

**Shoulder Pain-Atraumatic  
EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
1. Department of Research & Scientific Affairs, American Academy of Orthopaedic Surgeons. Physician Visits for Musculoskeletal Symptoms and Complaints. 2013; Available at: <a href="http://www.aaos.org/research/stats/patientstats.asp">http://www.aaos.org/research/stats/patientstats.asp</a> .	Review/Other-Dx	N/A	To present data about physician visits for musculoskeletal-related complaints or symptoms	No results stated in abstract.	4
2. Goud A, Segal D, Hedayati P, Pan JJ, Weissman BN. Radiographic evaluation of the shoulder. Eur J Radiol. 2008;68(1):2-15.	Review/Other-Dx	N/A	To review the radiographic examinations that are used at our hospital for evaluating arthritis, impingement, trauma and instability.	No results stated in abstract.	4
3. Pavlov H, Warren RF, Weiss CB, Jr., Dines DM. The roentgenographic evaluation of anterior shoulder instability. Clin Orthop Relat Res. 1985(194):153-158.	Review/Other-Dx	83 patients	To evaluate the usefulness of various radiographic projections and to correlate the information with the osseous pathology associated with prior glenohumeral dislocation.	Roentgen projections evaluated included the anteroposterior view with the humerus in internal and external rotation, axillary view, West Point view, Stryker notch, and Didiee view. The Hill-Sachs defect on the posterolateral aspect of the humeral head was best demonstrated on the combination of an internal rotation and a Stryker notch view. The osseous Bankart defect on the anteroinferior glenoid rim was best documented on the Didiee and West Point views. The external rotation and axillary view did not add significantly to the preoperative radiographic findings.	4

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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. <i>Orthopedics</i> . 1990;13(1):63-69.	Observational-Dx	75 patients	To compare the axillary and the scapular "Y" view for evaluation of a suspected shoulder dislocation.	Evaluation was by the following criteria: accuracy of diagnosis; patient preference; ease of technique; and diagnosis of associated pathology. In 69 cases (92%), the scapular "Y" view and axillary view resulted in the same diagnosis. However, in six cases (8%), the axillary view failed to give the correct diagnosis when compared to the scapular "Y" view. Sixty-one patients (81%) preferred the scapular "Y" view to the axillary view because of less pain. Once the technician was adept with the scapular "Y" view, it was preferred and was considered easier to obtain than the axillary view.	3
5. Iannotti JP, Zlatkin MB, Esterhai JL, Kressel HY, Dalinka MK, Spindler KP. Magnetic resonance imaging of the shoulder. Sensitivity, specificity, and predictive value. <i>J Bone Joint Surg Am</i> . 1991;73(1):17-29.	Observational-Dx	91 patients and 15 volunteers.	To evaluate the sensitivity, specificity, and predictive value of magnetic resonance imaging in the diagnosis of lesions of the rotator cuff, glenohumeral capsule, and glenoid labrum.	Magnetic resonance imaging demonstrated 100 per cent sensitivity and 95 per cent specificity in the diagnosis of complete tears, and it consistently predicted the size of the tear of the rotator cuff. There was a definite correlation between atrophy of the supraspinatus muscle and the size of a complete, chronic tear of the rotator cuff. The sensitivity and specificity of magnetic resonance imaging in the differentiation of tendinitis from degeneration of the cuff were 82 and 85 per cent, and in the differentiation of a normal tendon from one affected by tendinitis with signs of impingement the sensitivity and specificity were 93 and 87 per cent. The formation of spurs around the acromion and acromioclavicular joint correlated highly with increased age of the patient and with chronic disease of the rotator cuff. The sensitivity and specificity of magnetic resonance imaging in the diagnosis of labral tears associated with glenohumeral instability were 88 and 93 per cent.	3

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6. 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. <i>AJR Am J Roentgenol.</i> 2009;192(6):1701-1707.	Meta-analysis	65 articles	To compare the diagnostic accuracy of MRI, MR arthrography, and ultrasound for the diagnosis of rotator cuff tears through a meta-analysis of the studies in the literature.	In diagnosing a full-thickness tear or a partial-thickness rotator cuff tear, MR arthrography is more sensitive and specific than either MRI or ultrasound ( $p < 0.05$ ). There are no significant differences in either sensitivity or specificity between MRI and ultrasound in the diagnosis of partial- or full-thickness rotator cuff tears ( $p > 0.05$ ). Summary ROC curves for MR arthrography, MRI, and ultrasound for all tears show the area under the ROC curve is greatest for MR arthrography (0.935), followed by ultrasound (0.889) and then MRI (0.878); however, pairwise comparisons of these curves show no significant differences between MRI and ultrasound ( $p > 0.05$ ).	M
7. Miller J, Miller T, Adler R. Sensitivity of Imaging Modalities for Detecting Calcium Hydroxyapatite in a Soft Tissue Phantom. Radiological Society of North America 2009 Scientific Assembly and Annual Meeting, November 29 - December 4, 2009, Chicago IL. Available at: <a href="http://archive.rsna.org/2009/8007524.html">http://archive.rsna.org/2009/8007524.html</a> . Accessed May 23, 2017.	Experiment al-Dx	Powdered calcium hydroxyapatite mixed into two gelatin ice cube tray phantoms.	To determine whether radiography, CT scanning, MR imaging, or sonography is the most sensitive for detecting calcium hydroxyapatite in a soft tissue phantom.	The radiologists who reviewed the radiographs and CT images and the radiologists who reviewed the MR images were able to identify calcium down to 5% in both pure gelatin and gelatin/Metamucil. The radiologists who reviewed the sonographic images were able to identify calcium in the gelatin down to .1% and in the gelatin/Metamucil down to .5%. Posterior acoustic shadowing of the calcium was present in the 60%, 40%, and 20% concentrations, and was absent in concentrations of 10% or lower.	2
8. De Smet AA. Anterior oblique projection in radiography of the traumatized shoulder. <i>AJR Am J Roentgenol.</i> 1980;134(3):515-518.	Observational-Dx	132 consecutive shoulder radiographs	To determine if sufficient pathology was detected to justify the cost and radiation exposure to include an anterior oblique view as a standard additional view in the assessment of shoulder trauma.	There were 84 normal examinations and 48 abnormal examinations. There were 29 fractures, dislocations, or acromioclavicular separations identified. Two fractures of the greater tuberosity were seen only on the anteroposterior projection with external rotation. One humeral head fracture and three scapular fractures were visualized only on the anterior oblique projection.	3

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9. De Smet AA. Axillary projection in radiography of the nontraumatized shoulder. AJR Am J Roentgenol. 1980;134(3):511-514.	Observational-Dx	239 patients	To determine if the axillary projection revealed pathology not seen on the anteroposterior films.	There were 109 normal examinations and 130 abnormal examinations. The anteroposterior view with external rotation identified 14 abnormalities not seen on the other views. The axillary projection identified 15 abnormalities not seen on other views. If only these two views had been obtained, 99.3% of the abnormalities would have been identified.	3
10. Kilcoyne RF, Reddy PK, Lyons F, Rockwood CA, Jr. Optimal plain film imaging of the shoulder impingement syndrome. AJR Am J Roentgenol. 1989;153(4):795-797.	Review/Other-Dx	N/A	To describe challenges of imaging shoulder impingement syndrome and introduce a radiographic technique that makes the acromion visible.	Of the available techniques for imaging this spur, the 30# { 17c6a } udally angled anteroposterior radiograph of the shoulder in the erect position is the simplest, cheapest, and most reproducible method. In a busy clinical practice, it offers a distinct advantage over other method	4
11. Mayerhoefer ME, Breitsenseher MJ, Roposch A, Treitl C, Wurnig C. Comparison of MRI and conventional radiography for assessment of acromial shape. AJR Am J Roentgenol. 2005;184(2):671-675.	Observational-Dx	61 patients	To determine the value of different MRI planes independently and in combination for assessment of acromial shape.	Kappa coefficients were 0.36 (36%) for S-1, 0.41 (41%) for S-2, and -0.10 (-10%) for S-3. For the outlet view radiographs, the kappa coefficient was 0.55 (55%), showing better correlation than any single slice position. Best results, however, were achieved with a combination of S-1 and S-2, with a kappa coefficient of 0.66 (66%).	3

