Diagnostic Imaging Pathways - Shoulder (Pain or Instability)

Population Covered By The Guidance

This pathway provides guidance on the imaging of adult patients with new onset traumatic and non-traumatic shoulder pain or instability.

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Quick User Guide

Move the mouse cursor over the PINK text boxes inside the flow chart to bring up a pop up box with salient points.
Clicking on the PINK text box will bring up the full text.
The relative radiation level (RRL) of each imaging investigation is displayed in the pop up box.

SYMBOL	RRL	EFFECTIVE DOSE RANGE
	None	0
	Minimal	< 1 millisieverts
	Low	1-5 mSv
	Medium	5-10 mSv
	High	>10 mSv

Pathway Diagram

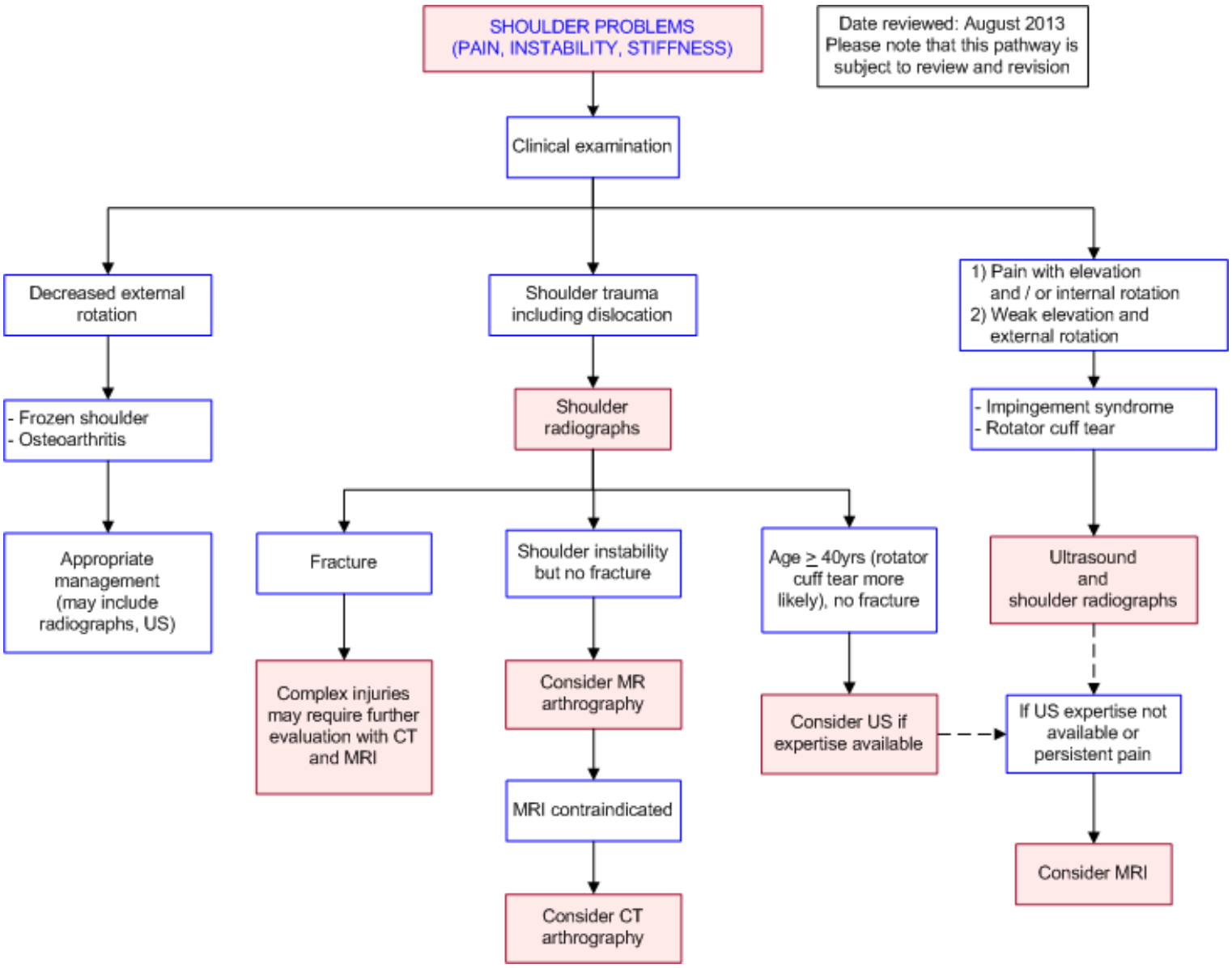

Image Gallery

Note: These images open in a new page

1 

Anterior Shoulder Dislocation

Image 1 (Plain Radiograph): Anterior shoulder dislocation showing anterior, medially and inferiorly displaced humeral head.

