The role of X-Ray in Clinical Evaluation of Shoulder Pain

Cathy Barrett BSc MSC MCSP MMACP FACP
Sharon Morgans MCSP MMACP
Advanced Physiotherapy Practitioners

Lecturer University College London
Central Health Physiotherapy; Cbarrett@central-health.com

With Contributions from;
Radiology and Orthopaedic Colleagues  Imperial Healthcare NHS Trust.
Aims of the Session.

1. To understand:
   - The range of radiology available in the evaluation of shoulder pathologies.
   - Normal anatomy
   - Normal variants and
   - Abnormal findings; X-ray and MRI.
   - Discussion of use of US and CT

2. To understand the appropriate timing and selection of investigations and be able to reason and justify this with patients and colleagues
Radiological investigation is an adjunct to your clinical examination and the main aim is to help you form a diagnosis for the presenting signs and symptoms, which will then guide further management.

- Hypothesis testing / confirmation/ exclusion
Pathology and Diagnostic Terminology.

1. Sub Acromial and Rotator Cuff Related Shoulder Pain;
   - Tissue pain sources; Bursitis, Rotator Cuff tendinopathy, calcific tendonitis
   - Bony factors; os acromiale, callus, ACJ OA
   - Should we care about acromial spurs?

2. Degenerative Joint Disease: Early, mid and late and Inflammatory Joint Disease

3. Instability:
   - Structural, Hyperlax or Motor Control?

4. ACJ and SCJ; OA, Instability and osteolysis

5 Stiff Shoulder
   - Primary (frozen shoulder) vs secondary eg OA, RCRSP, infection, tumour

6 Red flags
ABC of Radiology.

- A.
- B.
- C.
- S.
Anatomy; Muscle
Prosection indicating the subacromial Bursa
X-Ray Views For The Shoulder.

1. AP View
2. Lateral View
3. Axial View

- 30 degree caudal tilt
- AP with Medial Rotation
- AP with Lateral Rotation

Others-Serendipity for SCJ
Normal X-Ray Appearance

1. AP Locate:

- Gleno-Humeral Joint
- Humeral Head
- Greater Tub./Lesser Tub
- Scapula
- Glenoid
- Acromion
- Coracoid
- Clavicle
- ACJ
- SCJ
- Ribs
- Lung fields
AP Shoulder vs 30 degree caudal.
Better view of Sub acromial space
Normal shoulder
AP and 30 degree caudal tilt; What looks different?

Humeral Head
Gtr Tub./Lsr Tub
Sub acromial space
Scapula
Glenoid
Acromion
Coracoid
Clavicle
ACJ
Shape of the Acromion.

- Bigliani Classification.
Normal Shoulder lateral.

Instability;
Location of HH

Humeral Head
Gtr Tub./Lsr Tub
Sub acromial space
Scapula
Glenoid
Acromion
Coracoid
Clavicle
ACJ
Normal Shoulder Axial.
Axial; Try to locate;

Humeral Head
Glenoid
Acromion
Coracoid
Clavicle
ACJ
Other Shoulder Views.

1. Garth View, (apical oblique 45 degrees angle) Inferior glenoid. Sitting


3. Bernajeau View. As SN but in sitting. Antero-inferior glenoid

4. Serendipity View. SCJ 40 degrees ceph
Sub-Acromial/Rotator Cuff Related Shoulder Pain
(or the Diagnosis formerly known as IMPINGEMENT)

Clinical presentation.
Pain/weakness with elevation (arc/mid to end range/cannot lift).
Pain reaching behind back
Night pain when lying on the affected side.
Area; GHJ/lateral deltoid region

- ‘Tests’ AT BEST Provocation tests! Need a cluster
  Resisted external rotation weak/painful
  Resisted elevation (flexion, abduction at 90 degrees) weak/painful
  HBB and HF often painful and reduced ROM
  External rotation pain free.

Common: Provocation tests can be improved with change of scapula
The role of Xray in sub acromial shoulder pain (‘Impingement’)

- What are you looking for?
- What do you want to exclude?

In the light of the CSAW trial, what does any of it matter anyway??????