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12. Depalma AF, Kruper JS. Long-term study of shoulder joints afflicted with and treated for calcific tendinitis. Clin Orthop. 1961;20:61-72.	Observational-Tx	136 cases	To determine the nature of the residual alterations, if any, in shoulder joints treated for calcific tendonitis.	Conservative management results in the highest incidence of short-term good results (81% in 1-4 weeks). Surgical management produced 96 percent good results, 4% fair and no poor results. However, the convalescence period is longer in patients treated surgically. When complicating lesions are present, the convalescence period is increased by many weeks. Many shoulders exhibited progressive degenerative alterations in the rotator cuff as demonstrated by roentgenographic studies and clinical examination. forty-seven percent disclosed varying degrees of degenerative changes in the humeral head, and 18% exhibited marked crepitus in the afflicted shoulders.	2
13. Siegal DS, Wu JS, Newman JS, Del Cura JL, Hochman MG. Calcific tendinitis: a pictorial review. [Review] [29 refs]. Can Assoc Radiol J. 60(5):263-72, 2009 Dec.	Review/Other-Dx	N/A	To describe the imaging appearance of calcific tendinitis at specific sites and treatments used to manage the disease.	No results stated in abstract.	4

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14. Studler U, Pfirmann CW, Jost B, Rousson V, Hodler J, Zanetti M. Abnormalities of the lesser tuberosity on radiography and MRI: association with subscapularis tendon lesions. <i>AJR Am J Roentgenol.</i> 2008;191(1):100-106.	Observational-Dx	70 patients	To retrospectively evaluate the association between abnormalities of the lesser tuberosity and subscapularis tendon lesions.	For the diagnosis of subscapularis tendon tears, the sensitivity of cortical irregularities and cysts on radiographs was 44%/51% (reader 1/reader 2) and 21%/21%, respectively; specificity was 65%/68% and 87%/87%. The sensitivity of cortical irregularities and cysts on MRI was 64%/72% and 36%/39%. Specificity was 48%/45% and 81%/77%. For fatty atrophy of the subscapularis muscle, the sensitivity of cortical irregularities and cysts on radiographs was 67%/73% and 17%/27%, respectively; the specificity was 63%/63% and 83%/85%. Significant ( $p < 0.05$ ) positive correlations were found between cortical irregularities and surgical grade of subscapularis tendon tear for reader 2 (radiography, $\gamma = 0.39$ ; MRI, $\gamma = 0.45$ ) and between lesser tuberosity abnormalities and patient age ( $\gamma = 0.11$ and $0.43$ ) for both readers. Interobserver agreement of imaging findings varied from moderate to substantial ( $\kappa = 0.50-0.76$ ).	2
15. Steinbach LS. MR Imaging of the Rotator Cuff. In: Chung CB, Steinbach LS, eds. <i>MRI of the Upper Extremity : Shoulder, Elbow, Wrist and Hand.</i> Philadelphia: Wolters Kluwer Health/Lippincott Williams & Wilkins; 2010:244.	Review/Other-Dx	N/A	To present a practical approach to MRI interpretation, emphasizing the clinical correlations of imaging findings.	No results stated in abstract.	4
16. Chung CB, Gentili A, Chew FS. Calcific tendinosis and periarthritis: classic magnetic resonance imaging appearance and associated findings. <i>J Comput Assist Tomogr.</i> 2004;28(3):390-396.	Observational-Dx	N/A	To present a pictorial illustration of both the classic and atypical MR imaging (MRI) features of soft tissue calcifications in the musculoskeletal system.	No results stated in abstract.	4

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17. Farin PU. Consistency of rotator-cuff calcifications. Observations on plain radiography, sonography, computed tomography, and at needle treatment. Invest Radiol. 1996;31(5):300-304.	Observational-Dx	20 patients	To analyze findings of consistency of rotator-cuff calcifications found at ultrasound (US)-guided needle treatment compared with findings of plain radiography, US, and computed tomography (CT).	At needle treatments, 45% (9 of 20) of the calcifications were soft or nearly liquid, and 55% (11 of 20) were hard. On plain radiographs, 67% (6 of 9) were as soft and 64% (7 of 11) as hard. On sonograms, 77% (7 of 9) were soft and 82% (9 of 11) were hard. On CT images, 77% (7 of 9) were soft and 91% (10 of 11) were hard; CT attenuation values were 77% (7 of 9) and 91% (10 of 11), respectively.	4
18. Charoussat C, Bellaiche L, Duranthon LD, Grimberg J. Accuracy of CT arthrography in the assessment of tears of the rotator cuff. J Bone Joint Surg Br. 2005;87(6):824-828.	Observational-Dx	259 patients	To compare CT arthrography with arthroscopy in order to establish their ability to determine the existence of a tear as well as its size and extent in the two directions according to the classification of the French Arthroscopy Society.	CT arthrography had a sensitivity of 99% and a specificity of 100% for the diagnosis of tears of supraspinatus. For infraspinatus these figures were 97.44% and 99.52%, respectively and, for subscapularis, 64.71% and 98.17%. For lesions of the long head of the biceps, the sensitivity was 45.76% and the specificity was 99.57%.	3
19. 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.	Observational-Dx	148 patients	To evaluate the diagnostic efficacy of computed tomography arthrography (CTA) in the assessment of various shoulder pathologies with arthroscopic correlation.	The sensitivity, specificity, and agreement were comparable in each imaging study for Bankart, SLAP, and Hill-Sachs lesions, and full-thickness rotator cuff tears, but those of CTA were significantly lower than MRA for partial-thickness cuff tears. The AUROC curve for CTA and MRA were not significantly different for any of the pathologies, except partial-thickness cuff tears.	2

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20. Omoumi P, Bafort AC, Dubuc JE, Malghem J, Vande Berg BC, Lecouvet FE. Evaluation of rotator cuff tendon tears: comparison of multidetector CT arthrography and 1.5-T MR arthrography. Radiology. 2012;264(3):812-822.	Observational-Dx	56 patients	To compare the diagnostic performance of multidetector computed tomographic (CT) arthrography and 1.5-T magnetic resonance (MR) arthrography in the evaluation of rotator cuff lesions, with arthroscopic correlation.	There was no statistically significant difference in sensitivity and specificity between CT arthrography and MR arthrography in depiction of rotator cuff lesions. The respective sensitivity and specificity of CT arthrography were 92% and 93%-97% for the supraspinatus, 100% and 77%-79% for the infraspinatus, 75%-88% and 85%-90% for the subscapularis, and 55%-65% and 100% for the biceps tendon. The respective sensitivity and specificity of MR arthrography were 96% and 83%-93% for the supraspinatus, 88%-100% and 81%-83% for the infraspinatus, 75%-88% and 90%-100% for the subscapularis, and 65%-85% and 100% for the biceps tendon. Interobserver agreement was substantial to almost perfect (kappa = 0.744-0.964 for CT arthrography; kappa = 0.641-0.893 for MR arthrography), and intertechnique agreement was almost perfect (kappa > 0.819). CT and MR arthrography both yielded moderate interobserver and intertechnique agreement for measuring rotator cuff tears and grading muscle fatty infiltration.	2
21. Lecouvet FE, Simoni P, Koutaissoff S, Vande Berg BC, Malghem J, Dubuc JE. Multidetector spiral CT arthrography of the shoulder. Clinical applications and limits, with MR arthrography and arthroscopic correlations. Eur J Radiol. 2008;68(1):120-136.	Review/Other-Tx	N/A	To illustrate the capabilities and limits of CTA for the study of rotator cuff tears, shoulder instability, cartilage lesions, anatomical variants and abnormalities of the glenoid labrum, with MRA and surgical correlations.	No results stated in abstract.	4