2 

Supraspinatus Tendon Tear

Image 2 (Ultrasound): Full thickness supraspinatus tendon tear of the left shoulder (arrow).

3 **Glenoid Labral Tear**

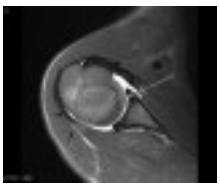

Image 3 (MR Arthrogram): Axial fat-saturated proton density image of shoulder showing anterior labral tear.

Teaching Points

- Plain radiography is the initial diagnostic modality for the evaluation of traumatic shoulder pain
- If impingement syndrome is suspected due to rotator cuff insufficiency, ultrasound is recommended in addition to plain radiography
- CT of the shoulder may be useful in complex fracture-dislocation injuries of the shoulder, as a pre-surgical tool
- MRI is useful as an alternative in suspected rotator cuff insufficiency, when ultrasound is not available or in complex cases

Plain Radiography

- Initial investigation of choice for all shoulder problems 1
- Can detect most fractures, dislocations, calcific tendonitis and other skeletal causes of pain such as arthritis and bone tumour 2
- Different situations require different types of plain films (AP/lateral/axillary views). Shoulder trauma protocols should have ?3 views, 2 of which are orthogonal 1
    - Axillary, scapular Y-view and AP view in trauma 3,4
    - Routine axillary views in non-traumatised shoulder 5
    - Impingement views in clinically suspected impingement syndrome and/or rotator cuff tears to detect subacromial spur 6

Ultrasonography

- High accuracy in the detection and staging of full-thickness rotator cuff tears, but less sensitive in partial-thickness tears 7,8
- A recent metaanalysis reported a pooled 96% sensitivity and 93% specificity for full thickness rotator cuff tears and 84% sensitivity and 89% specificity for partial thickness rotator cuff tears compared to arthroscopic or open surgical findings as the reference standard 7
- US is comparable to MRI in the hands of an experienced user. 8 In many institutions, US has replaced MR imaging in the initial evaluation of rotator cuff
- Equally sensitive but less specific than MR arthrography in the detection of full thickness tears, and less accurate than MR arthrography in the detection of partial thickness tears 8
- May be considered in the evaluation of patients >40 years of age with primary traumatic anterior shoulder dislocation as rotator cuff tear is more common in this age group 9
- Useful in guiding aspiration of calcium deposits or bursal injections
- Useful in evaluating the long head of biceps tendon 10
- Advantages: no ionising radiation, non-invasive, no contrast agent, relatively inexpensive, readily available
- Limitations
    - User-dependent

- Less sensitive in detecting partial thickness rotator cuff tears 7, 8
- Cannot accurately evaluate the labral-ligamentous complex and other deep shoulder structures

Magnetic Resonance Imaging (MRI)

- Allows accurate assessment of soft tissue injuries and has significant clinical impact 11
- Highly accurate in the assessment of full thickness rotator cuff tears. A recent metaanalysis reported a pooled 91% sensitivity and 97% specificity for full thickness rotator cuff tears and 80% sensitivity and 95% specificity for partial thickness rotator cuff tears, compared to surgical procedures as the reference standard 12
- Equally sensitive to MR arthrography and comparable in clinical impact for full thickness rotator cuff tears, but less accurate in the detection of partial-thickness tears 8,11-13
- Comparable accuracy to US in the assessment of both full and partial thickness rotator cuff tears 8
- Indicated in the investigation of rotator cuff disease when US expertise is unavailable or when further investigation of rotator cuff pathology is needed
- Advantages
  - No ionising radiation
  - Non-invasive
  - Demonstrates other lesions such as acromioclavicular joint osteoarthritis, occult fractures and avascular necrosis
  - Comprehensive display of soft tissue anatomy
    - Demonstration of the causes for impingement
    - Useful in characterisation and staging of bone tumours
- Limitations
  - Less specific than MR arthrography for rotator cuff tears, and less sensitive for detection of partial tears 8