- 85% improve with Conservative management
- 15% may need further Ix

Beard, Rees, Cook et al 2018 The Lancet

Patient Expectation Key; Beliefs re Physiotherapy, surgery etc

Chester R 2016
The role of Xray in ‘Impingement’

- To examine the bony contours of the outlet
- The potential bony factors that can compromise the outlet

Os acromiale, Acromial spur, calcific deposit, ACJ degenerative change, callus from previous fractures

The following patients all have symptoms of sub-acromial pain and bony features that may or may not be relevant
Shoulder Normal Variant or part of the problem? Which view is this. Label 1, 2, 3. Is it normal?
Os Acromiale; 5% Incidence
Which view is helpful in this diagnosis?

AP view

Axial View
What view is this?
Describe the bony changes you can see

Humeral Head
Gtr Tub./Lsr Tub
Sub acromial space
Scapula
Glenoid
Acromion
Coracoid
Clavicle
ACJ
What bony factors might be relevant to this patient’s shoulder pain?

- Humeral Head
- Gtr Tub./Lsr Tub
- Sub acromial space
- Scapula
- Glenoid
- Acromion
- Coracoid
- Clavicle
- ACJ
What looks abnormal? Can you guess this diagnosis?

Humeral Head
Gtr Tub./Lsr Tub
Sub acromial space
Scapula
Glenoid
Acromion
Coracoid
Clavicle
ACJ
Calcific Tendonitis

- **XR** (including Int/Ext rotation views)

- **Acute** (inflammatory extrusion) vs **Chronic** (mechanical obstruction)

‘Impingement’: XR picks up calcific deposit which is impinging as it travels under the arch

Associated bursal reaction
Phases of Calcific Tendonitis

- Pre Calcific Stage
- Calcific Stage:
  - 1. Cell-mediated calcification/Formative Stage
  - 2. Resting Stage
  - 3. Resorptive Stage: Deposit phagocytosis, Cuff
    - hyperaemia, Acute pain
- Post Calcific Stage:
- Recovery of tendon, ?Ongoing symptoms in some
Calcific Tendonitis Management

- Cortisone injection to suppress bursal reaction can be helpful in both acute and chronic.
- BUT may suppress healing of the tendon crater.
- Frozen shoulder incidence high.
- US guided aspiration if soft plus bursal injection.
- Babbottage liberates calcium into bursa – also very painful.
- Shock wave similar results to injection.
- Washout dramatically better if acute.
- Monitor next few months XR.
57 year old lady; bilateral symptoms of Sub acromial Pain. What does this XR show?

What other views might be useful?
Same Patient. What can you see?

External rotation
Same Patient. What can you see? Is there a difference between views?

How does this affect management?
Other bony pathologies compromising the outlet

- ACJ, OA, spurs and loose bodies
- Humeral/tuberosity callus
68 year old male with features of Sub Acromial pain.
ACJ very tender to palpation.
Describe what you see on XR and further diagnostic options.

Humeral Head
Gtr Tub./Lsr Tub
Sub acromial space
Scapula
Glenoid
Acromion
Coracoid
Clavicle
ACJ
Same patient post treatment.

- What was the treatment?
35 year old climber with sub acromial pain.

Go through checklist. What is abnormal?

What are the management options?

What History do you suspect?

Are any further Investigations necessary?
‘Impingement’ and the Soft tissues

- Rotator Cuff Injury and disease inferred from XR
- Bursal inflammation
Inferred RC tear – Acromio-humeral distance reduced

‘High riding’ humeral head
Suprascapular nerve (SSN):
I nnervates 70% of shoulder including bursa; Motor supply SSp and Isp
SSN block more effective for symptomatic RC partial and FTT than sub acromial injection at 6 and 12/52 post procedure (Coory et al 2019)
Targeting the Subacromial bursa

Bursal Inflammation common.
Sub acromial Injection mgmt. + Physio = effective ***

Acute v Chronic

Caution; Bursal pain post Vaccination

*** Unless surgeon or Dr Google has said they need an operation!!
Important to discuss ICE (Ideas, concerns and expectations)
Can we change expectation?

Chester 2016
Degenerative Joint Disease

- Subjective findings may include,
  - 1. Stiffness first thing eases with movement and aggravated by too much movement.
  - 2. Night pain and stiffness positional

- Objectively.
  - 1. There may be a capsular pattern of restriction of joint movement.
  - 2. Concurrent muscle weakness/ tends to be global.

- Crepitus if advanced
Stiff and painful shoulder
Radiological Signs of DJD

EARLY stage

1. Sclerosis; Humeral Head and Glenoid articular surface
2. Joint space narrowing
3. Marginal osteophyte formation
How does this compare?
What are the management options?