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22. Waldt S, Bruegel M, Mueller D, et al. Rotator cuff tears: assessment with MR arthrography in 275 patients with arthroscopic correlation. <i>Eur Radiol.</i> 2007;17(2):491-498.	Observational-Dx	139 patients with rotator cuff tears proved by arthroscopy and a control group of 136 patients with arthroscopically intact rotator cuff tendons.	To assess the diagnostic performance of magnetic resonance arthrography in the diagnosis of articular-sided partial-thickness and full-thickness rotator cuff tears in a large symptomatic population.	At arthroscopy, 197 rotator cuff tears were diagnosed, including 105 partial-thickness (93 supraspinatus, nine infraspinatus, three subscapularis) and 92 full-thickness (43 supraspinatus, 20 infraspinatus, 29 subscapularis) tendon tears. For full-thickness tears, sensitivity, specificity, and accuracy were 96%, 99%, and 98%, respectively, and for partial tears 80%, 97%, and 95%, respectively. False negative and positive assessments in the diagnosis of articular-sided partial-thickness tears were predominantly [78% (35/45)] observed with small articular-sided (Ellman grade1) tendon tears.	3
23. Zlatkin MB, Iannotti JP, Roberts MC, et al. Rotator cuff tears: diagnostic performance of MR imaging. <i>Radiology.</i> 1989;172(1):223-229.	Observational-Dx	32 patients including 8 asymptomatic volunteers	To determine the diagnostic performance of magnetic resonance (MR) imaging in the evaluation of suspected rotator cuff tears.	The sensitivity of MR imaging for all tears (partial and full thickness) was 0.91, and the specificity was 0.88; whereas the sensitivity and specificity of arthrography were each 0.71. The scoring system improved the sensitivity to 1.0 and the specificity to 0.92. Linear regression analysis showed excellent correlation between preoperative assessment of the size of rotator cuff tears and measurement at surgery ( $r = .95$ ).	3
24. Kneeland JB, Middleton WD, Carrera GF, et al. MR imaging of the shoulder: diagnosis of rotator cuff tears. <i>AJR Am J Roentgenol.</i> 1987;149(2):333-337.	Observational-Dx	25 patients	To present the results of MR imaging of 25 patients with suspected rotator cuff tears on whom arthrography or surgery was performed.	MR visualized abnormalities consistent with a tear in 20 of the 22 tears diagnosed by arthrography or surgery. In most cases, tears were seen as regions of increased signal intensity within the cuff on long-TR pulse sequences, although two cases simply showed an almost complete absence of normal cuff. The MR appearance of the two cases with partial tears was similar to that of full-thickness tears. Of the four cases with normal arthrograms, one case had MR findings consistent with a tear.	3

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25. Teefey SA, Rubin DA, Middleton WD, Hildebolt CF, Leibold RA, Yamaguchi K. Detection and quantification of rotator cuff tears. Comparison of ultrasonographic, magnetic resonance imaging, and arthroscopic findings in seventy-one consecutive cases. J Bone Joint Surg Am. 2004;86-A(4):708-716.	Observational-Dx	124 patients	To compare the accuracy of the two tests for detection and measurement of the size of rotator cuff tears, with arthroscopic findings used as the standard.	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%. Ultrasonography 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 ( $p > 0.05$ ).	2
26. American College of Radiology. ACR Appropriateness Criteria®: Shoulder Pain–Traumatic. Available at: <a href="https://acsearch.acr.org/docs/69433/Narrative/">https://acsearch.acr.org/docs/69433/Narrative/</a> .	Review/Other-Dx	N/A	Evidence-based guidelines to assist referring physicians and other providers in making the most appropriate imaging or treatment decision for a specific clinical condition.	N/A	4

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27. Chandnani VP, Yeager TD, DeBerardino T, et al. Glenoid labral tears: prospective evaluation with MRI imaging, MR arthrography, and CT arthrography. AJR Am J Roentgenol. 1993;161(6):1229-1235.	Observational-Dx	30 patients	To determine the sensitivity of MR imaging, MR arthrography, and CT arthrography in detecting glenoid labral tears and in determining whether the labrum is detached or degenerated.	At surgery, labral tears were found in 28 patients; a detached fragment was found in 26 patients. The labrum was found to be degenerated in 18. A labral tear was detected on MR images in 26 (93%) of 28, on MR arthrograms in 27 (96%) of 28, and on CT arthrograms in 19 (73%) of 26. A detached labral fragment was detected on MR images in 12 (46%) of 26, on MR arthrograms in 25 (96%) of 26, and on CT arthrograms in 13 (52%) of 25. Labral degeneration was detected on MR images in two (11%) of 18, on MR arthrograms in 10 (56%) of 18, and on CT arthrograms in four (24%) of 17. MR arthrography was the best of the three imaging techniques for showing the inferior part of the glenoid labrum and inferior glenohumeral ligament.	3
28. Hodler J, Kursunoglu-Brahme S, Snyder SJ, et al. Rotator cuff disease: assessment with MR arthrography versus standard MR imaging in 36 patients with arthroscopic confirmation. Radiology. 1992;182(2):431-436.	Observational-Dx	36 patients	To determine the relative diagnostic usefulness of standard proton density and T2-weighted images and contrast material-enhanced T1-weighted sequences (MR arthrography) in the evaluation of the rotator cuff.	In 19 rotator cuffs normal at arthroscopy, MR arthrography revealed no tear in 16 patients, a partial tear in one patient, and a full-thickness tear in two patients. Standard proton-density- and T2-weighted images were normal in 15 of these patients and revealed a partial tear in two patients and a full-thickness tear in two patients. In 13 partial tears found at arthroscopy, MR arthrography showed a partial tear in six patients, no tear in five patients, and a full-thickness tear in two patients; standard MR imaging revealed a partial tear in one patient, no tear in 10 patients, and a full-thickness tear in two patients. All four full-thickness tears proved with arthroscopy were correctly diagnosed with both MR imaging methods.	3