MR Arthrography

- Involves an MRI following the intra-articular injection of a dilute contrast agent (gadolinium)
- Most accurate imaging modality for defining
  1. Rotator cuff pathology 8,11,14
     - 96% sensitive, 99% specific and 98% accurate for full thickness tears, and 80% sensitive, 97% specific and 95% accurate for partial thickness tears compared to arthroscopy 14
     - Superior depiction of partial-thickness tears compared to conventional MRI 11
     - MR arthrography is less sensitive for bursal-sided partial thickness tears than articular-sided partial thickness tears 15
  2. Labral/capsule abnormalities in gleno-humeral instability 16,17
- Disadvantages: invasive, limited availability and high expense. Some studies report limited clinical value in patients already destined for arthroscopy 18,19

Computed Tomography (CT)

- Superior to plain radiographs in evaluation of complex fractures and fracture-dislocations involving the head of the humerus 3,20

- Allows planning of treatment of complex proximal humeral fractures 3,20

CT Arthrography

- Role has been largely taken over by MR arthrography
- Alternative for assessment of gleno-humeral instability (usually following dislocation) when MRI is unavailable 21-23
- Allows accurate evaluation of labral abnormalities 21
- Poor accuracy in the detection of partial thickness rotator cuff tears 21,23

References

Date of literature search: May 2013

The search methodology is available on request. Email

References are graded from Level I to V according to the Oxford Centre for Evidence-Based Medicine, Levels of Evidence. Download the document

1. Wise JN, Daffner RH, Weissman BN, Bancroft L, Bennett DL, Blebea JS, et al. **ACR Appropriateness Criteria on acute shoulder pain.** J Am Coll Radiol. 2011;8(9):602-9. (Evidence based guidelines)
2. Stiles RG, Otte MT. **Imaging of the shoulder.** Radiology. 1993;188(3):603-13. (Review article)
3. Bahrs C, Rolauffs B, Sudkamp NP, Schmal H, Eingartner C, Dietz K, et al. **Indications for computed tomography (CT) diagnostics in proximal humeral fractures: a comparative study of plain radiography and computed tomography.** BMC Musculoskelet Disord. 2009;10:33. (Level II/III evidence)
4. Silfverskiold JP, Straehley DJ, Jones WW. **Roentgenographic evaluation of suspected shoulder dislocation: a prospective study comparing the axillary view and the scapular 'Y' view.** Orthopedics. 1990;13(1):63-9. (Level II/III evidence)
5. De Smet AA. **Axillary projection in radiography of the nontraumatized shoulder.** AJR Am J Roentgenol. 1980;134(3):511-4. (Level II/III evidence)
6. Jim YF, Chang CY, Wu JJ, Chang T. **Shoulder impingement syndrome: impingement view and arthrography study based on 100 cases.** Skeletal Radiol. 1992;21(7):449-51. (Level III evidence)
7. Smith TO, Back T, Toms AP, Hing CB. **Diagnostic accuracy of ultrasound for rotator cuff tears in adults: a systematic review and meta-analysis.** Clin Radiol. 2011;66(11):1036-48. (Level I evidence)
8. de Jesus JO, Parker L, Frangos AJ, Nazarian LN. **Accuracy of MRI, MR arthrography, and ultrasound in the diagnosis of rotator cuff tears: a meta-analysis.** AJR Am J Roentgenol. 2009;192(6):1701-7. (Level I evidence)
9. Pevny T, Hunter RE, Freeman JR. **Primary traumatic anterior shoulder dislocation in patients 40 years of age and older.** Arthroscopy. 1998;14(3):289-94. (Level III evidence)
10. Ardic F, Kahraman Y, Kacar M, Kahraman MC, Findikoglu G, Yorgancioglu ZR. **Shoulder impingement syndrome: relationships between clinical, functional, and radiologic findings.** Am J Phys Med Rehabil. 2006;85(1):53-60. (Level II evidence)
11. Dinnes J, Loveman E, McIntyre L, Waugh N. **The effectiveness of diagnostic tests for the assessment of shoulder pain due to soft tissue disorders: a systematic review.** Health Technol Assess. 2003;7(29):iii, 1-166. (Level II evidence)
12. Smith TO, Daniell H, Geere J-A, Toms AP, Hing CB. **The diagnostic accuracy of MRI for the**