Sclerosis
Joint space
Osteophyte formation

LATE stage
GHJ OA Management

- Historically:
  - Intra-articular injection for pain relief
  - Physiotherapy, NSAIDs.
  - Joint replacement (arthroplasty)

- BUT
  - Intra-articular injection increases risk of infection with hemiarthroplasty by > 50%
  - DO NOT DO ANY FORM of intra-articular injection if arthroplasty is a possibility in next 6/12

- Remember the stiffness is a secondary phenomenon so hydrodistension saline injections should not be utilised in this group
Shoulder Arthroplasty

- Indications:
  - Pain, function, sleep disturbance

- Considerations
  - Functioning Rotator Cuff, age, pathology

- Hemicap, hemiarthroplasty, Total Shoulder replacement, Reverse anatomy shoulder replacement
Destructive Joint Disease

- What is the difference in the XR picture?
- Most likely diagnosis? Management?
Same patient post treatment.

- Hemiarthroplasty.
ACJ Pathology.

- Degenerative arthritis
- Traumatic Instability: Various classifications
- Osteolysis lateral clavicle
Degenerative arthritis ACJ: Xray / diagnostic injection

- High arc pain
- HF pain
- ACJ localised
- Tender on palpation
- Can be associated with cuff pathology
Impingement due to large clavicular osteophyte
Management of ACJ Arthritis

- **Conservative**
  - Activity modification
  - Analgesics
  - Injections

- **Surgical**
  - Lateral Clavicle Excision
ACJ Instability; Mechanism; Fall, Tackle, BIKE accident

Type 1

Type 2

Type 3
Investigation ACJ instability

- Xray neutral and abducted arm
- Only MR if complicated / associated cuff pathology suspected (some traumatic cases eg sportsmen)
Look for increased joint separation when loaded.
Indications for surgery

- Significant pain
- Functional compromise
- Poor position which may cause other issues
- Aesthetics (instability)
24 year old keen sportsman
Just completed 18 months rehab for unstable left shoulder

- Traumatic ski injury at 90 mph
- Bottom image is at 3 days post injury
- Top image is at 3 weeks
- Overlap deemed a poor position and surgeon decided to stabilise
- Hyperlax and did not want to decondition
Osteolysis lateral clavicle

- Often presents as localised ACJ pain
- Weight-lifters and Gym Bunnies
- Increasingly common in women
- Microfracture which can’t heal if not rested
- XRAY; Osteopenia lateral clavicle

- Can be hard to treat as need 6 weeks+ off weights

Differentials; RA, Scleroderma, tumour
Osteolysis lateral end clavicle
Sterno clavicular joint Pain

Xray; US; MR; CT

Intra articular vs extra articular.

- OA; XR Bilateral (serendipity view); +/- CT
- Intra-articular disc? (MRI; not seen well on US)
- Lump; XR and Ultrasound. Esp if middle aged ♀
- Osteophytes and fluid seen by US
- If hot and collection, aspirate. TB vs other infection. Pyogenic from ITU IV lines
- CT to differentiate esp tumour
Serendipity View SCJ XR (Bilateral AP); Normal
R Sternoclavicular Degenerative Joint Disease; XR and CT images
Sternoclavicular Joint Instability

Anterior

- Common
- Hyperlax
- Motor patterning
- Adolescent growth
- Refer if parental concern

Posterior

- Rare
- Usually traumatic
- Urgent A+E referral
Glenohumeral Joint Instability.

TRAUMATIC?
- 1. Relates to FIRST episode
- 2. Direction of apprehension?
- 3. Recurrence?

HYPERLAX?