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<p>29. Flemming DJ, Murphey MD, Shekitka KM, Temple HT, Jelinek JJ, Kransdorf MJ. Osseous involvement in calcific tendinitis: a retrospective review of 50 cases. AJR Am J Roentgenol. 2003;181(4):965-972.</p>	<p>Review/Other-Dx</p>	<p>50 patients</p>	<p>to describe the spectrum of radiologic and pathologic manifestations of calcific tendinitis involving bone.</p>	<p>The average age of patients was 50 years (range, 16-82 years), with 29 female patients (58%). Calcific tendinitis with associated bone involvement was seen most commonly in the femur (40%) and the humerus (40%). Concretions were most commonly solid-appearing (50%). Cortical erosion was the most common manifestation of osseous involvement (78% of cases). Marrow involvement was shown in 18 (36%) of 50 cases. Marrow extension was most commonly seen in the lesser and greater tuberosities of the humerus, which accounted for 61% (11/18) of cases. Focal increased radionuclide uptake was seen in 13 (100%) of 13 cases. CONCLUSION: Calcific tendinitis presenting with osseous destruction, marrow changes, and soft-tissue calcifications may be confused with neoplasm both radiologically and pathologically.</p>	<p>4</p>

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<p>30. Magee T. 3-T MRI of the shoulder: is MR arthrography necessary? AJR Am J Roentgenol. 2009;192(1):86-92.</p>	<p>Observational-Dx</p>	<p>150 patients</p>	<p>To report the diagnostic sensitivity of 3-T conventional MRI versus MR arthrography of the shoulder in the same patient population.</p>	<p>Three full-thickness and nine partial-thickness supraspinatus tendon tears, seven SLAP tears, six anterior labral tears, and two posterior labral tears were seen on MR arthrography but not on conventional MRI. All additional MR arthrography findings were confirmed at arthroscopy. On conventional MRI, sensitivities and specificities compared with arthroscopy were as follows: anterior labral tear, 83% sensitivity and 100% specificity; posterior labral tear, 84% and 100%; SLAP tear, 83% and 99%; supraspinatus tendon tear, 92% and 100%; partial-thickness articular surface tear, 68% and 100%; and partial-thickness bursal surface tear, 84% and 100%. On MR arthrography, sensitivities and specificities compared with arthroscopy were as follows: anterior labral tear, 98% sensitivity and 100% specificity; posterior labral tear, 95% and 100%; SLAP tear, 98% and 99%; supraspinatus tendon tear, 100% and 100%; partial-thickness articular surface tear, 97% and 100%; and partial-thickness bursal surface tear, 84% and 100%. MR arthrography showed a statistical improvement in sensitivity (p&lt;0.05) for detection of partial-thickness articular surface supraspinatus tears, anterior labral tears, and SLAP tears at 3 T.</p>	<p>3</p>

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31. Lee SY, Lee JK. Horizontal component of partial-thickness tears of rotator cuff: imaging characteristics and comparison of ABER view with oblique coronal view at MR arthrography initial results. <i>Radiology</i> . 2002;224(2):470-476.	Observational-Dx	16 patients	To determine the characteristics of horizontal components of partial-thickness tears of the rotator cuff at magnetic resonance (MR) arthrography and to determine whether use of the abduction and external rotation (ABER) position improved detection of a horizontal component in partial-thickness tears.	A horizontal component (24 lesions; one tendon involved in eight patients and two tendons involved in eight patients) was observed in 100% of the lesions on ABER views and in 21% of the lesions (n = 5) on oblique coronal images. The mean length of the horizontal components, measured on ABER views, was 1.9 cm (range, 0.6-4.5 cm). Thirteen (54%) of the 24 lesions were classified as grade I (<3 mm) in depth, four (17%) were classified as grade II (3-6 mm), and seven (29%) were classified as grade III (>6 mm). Articular separation sites with a flap lesion were visualized in 15 (62%) of 24 lesions on ABER views.	3
32. Roger B, Skaf A, Hooper AW, Lektrakul N, Yeh L, Resnick D. Imaging findings in the dominant shoulder of throwing athletes: comparison of radiography, arthrography, CT arthrography, and MR arthrography with arthroscopic correlation. <i>AJR Am J Roentgenol</i> . 1999;172(5):1371-1380.	Observational-Dx	17 patients	To compare conventional radiography, arthrography, CT arthrography, and MR arthrography--including use of the abduction and external rotation position--with arthroscopic correlation, to determine the spectrum of abnormalities encountered and the relative benefits of each imaging method in the evaluation of shoulder lesions occurring in 17 throwing athletes.	Structures found to be affected were, in decreasing order of frequency, the following: the posterosuperior labrum, supraspinatus tendon, infraspinatus tendon, humeral head, glenoid cavity and rim, acromioclavicular joint, anteroinferior capsulolabral complex, biceps tendon, and subscapularis tendon. MR arthrography without and with abduction and external rotation yielded the highest sensitivity and specificity for all lesions with the exceptions of bone sclerosis and enthesophytes (which were best seen with CT arthrography). MR arthrography with abduction and external rotation was most accurate for diagnosis of rotator cuff and anteroinferior capsulolabral complex tears.	3
33. Nazarian LN, Jacobson JA, Benson CB, et al. Imaging algorithms for evaluating suspected rotator cuff disease: Society of Radiologists in Ultrasound consensus conference statement. <i>Radiology</i> . 2013;267(2):589-595.	Review/Other-Dx	N/A	To provide algorithms with which to guide the imaging evaluation of suspected rotator cuff disease in patients with a native rotator cuff, patients with a repaired rotator cuff, and patients who have undergone shoulder replacement.	No results stated in abstract.	4

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34. Vlychou M, Dailiana Z, Fotiadou A, Papanagiotou M, Fezoulidis IV, Malizos K. Symptomatic partial rotator cuff tears: diagnostic performance of ultrasound and magnetic resonance imaging with surgical correlation. <i>Acta Radiol.</i> 2009;50(1):101-105.	Observational-Dx	56 patients	To apply ultrasound (US) imaging in order to evaluate the prevalence of partial rotator cuff tears in patients with painful shoulders.	Arthroscopy or mini-open surgery revealed 53 cases with partial tears of the rotator cuff and three with extensive tendinopathy. Both imaging modalities detected successfully 44 cases of partial tears of the supraspinatus tendon. US imaging yielded a sensitivity of 95.6%, a specificity of 70%, an accuracy of 91%, and a positive predictive accuracy of 93.6%. The corresponding values for MRI were 97.7%, 63.6%, 91%, and 91.7%, respectively.	2
35. De Zordo T, Ahmad N, Odegaard F, et al. US-guided therapy of calcific tendinopathy: clinical and radiological outcome assessment in shoulder and non-shoulder tendons. <i>Ultraschall Med.</i> 2011;32 Suppl 1:S117-123.	Observational-Tx	40 patients	To analyze the effectiveness and complication rate of ultrasound (US)-guided perforation and lavage using a two-needle technique with 16 - 18 G needles in the treatment of patients with calcific tendinopathy in the shoulder, elbow, hip, and knee by radiological and clinical follow-up.	34 shoulder tendons and 6 non-shoulder tendons were identified. The mean calcium reduction was 39.9 mm(2) (range, 0 - 215; p < 0.001), while 80 % of patient showed a resolution of more than 60 % resulting in good clinical improvement. A very low complication rate was found (1 partial tear).	2
36. Yoo JC, Koh KH, Park WH, Park JC, Kim SM, Yoon YC. The outcome of ultrasound-guided needle decompression and steroid injection in calcific tendinitis. <i>J Shoulder Elbow Surg.</i> 2010;19(4):596-600.	Observational-Tx	30 patients	To document preliminarily clinical and radiographic results of ultrasound (US)-guided fine needle decompression and subacromial steroid injection in patients with calcific tendinitis of the shoulder.	At 6 months after the index procedure, 25 shoulders (71.4%) showed ASES and Constant score improvements from 48.0 and 53.7 to 84.6 and 87.9, respectively (P < .01). Ten shoulders (28.6%) showed no symptom relief at the last follow-up. In shoulders with pain improvement, the mean size of calcific deposits reduced from 13.6 to 5.6 mm (P < .01), and in shoulders with no pain improvement or that underwent operation, mean size was 13.1 mm at initial visits and 12.7 mm at final visits (P = .75).	2
37. Bencardino JT, Gyftopoulos S, Palmer WE. Imaging in anterior glenohumeral instability. <i>Radiology.</i> 2013;269(2):323-337.	Review/Other-Dx	N/A	To focus on imaging findings in acute first-time shoulder dislocation, chronic instability with repeated dislocation, and chronic instability without repeated dislocation.	The goal of imaging depends on the clinical scenario. Image interpretation and reporting may need to emphasize diagnosis and the identification of lesions that are associated with instability or the characterization of lesions for treatment planning.	4

