

Appropriate Use Criteria for Nontraumatic Shoulder Pain Evidence Table

Year	Author	Title	Journal	Grade (oxford level of evidence)	Study type	Study Details/ # of Patients	Rule	Rule (simplified)
2013	Lenza	Magnetic resonance imaging, magnetic resonance arthrography and ultrasonography for assessing rotator cuff tears in people with shoulder pain for whom surgery is being considered.	The Cochrane database of systematic reviews Sep 2013;(9):CD009020	1A	Meta-analysis	1147 patients, 252 with MRI and US, 127 MRA and US	No difference in MRI and US for detecting rotator cuff tears. MRA does not have additional benefit in detecting full thickness tears.	US, MRI, and MRA have similar efficacy in detecting partial and full thickness rotator cuff tears.
2015	McCreesh	Acromiohumeral distance measurement in rotator cuff tendinopathy: is there a reliable, clinically applicable method? A systematic review.	British journal of sports medicine Mar 2015;49(5):298-305	1A	Systematic review	8 studies, varied	Ultrasound highly reliable for single test, inter-rater reliability requires further investigation	US followed by CT or MRI can accurately assess acromial-humeral distance
1999	Blanchard	Diagnostic and therapeutic impact of MRI and arthrography in the investigation of full-thickness rotator cuff tears.	European radiology 1999;9(4):638-42	1B	RCT	104	The accuracy of MRI for full thickness rotator cuff tears in 38 patients with surgical confirmation was 79 %, sensitivity 81 % and specificity 78 %; the accuracy of arthrography was 82 %, sensitivity 50 % and specificity 96 %	MRI and arthrography have similar utility in diagnosis and surgical planning for rotator cuff tears
N/A	Mohtadi NG	A prospective, double-blind comparison of magnetic resonance imaging and arthroscopy in the evaluation of patients presenting with shoulder pain.	Journal of shoulder and elbow surgery ;13(3):258-65	1B	Retrospective cohort	58	MRI w/ intravenous gadolinium was highly accurate in detecting full thickness supraspinatus tears and AC joint pathology but had poor concordance with arthroscopic findings in identifying biceps tendon pathology and classifying curvature of the acromion.	MRI is a useful tool for identifying shoulder pathology but has mixed correlations with arthroscopic findings.
2010	Rutten	Detection of rotator cuff tears: the value of MRI following ultrasound.	European radiology Feb 2010;20(2):450-7	1B	Retrospective review	5,216 patients who underwent ultrasound, 275 of these patients who had MRI afterwards with 68 of these needing surgery	US and MRI correctly depicted 21 (95%) and 22 (100%) of the 22 full-thickness tears, and 8(89%) and 6 (67%) of the 9 partial-thickness tears, respectively.	US and MRI have comparable accuracy in detecting partial and full thickness RC tears.
2015	Sheridan	Accuracy of magnetic resonance imaging to diagnose superior labrum anterior-posterior tears.	Knee surgery, sports traumatology, arthroscopy : official journal of the ESSKA Sep 2015;23(9):2645-50	1B	Retrospective cohort	444	MRI had an accuracy of 76%, PPV of 24%, and NPV of 95% in diagnosing SLAP tears. MRI had 66% sensitivity and 77% specificity. MRA had an accuracy of 69%, sensitivity of 80% and PPV of 29%. Non-contrast MRI had an accuracy of 85% with sensitivity of 36% and PPV of 13%.	While MRI can exclude SLAP lesions, MRI alone is not an accurate clinical tool. MRA has a high number of false positives.
2004	Teefey	Detection and quantification of rotator cuff tears. Comparison of ultrasonographic, magnetic resonance imaging, and arthroscopic findings in seventy-one consecutive cases.	The Journal of bone and joint surgery. American volume Apr 2004;86-A(4):708-16	1B	Prospective Cohort study  Comparing US and MRI with patients with cuff tears checked with arthroscopy	46 full thickness tears, 19 partial thickness, 9 no tear	Ultrasonography correctly identified forty-five of the forty-six full-thickness tears and magnetic resonance imaging, all forty-six. Ultrasonography correctly identified thirteen of the nineteen partial-thickness rotator cuff tears and magnetic resonance imaging, twelve of the nineteen. The overall accuracy for both imaging tests was 87%. Ultra-sonography correctly predicted the degree of retraction of 73% of the full-thickness tears and the length of 85% of the partial-thickness tears, and magnetic resonance imaging correctly predicted the retraction and length of 63% and 75%, respectively. Ultrasonography correctly predicted the width of 87% of the full-thickness tears and 54% of the partial-thickness tears, and magnetic resonance imaging correctly predicted the width of 80% and 75%, respectively. No significant differences between ultrasonography and magnetic resonance imaging were demonstrated (p > 0.05).	In investigators with equal experience, US and MRI have comparable accuracy in identifying partial and full thickness tears.