MOTOR CONTROL?
Instability

EXAMINATION

1. Apprehension tests.
2. Rotator cuff function
3. Do they have significant hypermobility?
4. XR/CT to determine bony anatomy.
5. MRI/arthrogram for labral pathology
6. Arthroscopy GOLD standard
Lesions associated with **Traumatic GHJ Dislocation**

- Hill Sachs and reverse Hill-Sachs XR (CT can be useful)
- Bankart (including bony Bankart (XR)) (MRI or arthrogram)
- Glenoid rim Fractures XR (CT can be useful)
  - SLAP (MRI)
  - HAGL (CT can be useful)
  - ALPSA (MRI or arthrogram)
  - Nerve lesions (n.cond)
  - Rotator cuff lesions (US or MRI)
Anterior Dislocation

Possible damage to antero-inferior glenoid rim and capsule and posterior humeral head (Hill Sachs)

Positive for Anterior apprehension (Abduction/external rotation)
Anterior dislocation
(Abduction/external rotation mechanism)
Hill Sachs defect (Humeral head)

AP and axial views useful
Anterior dislocation; 
Glenoid rim Bony lesions

Axial X-ray suggests glenoid bony injury. Confirmed on CT
Posterior Instability

Consider damage to posterior glenoid rim and anterior humeral head

Positive posterior apprehension test (Flexion/internal rotation or horizontal flexion)
Reverse HS and posterior Bony Bankart

Axial X-ray suggests glenoid bony injury. Confirmed on CT
Instability labral lesions (MRI)
Recurrent Posterior Instability; Atraumatic common; Assoc with generalised hypermobility; Investigations often unremarkable
Consider cuff strength/scapula position
Recurrent Shoulder Instability
40 year old Alcoholic epileptic
Frequently presenting to A+E/ Fracture clinic

What bony Possibilities should you consider?

Any further Investigation?
Shoulder CT.
Same patient. Treatment Options?
Surgery; Hemi cap.

Other treatment Options?
Frozen Shoulder:

- 3 phases: Pain, stiffness, thawing
- Must have normal XR. MRI can be helpful

Treatment Options:
- Intra-articulal Hydrodistension injection
- Sub acromial injection
- Watch and wait

Differential: Tumour, OA
Painful Stiff shoulder: Is this xray normal?
Painful stiff shoulder
What is the cause? Is it frozen shoulder?

Case 1

Case 2
Stiff shoulder; when to XR

- Atypically young
- Smoking History
- Steroid Hx
- Trauma
- Malignant Hx
- Before referral to secondary care
- Before Hydrodilatation

Roberts et al 2018
350 xrays performed over 42 month period

- 342 (97%) had no significant pathology
- 6 had severe OA
- 2 had serious pathology (1 fracture- Hx of trauma, and 1 lucency- Hx of lung Ca)
Trauma
Persistent Shoulder Pain post fall, sports injury

Possible causes

- GHJ Instability
  - Soft tissue
  - Bony
- ACJ Sprain
- RC Tear vs grumpy cuff
- Developing Frozen Shoulder
- Fracture;
  - Humeral head- GT
  - Displaced vs undisplaced
  - Clavicle

Consideration

- Differential
- Likelihood of imaging causing concern vs reassurance
- Implications if missed
- Management Options
- Age of patient

Discussion; XR, US, MRI, CT use
CASE: 41 year old female; persistent shoulder pain after falling onto outstretched hand while running

A+E; no XR
GP 10 days later
XR
What do you see?
Reminder;
Judicious use of Imaging given history vs Risk of Neglect
RCR Guidelines; XR remains first line of Imaging in Shoulder Trauma
Red flags.

- Night pain
- Past history Ca
- Non response to management
- Rest pain
- Pain not relieved by NSAIDS
- Poor GH (sweats, appetite, weight loss, malaise)
- Age > 55 or < 25 years
43 year male. Grtr Tub fracture but 4 months post injury, pain was worsening. Physio referred for XR

What does XR indicate?

Go through your checklist
Further Investigation?
Shoulder Masquerader.
Same patient MRI scan
30 year old male. Leukaemia with bilateral shoulder pain post chemotherapy; MRI confirmed AVN.

Large area of sclerosis
Humeral head
AVN Treatment; Hemicap arthroplasty; Good Outcome
80 year old female.
Atraumatic Onset Shoulder Pain
Use your Checklist; What is the diagnosis?
40 year old male; Painful stiff and swollen shoulder
What looks abnormal?

Diagnosis?
Management?

URGENT REFERRAL; Painful Shoulder Stiff shoulder Swelling/Mass
Let’s Take a Break!!!!

Cathy Barrett  BSc (Hons) Mphty.st MCSP MACP FACP
Sharon Morgans  Grad Dip Phys MCSP MACP

Advanced Physiotherapy Practitioners
Clinical Physiotherapy Specialists Shoulder and Elbow

cbarrett@central-health.com
Catherine.barrett@ucl.ac.uk