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EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
38. Bergin D.. Imaging shoulder instability in the athlete. [Review] [101 refs]. Magn Reson Imaging Clin N Am. 17(4):595-615, v, 2009 Nov.	Review/Other-Dx	N/A	To review imaging of instability-related injuries in athletes, with special emphasis on MR imaging.	No results stated in abstract.	4
39. Huijsmans PE, de Witte PB, de Villiers RV, et al. Recurrent anterior shoulder instability: accuracy of estimations of glenoid bone loss with computed tomography is insufficient for therapeutic decision-making. Skeletal Radiol. 2011;40(10):1329-1334.	Observational-Dx	54 patients	To evaluate the reliability of glenoid bone loss estimations based on either axial computed tomography (CT) series or single sagittal ("en face" to glenoid) CT reconstructions, and to assess their accuracy by comparing with actual CT-based bone loss measurements, in patients with anterior glenohumeral instability.	In both series, larger defects were estimated when based on sagittal CT images compared to axial views. In the second series, mean measured bone loss was 11.5% (SD = 6.0) of the total original glenoid area, with estimations of 9.6% (SD = 7.2) and 7.8% (SD = 4.2) for sagittal and axial views, respectively. Correlations of defect estimations with actual measurements were fair to poor; glenoid defects tended to be underestimated, especially when based on axial views.	3
40. Macmahon PJ, Palmer WE. Magnetic resonance imaging in glenohumeral instability. Magn Reson Imaging Clin N Am. 2012;20(2):295-312, xi.	Review/Other-Dx	N/A	To review the structures important in glenohumeral stabilization and illustrate their normal appearances and the abnormalities associated with anterior, posterior, and multidirectional instability.	No results stated in abstract.	4
41. Stevens KJ, Preston BJ, Wallace WA, Kerslake RW. CT imaging and three-dimensional reconstructions of shoulders with anterior glenohumeral instability. Clin Anat. 1999;12(5):326-336.	Review/Other-Dx	11 patients	To evaluate the bony abnormalities associated with glenohumeral instability using CT imaging with 3-D reconstruction images.	In the 12 shoulders imaged, we identified four main abnormalities. A humeral-head defect or Hill-Sachs deformity was seen in 83% cases, fractures of the anterior glenoid rim in 50%, periosteal new bone formation secondary to capsular stripping in 42%, and loose bone fragments in 25%. Manipulation of the 3-D images enabled the abnormalities to be well seen in all cases, giving a graphic visualization of the joint, and only two 3-D images were needed to demonstrate all the necessary information.	4



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EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
42. Dumont GD, Russell RD, Robertson WJ. Anterior shoulder instability: a review of pathoanatomy, diagnosis and treatment. <i>Curr Rev Musculoskelet Med.</i> 2011;4(4):200-207.	Review/Other-Dx	N/A	To review the pathoanatomy, diagnosis, and treatment of anterior shoulder instability.	An individualized treatment approach, based upon the patient's injury pattern and expectations, will likely lead to the most successful outcome.	4
43. Saito H, Itoi E, Sugaya H, Minagawa H, Yamamoto N, Tuoheti Y. Location of the glenoid defect in shoulders with recurrent anterior dislocation. <i>Am J Sports Med.</i> 2005;33(6):889-893.	Review/Other-Dx	123 patients	To clarify the location and extent of the glenoid defect in shoulders with recurrent anterior dislocation.	The defects were located between 12:08 and 6:32, with the range between 2:30 and 4:20 being the most frequent. The extent of the glenoid defect was 106.7 degrees +/- 27.1 degrees (mean +/- standard deviation). The mean orientation of the defect was pointing toward 3:01 on the clock face of the glenoid, at a mean angle of 90.5 degrees +/- 10.4 degrees from the 12-o'clock direction.	4

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EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
<p>44. Sugaya H, Moriishi J, Dohi M, Kon Y, Tsuchiya A. Glenoid rim morphology in recurrent anterior glenohumeral instability. <i>J Bone Joint Surg Am.</i> 2003;85-A(5):878-884.</p>	<p>Review/Ot her-Dx</p>	<p>100 patients</p>	<p>To quantify glenoid osseous defects and to define their characteristics in patients with recurrent anterior instability.</p>	<p>Investigation of the normal glenoids revealed no side-to-side differences. Investigation of the affected glenoids revealed an abnormal configuration in ninety shoulders. Fifty glenoids had an osseous fragment. One fragment was large (26.9% of the glenoid fossa), twenty-seven fragments were medium (10.6% of the glenoid fossa, on the average), and twenty-two were small (2.9% of the glenoid fossa, on the average). In the forty shoulders without an osseous fragment, the anteroinferior portion of the glenoid appeared straight on the en face view and it appeared obtuse or slightly rounded, compared with the normally sharp contour of the normal glenoid rim, on the oblique view, suggesting erosion or a mild compression fracture at this site. Arthroscopic investigation revealed a Bankart lesion in ninety-seven of the 100 shoulders and an osseous fragment in forty-five of the fifty shoulders in which an osseous Bankart lesion had been identified with the three-dimensionally reconstructed computed tomography. In the shoulders with distinctly abnormal morphology on three-dimensionally reconstructed computed tomography, the arthroscopic appearance of the anteroinferior portion of the glenoid rim was compatible with the appearance demonstrated by the three-dimensionally reconstructed computed tomography.</p>	<p>4</p>

**Shoulder Pain-Atraumatic  
EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
<p>45. Acid S, Le Corroller T, Aswad R, Pauly V, Champsaur P. Preoperative imaging of anterior shoulder instability: diagnostic effectiveness of MDCT arthrography and comparison with MR arthrography and arthroscopy. AJR Am J Roentgenol. 2012;198(3):661-667.</p>	<p>Observational-Dx</p>	<p>40 patients</p>	<p>To assess the diagnostic effectiveness of MDCT arthrography in the preoperative planning of anterior shoulder instability compared with MR arthrography and arthroscopy.</p>	<p>In detecting glenoid rim fractures, MDCT arthrography had a sensitivity of 100% (12/12), a specificity of 96% (27/28), and better agreement with surgery (kappa = 0.94) than did MR arthrography (kappa = 0.74). For the depiction of glenoid cartilage lesions, MDCT arthrography had a sensitivity of 82% (18/22), a specificity of 89% (16/18), and slightly better agreement with surgery (kappa = 0.70) than did MR arthrography (kappa = 0.66). In identifying anterior labral periosteal sleeve avulsion lesions, MDCT arthrography had a sensitivity of 93% (26/28), a specificity of 100% (12/12), and better agreement with surgery (kappa = 0.89) than did MR arthrography (kappa = 0.74). For the diagnosis of humeral avulsion of the inferior glenohumeral ligament lesions, MDCT arthrography had a sensitivity and a specificity of 100% (2/2) and better agreement with surgery (kappa = 1) than did MR arthrography (kappa = 0.79).</p>	<p>2</p>