detection of partial- and full-thickness rotator cuff tears in adults. Magn Reson Imaging. 2012;30(3):336-46. (Level I evidence)
13. Blanchard TK, Bearcroft PW, Constant CR, Griffin DR, Dixon AK. **Diagnostic and therapeutic impact of MRI and arthrography in the investigation of full-thickness rotator cuff tears.** Eur Radiol. 1999;9(4):638-42. (Level II/III evidence)
14. Waldt S, Bruegel M, Mueller D, Holzapfel K, Imhoff AB, Rummeny EJ, et al. **Rotator cuff tears: assessment with MR arthrography in 275 patients with arthroscopic correlation.** Eur Radiol. 2007;17(2):491-8. (Level II evidence)
15. Chun KA, Kim MS, Kim YJ. **Comparisons of the various partial-thickness rotator cuff tears on MR arthrography and arthroscopic correlation.** Korean J Radiol. 2010;11(5):528-35. (Level II evidence)
16. Smith TO, Drew BT, Toms AP. **A meta-analysis of the diagnostic test accuracy of MRA and MRI for the detection of glenoid labral injury.** Arch Orthop Trauma Surg. 2012;132(7):905-19. (Level I evidence)
17. Jana M, Srivastava DN, Sharma R, Gamanagatti S, Nag HL, Mittal R, et al. **Magnetic resonance arthrography for assessing severity of glenohumeral labroligamentous lesions.** J Orthop Surg (Hong Kong). 2012;20(2):230-5. (Level II/III evidence)
18. van der Veen HC, Collins JPM, Rijk PC. **Value of magnetic resonance arthrography in post-traumatic anterior shoulder instability prior to arthroscopy: a prospective evaluation of MRA versus arthroscopy.** Arch Orthop Trauma Surg. 2012;132(3):371-5. (Level II/III evidence)
19. Jonas SC, Walton MJ, Sarangi PP. **Is MRA an unnecessary expense in the management of a clinically unstable shoulder? A comparison of MRA and arthroscopic findings in 90 patients.** Acta Orthopaedica. 2012;83(3):267-70. (Level III evidence)
20. Jurik AG, Albrechtsen J. **The use of computed tomography with two- and three-dimensional reconstructions in the diagnosis of three- and four-part fractures of the proximal humerus.** Clin Radiol. 1994;49(11):800-4. (Level IV evidence)
21. Oh JH, Kim JY, Choi JA, Kim WS. **Effectiveness of multidetector computed tomography arthrography for the diagnosis of shoulder pathology: comparison with magnetic resonance imaging with arthroscopic correlation.** J Shoulder Elbow Surg. 2010;19(1):14-20. (Level II evidence)
22. Nelson MC, Leather GP, Nirschl RP, Pettrone FA, Freedman MT. **Evaluation of the painful shoulder. A prospective comparison of magnetic resonance imaging, computerized tomographic arthrography, ultrasonography, and operative findings.** J Bone Joint Surg Am. 1991;73(5):707-16. (Level III evidence)
23. Shahabpour M, Kichouh M, Laridon E, Gielen JL, De Mey J. **The effectiveness of diagnostic imaging methods for the assessment of soft tissue and articular disorders of the shoulder and elbow.** Eur J Radiol. 2008;65(2):194-200. (Review article)

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Shoulder (Pain or Instability) Arthogram Computed Tomography (CT) Magnetic Resonance Imaging (MRI) Ultrasound	Contrast Medium (Gadolinium versus Iodine) Gadolinium Contrast Medium Iodine-Containing Contrast Medium Magnetic Resonance Imaging (MRI) Plain Radiography/X-rays Radiation Risk of Medical Imaging During Pregnancy Radiation Risk of Medical Imaging for Adults and Children Ultrasound

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