N/A	Torstensen ET	Comparison of magnetic resonance imaging and arthroscopy in the evaluation of shoulder pathology.	Journal of shoulder and elbow surgery ;8(1):42-5	1B	Retrospective cohort	57	In patient with shoulder pain of unclear etiology, MRI has accuracy of 62%, sensitivity 73% and specificity of 58% in identifying labral tears; 68% accuracy, 96% sensitivity, specificity of 49% for rotator cuff tears. Non-rotator cuff, non-labral disease was identified with an accuracy of 75%, sensitivity of 63%, and specificity of 87%.	MRI has low accuracy in assessing pathologic shoulder conditions in patients with unclear clinical diagnoses.
2000	Beacroft	An assessment of the effectiveness of magnetic resonance imaging of the shoulder: literature review.	Skeletal radiology Dec 2000;29(12):673-9	2A	Systemic review	Varies	The primary diagnosis was altered in 23 to 68% of cases following MRI, and subsequently changed the management plans in 15 to 61% of cases.	MRI effectiveness depends on clinical skills of referring clinician and prevalence of disease in population.
2003	Dinnes	The effectiveness of diagnostic tests for the assessment of shoulder pain due to soft tissue disorders: a systematic review.	Health technology assessment (Winchester, England) 2003;7(29):iii, 1-166	2A	Systemic review	multiple studies	US, MRI, and MRA have good sensitivity and specificity when detecting full thickness rotator cuff tears but less so for partial tears.	US, MRI, and MRA have better accuracy in diagnosing full thickness rotator cuff tears compared to partial thickness tears.
2014	Redondo-Alonso	Relationship between chronic pathologies of the supraspinatus tendon and the long head of the biceps tendon: systematic review.	BMC musculoskeletal disorders Nov 2014;15():377	2A	Systemic review	N/A	Patients presenting with long head biceps tendon lesions along with supraspinatus tears range from 22% to 78.5%.	Supraspinatus and long head biceps tears can be visualized with arthroscopy, ultrasound, and MRI.
1997	Alasaarela	Sonography and MRI in the evaluation of painful arthritic shoulder.	British journal of rheumatology Sep 1997;36(9):996-1000	2B	Retrospective review	31	In painful shoulders with chronic arthritis, US and MRI revealed effusion in the subacromial bursa, biceps tendon sheath, and glenohumeral joint. MRI was more accurate in depicting joint inflammation because of its ability to visualize synovial hypertrophy. US had similar ability in visualizing biceps tendon ruptures. MRI was better at evaluating full thickness tears of the supraspinatus tendon. US was better able to show degeneration and partial thickness tears of the rotator cuff.	US is recommended as first imaging method for the detection of soft tissue changes in the arthritic shoulder. MRI may be needed if suspecting rotator cuff problems.
2006	Ardic	Shoulder impingement syndrome: relationships between clinical, functional, and radiologic findings.	American journal of physical medicine & rehabilitation Jan 2006;85(1):53-60	2B	Prospective Cohort	58	Ultrasound has excellent sensitivity for diagnosing rotator cuff tears (98.1%) and biceps pathologies (100%); MRI was superior to ultrasonography in many important shoulder structures such as a glenoid labral tear and subacromial bursal effusion/hypertrophy.	Ultrasound accurately diagnoses rotator cuff tears but MRI can more accurately identify other important pathologies, such as, labral tear or subacromial bursal effusion
1997	Bachmann	Diagnosis of rotator cuff lesions: comparison of US and MRI on 38 joint specimens.	European radiology 1997;7(2):192-7	2B	Prospective Cohort	38	Specificity was 67 % in US (4 of 12 cases were false positive) and 100 % in MRI (no abnormal findings in healthy tendons). Ultrasound should be the primary diagnostic method in screening of shoulder pain because it is economic and fast. Them RI technique should be used secondary because it provides more information about extent of tendons and has lower risk of artefacts.	MRI and US are both sensitive in detection of abnormalities of the rotator cuff
1997	Blanchard	Magnetic resonance imaging or arthrography of the shoulder: which do patients prefer?	The British journal of radiology Aug 1997;70(836):786-90	2B	Prospective Cohort	110	Mean anxiety was slightly higher for patients undergoing MRI compared to arthrography, but there was no statistical difference.	There is no clear difference between MRI and arthrography in terms of anxiety, pain, and preference for patients.