**Shoulder Pain-Atraumatic  
EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
46. Magee T, Williams D, Mani N. Shoulder MR arthrography: which patient group benefits most?. AJR Am J Roentgenol. 183(4):969-74, 2004 Oct.	Observational-Dx	70 patients	To compare the diagnostic accuracy of conventional MRI versus MR arthrography of the shoulder in the assessment of high-performance athletes (professional baseball players) and to compare our findings in these patients with the conventional MRI and MR arthrographic findings in an age-matched control group of nonprofessional athletes.	In the 20 consecutive professional athlete patients, two full-thickness and six partial-thickness undersurface supraspinatus tendon tears were seen on MR arthrography but not seen on conventional MRI as well as six SLAP tears, two anterior labral tears, and one posterior labral tear. Three patients had both SLAP tears and full- or partial-thickness supraspinatus tendon tears. Of 14 patients with findings on MR arthrography that were not seen on MRI, 11 had arthroscopic correlation. In all 11, arthroscopic findings confirmed findings on MR arthrography. In the group of 50 nonprofessional athlete patients, five had additional findings on MR arthrography not seen on conventional MRI: two anterior labral tears, two partial-thickness supraspinatus tendon tears, and two SLAP tears. One patient had both a partial-thickness supraspinatus tendon tear and a SLAP tear seen on MR arthrography. The five patients with additional findings on MR arthrography had arthroscopy. In all five, arthroscopic findings confirmed the findings on MR arthrography.	4
47. Tuite MJ, De Smet AA, Norris MA, Orwin JF. MR diagnosis of labral tears of the shoulder: value of T2*-weighted gradient-recalled echo images made in external rotation. AJR Am J Roentgenol. 1995;164(4):941-944.	Observational-Dx	24 patients	To determine whether the diagnostic accuracy of detecting anteroinferior labral tears by MR imaging would be improved by adding a T2*-weighted gradient-recalled echo sequence with the humerus in external rotation.	Both observers identified one patient for whom a surgically proved labral tear was seen only on the external-rotation images. The sensitivity increased from 0.43 to 0.50 (p = .35) for observer 1 and from 0.36 to 0.43 (p = .35) for observer 2. The specificity of 0.90 for both observers remained unchanged. The accuracy improved from 0.62 to 0.67 for observer 1 and from 0.55 to 0.62 for observer 2.	3

**Shoulder Pain-Atraumatic  
EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
48. Major NM, Browne J, Domzalski T, Cothran RL, Helms CA. Evaluation of the glenoid labrum with 3-T MRI: is intraarticular contrast necessary? AJR Am J Roentgenol. 2011;196(5):1139-1144.	Observational-Dx	42 patients	To evaluate the diagnostic accuracy of 3-T MRI versus 3-T MR arthrography for assessing labral abnormalities in the shoulder using arthroscopy as the gold standard.	Of the 22 arthroscopies performed, 26 labral tears were found in 18 shoulders and four shoulders were normal with respect to the labrum. There were 12 superior, nine posterior, and five anterior labral tears identified at arthroscopy. By consensus review, conventional MRI identified nine of 12 superior (sensitivity, 75%; specificity, 100%), seven of nine posterior (sensitivity, 78%; specificity, 92%), and three of five anterior (sensitivity, 60%; specificity, 94%) labral tears. MR arthrography identified nine of 12 superior (sensitivity, 75%; specificity, 100%), eight of nine posterior (sensitivity, 89%; specificity, 100%), and five of five anterior (sensitivity, 100%; specificity, 100%) labral tears.	2
49. Palmer WE, Brown JH, Rosenthal DI. Labral-ligamentous complex of the shoulder: evaluation with MR arthrography. Radiology. 1994;190(3):645-651.	Observational-Dx	48 patients	To determine the usefulness of magnetic resonance (MR) arthrography in assessment of the labral-ligamentous complex and test the hypothesis that the inferior glenohumeral ligament (IGHL) is an important anatomic feature of clinical instability.	Surgical findings showed that 14 labra were normal, 29 were torn, and six were deficient. (One labrum was torn and deficient in separate locations.) MR arthrographic findings had a diagnostic sensitivity of 91% and specificity of 93%. In 32 patients with proved labral abnormalities, 30 lesions involved the labral-bicipital junction, origins of the glenohumeral ligaments, or both. In 22 of 23 shoulders considered clinically unstable, a labral abnormality involved the origin of the IGHL.	2

**Shoulder Pain-Atraumatic  
EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
50. Palmer WE, Caslowitz PL. Anterior shoulder instability: diagnostic criteria determined from prospective analysis of 121 MR arthrograms. Radiology. 1995;197(3):819-825.	Observational-Dx	121 patients	To determine magnetic resonance (MR) arthrographic criteria in the diagnosis of anterior glenohumeral instability.	Operative results showed 59 normal, 57 torn, and five deficient labra. In 37 unstable shoulders, 31 had discrete inferior labral-ligamentous lesions and six had capsular laxity. MR arthrograms showed labral abnormalities with 92% sensitivity, 92% specificity. Inferior labral-ligamentous lesions enabled prediction of anterior instability with 76% sensitivity (capsular laxity was missed in all shoulders), 98% specificity. Inferior labral-ligamentous abnormalities were strongly associated with unstable shoulders (P << .0001), whereas noninferior labral-ligamentous abnormalities were related to stable shoulders (P = .01). Capsular insertion types showed no significant differences between stable and unstable shoulders (P > .8).	2
51. Waldt S, Burkart A, Imhoff AB, Bruegel M, Rummeny EJ, Woertler K. Anterior shoulder instability: accuracy of MR arthrography in the classification of anteroinferior labroligamentous injuries. Radiology. 2005;237(2):578-583.	Observational-Dx	104 patients and 101 controls	To retrospectively evaluate the accuracy of magnetic resonance (MR) arthrography in the classification of anteroinferior labroligamentous injuries by using arthroscopy as the reference standard.	At arthroscopy, 104 anteroinferior labroligamentous lesions were diagnosed, including 44 Bankart lesions, 22 ALPSA lesions, 12 Perthes lesions, and three GLAD lesions. Twenty-three labral lesions were nonclassifiable at arthroscopy, all of which occurred after a history of chronic instability. Nineteen (83%) of these 23 lesions were also nonclassifiable at MR arthrography. With arthroscopy used as the reference standard, labroligamentous lesions were detected and correctly classified at MR arthrography with sensitivities of 88% and 77%, specificities of 91% and 91%, and accuracies of 89% and 84%, respectively. Bankart, ALPSA, and Perthes lesions were correctly classified in 80%, 77%, and 50% of cases, respectively. The three GLAD lesions were all correctly assessed.	3

