Anterior Deltopectoral
  - Ia
  - Coracoid
  - Some type III

- Hazards
  - axillary nerve
  - ant / posterior circumflex humeral artery
Posterior Approach

• Types  Ib, II, III, IV & Va
• Deltoid retracted or formally detached
• Incision of infraspinatus tendon
• Interval between infraspinatus & teres minor

• Hazards
  – suprascapular & axillary nerves
  – posterior circumflex humeral artery
Posterosuperior Approach

• Additional split trapezius & supraspinatus tendon
• Development of interval between scapular spine & clavicle

• Indications
  – Type III & IV
  – Vb & Vc

• Suprascapular & axillary nerves
Results & Prognosis

• Goals  
  Full function, no instability, no OA

• Undisplaced 90% non-op with excellent results

• Anatomical reduction, stable fixation & aggressive early postop rehab

• Displaced fractures  Leung et al 100% GOOD / EXCELLENT
THANK YOU