1993	Chandnani	Glenoid labral tears: prospective evaluation with MRI imaging, MR arthrography, and CT arthrography.	AJR. American journal of roentgenology Dec 1993;161(6):1229-35	2B	Prospective Cohort	30	MRA, MRI and CTA detected labral tears in 93%, 96%, and 73% In patients with labral tears, respectively. Detached labral fragment was detected in 46%, 96%, and 52% in MRI, MRA, and CTA respectively.	MRA and MRI detect labral tears with greater sensitivity compared to CTA. MRA is the most sensitive of the three in detecting detached labral fragment.
2005	DiMario	MR study of the intrinsic acromial angle in 74 symptomatic patients.	La Radiologia medica Sep 2005;110(3):273-9	2B	Retrospective cohort	74	Intrinsic acromial angle and acromio-humeral distance may correlate with internal impingement syndrome.	MRI can be used to gauge subacromial space and screen for internal impingement.

Appropriate Use Criteria for Nontraumatic Shoulder Pain Evidence Table

Year	Author	Title	Journal	Grade (oxford level of evidence)	Study type	Study Details/ # of Patients	Rule	Rule (simplified)
1996	Gaenslen	Magnetic resonance imaging for evaluation of failed repairs of the rotator cuff. Relationship to operative findings.	The Journal of bone and joint surgery. American volume Sep 1996;78(9):1391-6	2B	Prospective Cohort	29 patients, 30 shoulders	The sensitivity and specificity of magnetic resonance imaging for the diagnosis of full-thickness tears, partial-thickness tears, and intact rotator cuffs were 84 and 91 per cent, 83 and 83 per cent, and 80 and 100 per cent, respectively. The positive and negative predictive values were 94 and 77 per cent, 56 and 95 per cent, and 100 and 96 per cent, respectively.	Repeat MRI following rotator cuff repair has high sensitivity and specificity for detection of reinjury.
N/A	Hirano	Acromial shapes and extension of rotator cuff tears: magnetic resonance imaging evaluation.	Journal of shoulder and elbow surgery ;11(6):576-8	2B	Retrospective cohort	192	Classified acromial shapes into three types--flat, curved, and hooked, among 91 shoulders with rotator cuff tears, 33 were flat, 22 were curved, and 36 were hooked. The size of rotator cuff tears was significantly larger in hooked morphology.	MRI may aid in understanding acromion structural effects on the rotator cuff.
1996	Imhoff	Correlation of MR imaging, CT arthrography, and arthroscopy of the shoulder.	Bulletin (Hospital for Joint Diseases (New York, N.Y.)) 1996;54(3):146-52	2B	Retrospective cohort	64	For the evaluation of rotator cuff tears MRI proved to have a sensitivity of 83.3% and an accuracy of 90.3%. Labral pathology was depicted with a sensitivity of 69.2% and an accuracy of 87.1%. In cases involving a Hill-Sachs lesion, the sensitivity of MRI was 90% and the accuracy 95%.	MR imaging is an accurate method in the evaluation of rotator cuff pathology and to some extent labral abnormalities.
N/A	Jahnke AH	A prospective comparison of computerized arthrotomography and magnetic resonance imaging of the glenohumeral joint.	The American journal of sports medicine ;20(6):695-700; discussion 700-1	2B	Prospective Cohort	25	MRI better at diagnosing labrum, humeral head impression lesions compared to CT. Both imaging techniques equitable in identifying biceps labral lesions, intraarticular loose bodies within the glenohumeral joint. Neither technique was consistent in evaluating capsular redundancy. MRI more accurate in evaluating anterior or posterior glenoid labral abnormalities.	MRI superior to CT in identifying labral pathology and humeral impression injuries compared to CT
2015	Jain	Reliability of magnetic resonance imaging assessment of rotator cuff: the ROW study.	PM & R : the journal of injury, function, and rehabilitation Mar 2015;7(3):245-54.e3; quiz 254	2B	Prospective cohort	31	Interrater reliability between shoulder specialist and radiologist is high for: presence of tear, tear thickness, longitudinal size of tear, fatty infiltration, and muscle atrophy. Fair interrater reliability for transverse measure of tear. Intrarater reliability is high between all aspects measured	There is good interrater and intrarater reliability between shoulder surgeons and radiologists in MRI interpretation for rotator cuff tears.