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EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
52. Beltran LS, Adler R, Stone T, Surace J, Beltran J, Bencardino JT. MRI and Ultrasound Imaging of the Shoulder Using Positional Maneuvers. <i>AJR Am J Roentgenol.</i> 2015;205(3):W244-254.	Review/Other-Dx	N/A	To review the normal anatomy and pathologic conditions of the shoulder on the basis of the appearance on MR and ultrasound images obtained during performance of abduction external rotation and flexion adduction internal rotation positional maneuvers.	Knowledge of the normal appearance of anatomic structures and pathologic changes in nontraditional imaging planes is necessary to avoid pitfalls in interpretation.	4
53. Cvitanic O, Tirman PF, Feller JF, Bost FW, Minter J, Carroll KW. Using abduction and external rotation of the shoulder to increase the sensitivity of MR arthrography in revealing tears of the anterior glenoid labrum. <i>AJR Am J Roentgenol.</i> 1997;169(3):837-844.	Observational-Dx	256 patients	To compare oblique axial MR arthrograms obtained with the patient's shoulder in abduction and external rotation (ABER) position with conventional axial MR arthrograms obtained with the patient's arm in neutral position and the shoulder not rotated in revealing tears of the anterior glenoid labrum (AGL).	Of the 92 patients who underwent surgery, AGL tears were found in 27. Conventional axial MR arthrograms revealed 13 tears (sensitivity, 48%; specificity, 91%). A separate review of MR arthrograms obtained with patients in the ABER position revealed 24 tears (sensitivity, 89%; specificity, 95%). Reviewed together, axial MR arthrograms and MR arthrograms obtained with patients in the ABER position revealed 26 tears (sensitivity, 96%; specificity, 97%).	2
54. Tirman PF, Bost FW, Steinbach LS, et al. MR arthrographic depiction of tears of the rotator cuff: benefit of abduction and external rotation of the arm. <i>Radiology.</i> 1994;192(3):851-856.	Observational-Dx	5 patients	To show the effectiveness of positioning the arm in abduction and external rotation (ABER) during magnetic resonance (MR) arthrography for depiction of tears of the rotator cuff.	One partial tear of the distal infraspinatus tendon was detected with ABER MR arthrography only. One full-thickness tear was detected with both MR arthrography and ABER MR arthrography, but the component of the tear that extended into the infraspinatus tendon was depicted with ABER MR arthrography only. One partial tear was detected with both MR arthrography and ABER MR arthrography; no additional information was provided by either technique alone.	4

**Shoulder Pain-Atraumatic  
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Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
55. Schaeffeler C, Waldt S, Bauer JS, et al. MR arthrography including abduction and external rotation images in the assessment of atraumatic multidirectional instability of the shoulder. <i>Eur Radiol.</i> 2014;24(6):1376-1385.	Observational-Dx	21 patients and 17 controls	To evaluate diagnostic signs and measurements in the assessment of capsular redundancy in atraumatic multidirectional instability (MDI) of the shoulder on MR arthrography (MR-A) including abduction/external rotation (ABER) images.	The crescent sign had a sensitivity of 57%/62%/48% (observers 1/2/3) and specificity of 100%/100%/94% in the diagnosis of MDI. The triangle sign had a sensitivity of 48%/57%/48% and specificity of 94%/94%/100%. The combination of both signs had a sensitivity of 86%/90%/81% and specificity of 94%/94%/94%. A positive triangle sign was significantly associated with decentring of the HH. Measurements of RI herniation, RI width and glenoid were not significantly different between both groups.	3
56. Bureau NJ, Dussault RG, Keats TE. Imaging of bursae around the shoulder joint. <i>Skeletal Radiol.</i> 1996;25(6):513-517.	Review/Other-Dx	N/A	To review the anatomy of the major bursae around the shoulder joint and discuss the use of the different imaging modalities which demonstrate their radiologic features.	No results stated in abstract.	4



**Shoulder Pain-Atraumatic  
EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
57. Kaplan PA, Bryans KC, Davick JP, Otte M, Stinson WW, Dussault RG. MR imaging of the normal shoulder: variants and pitfalls. Radiology. 1992;184(2):519-524.	Review/Ot her-Dx	30 volunteers	To resolve some of the controversy regarding anatomic features of the shoulder at MR imaging, by using current MR imaging techniques in carefully selected healthy volunteers.	With regard to normal anatomic features at magnetic resonance (MR) imaging: (a) The supraspinatus tendon has low signal intensity, except for a 1-cm area with intermediate signal intensity in the region of the "critical zone." (b) The deltoid tendon attachment on the inferior surface of the acromion may simulate a subacromial spur if not imaged in continuity. (c) Fluid in the long head of the biceps tendon sheath is normal if not completely surrounding the tendon. (d) The anterolateral branch of the anterior humeral circumflex vessels in the proximal bicipital groove adjacent to the biceps tendon mimics fluid in the tendon sheath. (e) Continuity or obliteration of the subacromial-subdeltoid bursal fat plane is an unreliable diagnostic sign since the fat plane is often focally absent. (f) Fluid is not detected in subacromial-subdeltoid bursae. (g) Undercutting of the anterior glenoid labrum by hyaline cartilage or a closely apposed middle glenohumeral ligament may simulate an anterior labral tear.	4
58. Resnick D. Hydroxyapatite Crystal Deposition Disease. In: Resnick D, ed. Diagnosis of bone and joint disorders. 3rd ed. Philadelphia: Saunders; 1995:1615-1648.	Review/Ot her-Dx	N/A	To provide tools for the diagnosis of bone and joint disorders.	N/A	4

**Shoulder Pain-Atraumatic  
EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
59. Breidahl WH, Newman JS, Taljanovic MS, Adler RS. Power Doppler sonography in the assessment of musculoskeletal fluid collections. <i>AJR Am J Roentgenol.</i> 1996;166(6):1443-1446.	Review/Other-Dx	39 patients	To evaluate the ability of power Doppler sonography to differentiate musculoskeletal fluid collections of varying etiologies.	Adjacent to 36 effusions and fluid collections, we saw moderate or marked hyperemia. Thirty-five of the 36 had an inflammatory or neoplastic cause, including 15 infected collections. One fluid collection had a degenerative etiology (subdeltoid bursitis secondary to supraspinatus tendon tear). Adjacent to the seven remaining effusions and fluid collections, we saw normal or mildly increased hyperemia; none of these collections had an inflammatory etiology.	4
60. Sofka CM, Collins AJ, Adler RS. Use of ultrasonographic guidance in interventional musculoskeletal procedures: a review from a single institution. <i>J Ultrasound Med.</i> 20(1):21-6, 2001 Jan.	Review/Other-Dx	5 cases	To evaluate the utility of ultrasonographic guidance for intervention in the musculoskeletal system.	In all cases, the target of interest was identified easily with ultrasonography, and needle position was documented readily. Also in all cases, aspiration or medication delivery to the site of interest was observed during real time and was documented on postprocedure images of the area. No significant complications (e.g., bleeding, infection, and neurovascular compromise) were encountered during or immediately after any procedure.	4
61. Binder AI, Bulgen DY, Hazleman BL, Tudor J, Wraight P. Frozen shoulder: an arthrographic and radionuclear scan assessment. <i>Ann Rheum Dis.</i> 1984;43(3):365-369.	Observational-Dx	42 patients	To assess the plain x-ray, arthrographic, and technetium diphosphonate scan features at presentation in a carefully defined group of patients with clinical frozen shoulder and examine the relevance to the rate and extent of recovery.	During a therapeutic study of strictly defined clinical frozen shoulder 35 of 38 patients showed increased technetium diphosphonate uptake in the affected shoulder in comparison with the opposite side. Of 36 patients who had arthrography 15 showed evidence of capsulitis, 11 rupture of the rotator cuff, and five no abnormality.	3
62. Ekelund AL, Rydell N. Combination treatment for adhesive capsulitis of the shoulder. <i>Clin Orthop Relat Res.</i> 1992(282):105-109.	Observational-Tx	22 patients	To review the authors' experience of treating refractory cases of adhesive capsulitis with distention-arthrography and intraarticular deposition of local anesthetics and steroids, followed by manipulation, in 22 patients.	A rapid improvement was seen after treatment and at four to six weeks: 91% (21/23) of the patients had no or slight pain and 83% (19/23) of the patients had normal, or almost normal, range of motion. The treatment was well tolerated and no complications were recorded.	3