2013	Kim	Use of magnetic resonance arthrography to compare clinical features and structural integrity after arthroscopic repair of bursal versus articular side partial-thickness rotator cuff tears.	The American journal of sports medicine Sep 2013;41(9):2041-7	2B	Case Control	83	There is similar re-tear rates for patients undergoing bursal and articular sided partial thickness rotator cuff tear repairs. Patients with bursal sided tears showed higher incidence of preoperative impingement, spur protrusion, and concomitant acromioplasty	MRI can be used to detect anatomic causes of impingement in bursal and articular sided rotator cuff tears.
2006	Krief	Shoulder pain and disability: comparison with MR findings.	AJR. American journal of roentgenology May 2006;186(5):1234-9	2B	Retrospective consecutive cohort	1079	Level of pain, impairment or disability did not correlate with location and size of full thickness rotator cuff tears. Patients with biceps tendinopathy did not experience increased pain when compared with patients without biceps tendinopathy or with biceps tendon rupture.	Full thickness rotator cuff tears seen on MRI do not correlate with level of pain, impairment, and disability.
2015	Loew	How to discriminate between acute traumatic and chronic degenerative rotator cuff lesions: an analysis of specific criteria on radiography and magnetic resonance imaging.	Journal of shoulder and elbow surgery Nov 2015;24(11):1685-93	2B	Prospective cohort	50	Plain radiographs are similar between chronic and traumatic rotator cuff tears. MRI will show muscle edema for traumatic tears and kinking of the central tendon. Muscular atrophy is observed in chronic tears.	MRI is helpful to distinguish between traumatic and chronic tears.
1991	Nelson	Evaluation of the painful shoulder. A prospective comparison of magnetic resonance imaging, computerized tomographic arthrography, ultrasonography, and operative findings.	The Journal of bone and joint surgery. American volume Jun 1991;73(5):707-16	2B	Prospective cohort	21	MRI has better diagnostic utility compared to ultrasound in establishing etiology of shoulder pain if due to rotator cuff, labrum, impingement, coracoacromial arch stenosis, or OA of the glenohumeral or AC joints. MRI has decreasing efficacy in obese patients and those who had prior surgery. MRI was more accurate than CT arthrography and US in identifying partial thickness tears.	MRI is more accurate than US and CT in identifying partial thickness tears and as accurate as CT arthrography in detecting labral abnormalities.
N/A	Stetson EB	The crank test, the O'Brien test, and routine magnetic resonance imaging scans in the diagnosis of labral tears.	The American journal of sports medicine ;30(6):806-9	2B	Prospective Cohort	65	MRI had a PPV of 63%, 92% specificity, 42% sensitivity, NPV of 83%.	MRI has higher specificity than sensitivity for detecting SLAP tears.
1998	Tuite	Anterior versus posterior, and rim-rent rotator cuff tears: prevalence and MR sensitivity.	Skeletal radiology May 1998;27(5):237-43	2B	Retrospective cohort	110	In patients younger than 36, 79% patients had tears in the anterior half of the rotator cuff and in 89% of patients older than 36. There is equal sensitivity for MRI detecting anterior tears compared to posterior tears.	Most rotator cuff tears are centered in the anterior half of the supraspinatus. There is no difference in sensitivity of MRI in diagnosing posterior tears vs anterior half tears of the
2015	Ueda	Rotator Cuff Lesions in Patients with Stiff Shoulders: A Prospective Analysis of 379 Shoulders.	The Journal of bone and joint surgery. American volume Aug 2015;97(15):1233-7	2B	Prospective Cohort	379	MRI and US demonstrated intact RC cuff in 51% of patients of adhesive capsulitis, a full thickness tear in 35% and a partial thickness tear in 15%. When divided by ROM limitation, more severely limited shoulders had high rates of intact rotator cuff. Shoulder stiffness with severe and global loss of passive range of motion is not associated with full thickness rotator cuff tears.	The severity of shoulder stiffness is not associated with full thickness rotator cuff tears as demonstrated by MRI/US.
2010	Moosmayer	MRI of symptomatic and asymptomatic full-thickness rotator cuff tears. A comparison of findings in 100 subjects.	Acta orthopaedica Jun 2010;81(3):361-6	3B	Case-control	100 patients, 50 with asymptomatic full thickness cuff tears, 50 with asymptomatic	There were statistically significant associations between symptoms and tear size exceeding 3 cm in the medial-lateral plane, positive tangent sign, and fatty degeneration exceeding grade 1 of the supraspinatus and infraspinatus muscles.	MRI showing tears >3cm in the medial-lateral plane, fatty degeneration, and a positive tangent sign correspond to symptomatic cuff tear