**Shoulder Pain-Atraumatic  
EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
63. Neviaser TJ. Arthrography of the shoulder. Orthop Clin North Am. 1980;11(2):205-217.	Review/Other-Dx	NA	To describe the anatomy of the shoulder and proper techniques of arthrography.	No results stated in abstract.	4
64. Zhao W, Zheng X, Liu Y, et al. An MRI study of symptomatic adhesive capsulitis. PLoS One. 2012;7(10):e47277.	Review/Other-Dx	60 patients and 60 volunteers	To describe and evaluate the pathomorphology of the shoulder in Asian patients with AC compared to healthy volunteers.	Significant abnormal findings were observed on MRI, especially at the rotator cuff interval. The coracohumeral ligament (CHL), articular capsule thickness in the rotator cuff interval as well as the fat space under coracoid process were evaluated. MRI showed that patients with adhesive capsulitis had a significantly thickened coracohumeral ligament and articular capsule in the rotator cuff interval compared to the control subjects (4.2 vs. 2.4 mm, 7.2 vs. 4.4 mm; p<0.05). Partial or complete obliteration of the subcoracoid fat triangle was significantly more frequent in patients with adhesive capsulitis compared with control subjects (73% vs. 13%, 26% vs. 1.6%; p<0.001). Synovitis-like abnormality around the long biceps tendon was significantly more common in patients with adhesive capsulitis than in control subjects. With regards to the inter-observer variability, two MR radiologists had an excellent kappa value of 0.86.	4

**Shoulder Pain-Atraumatic  
EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
65. Emig EW, Schweitzer ME, Karasick D, Lubowitz J. Adhesive capsulitis of the shoulder: MR diagnosis. <i>AJR Am J Roentgenol.</i> 1995;164(6):1457-1459.	Observational-Dx	10 patients and 15 controls	To study the MR findings in 10 patients with Adhesive capsulitis to assess the diagnostic utility of MR imaging.	Thickening of capsule and synovium on MR images was characteristic of adhesive capsulitis, with a significant difference between mean thickness in patients with adhesive capsulitis (5.2 mm) and in asymptomatic volunteers (2.9 mm) ( $p < .01$ ). Capsule and synovium thickness greater than 4 mm was a specific (95%) and sensitive (70%) criterion for the diagnosis of adhesive capsulitis. There was no significant difference in volume of articular fluid or thickness of the coracohumeral ligament between patients with adhesive capsulitis and asymptomatic volunteers ( $p > .5$ ). The rotator cuff interval was not useful for assessing changes of adhesive capsulitis.	3
66. Tamai K, Yamato M. Abnormal synovium in the frozen shoulder: a preliminary report with dynamic magnetic resonance imaging. <i>J Shoulder Elbow Surg.</i> 1997;6(6):534-543.	Review/Other-Dx	16 patients	To investigate whether the dynamic MRI findings of the synovium in FS might differ from those in normal shoulders or in subacromial impingement syndrome.	The signal intensity was measured at the periphery of the glenohumeral joint and in the subacromial bursa. The coefficient of enhancement (percent signal increase per second) in the frozen shoulders was 1.33 +/- 0.43 (mean +/- SD) for the glenohumeral joint and 0.89 +/- 0.47 for the subacromial bursa. These values were far greater than those in subacromial impingement syndrome or in the control group, indicating increased blood flow to the synovium in the frozen shoulders.	4

**Shoulder Pain-Atraumatic  
EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
67. Manton GL, Schweitzer ME, Weishaupt D, Karasick D. Utility of MR arthrography in the diagnosis of adhesive capsulitis. <i>Skeletal Radiol.</i> 2001;30(6):326-330.	Observational-Dx	9 patients and 19 controls.	To assess the utility of MR arthrography in diagnosing adhesive capsulitis.	There was a trend towards differences in capsular and synovial thickness ( $P>0.07$ ) between the subjects with and without adhesive capsulitis; however, the controls had thicker synovium/capsules. Surprisingly, the amount of fluid in the axillary recess and biceps tendon sheath was not significantly different between the groups ( $P>0.25$ ). There were more tears of the rotator cuff in controls than in patients with adhesive capsulitis (6, 3 vs 1, 1: complete, partial). Also, both corrugation (7 vs 0) and interval abnormalities (7 vs 0) were more common in the controls.	4
68. Mengiardi B, Pfirrmann CW, Gerber C, Hodler J, Zanetti M. Frozen shoulder: MR arthrographic findings. <i>Radiology.</i> 2004;233(2):486-492.	Observational-Dx	22 patients including 22 healthy controls	To evaluate the magnetic resonance (MR) arthrographic findings in patients with frozen shoulder.	Patients with frozen shoulder had a significantly thickened CHL (4.1 mm vs 2.7 mm in controls) and a thickened joint capsule in the rotator cuff interval (7.1 mm vs 4.5 mm; $P < .001$ for both comparisons, Mann-Whitney test) but not in the axillary recess. The volume of the axillary recess was significantly smaller in patients with frozen shoulder than in control subjects ( $P = .03$ , Mann-Whitney test). Thickening of the CHL to 4 mm or more had a specificity of 95% and a sensitivity of 59% for diagnosis of frozen shoulder. Thickening of the capsule in the rotator cuff interval to 7 mm or more had a specificity of 86% and a sensitivity of 64%. Synovitis-like abnormalities at the superior border of the subscapularis tendon were significantly more common in patients with frozen shoulder than in control subjects ( $P = .014$ , chi(2) test). Complete obliteration of the fat triangle between the CHL and the coracoid process (subcoracoid triangle sign) was specific (100%) but not sensitive (32%).	3

**Shoulder Pain-Atraumatic  
EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
69. De Maeseneer M, Boulet C, Pouliart N, et al. Assessment of the long head of the biceps tendon of the shoulder with 3T magnetic resonance arthrography and CT arthrography. <i>Eur J Radiol.</i> 2012;81(5):934-939.	Observational-Dx	36 patients	To examine the assessment of proximal biceps tendon lesions including degeneration, tendon luxation, and partial and complete tendon tears with 3T MR arthrography and CT arthrography.	The pooled sensitivity for lesion detection for CT arthrography was 31% and the specificity 95%. The pooled sensitivity for MR arthrography was 27% and the specificity 94%. There were no statistically significant differences between CT and MR. The interobserver agreement calculated with the kappa statistic was poor for CT and for MR. Both CT arthrography and MR arthrography perform poorly in the detection of biceps tendon pathology of the shoulder.	2
70. Chan TW, Dalinka MK, Kneeland JB, Chervrot A. Biceps tendon dislocation: evaluation with MR imaging. <i>Radiology.</i> 1991;179(3):649-652.	Review/Other-Dx	420 shoulder MR examinations	To evaluate and describe the appearance of soft tissue abnormalities as they to bicep tendon dislocation.	No results stated in abstract.	4
71. Pfahler M, Branner S, Refior HJ. The role of the bicipital groove in tendopathy of the long biceps tendon. <i>J Shoulder Elbow Surg.</i> 1999;8(5):419-424.	Review/Other-Dx	37 patients and 30 controls	To study the anatomy of the bicipital groove and its relationship to clinical symptoms.	In 28 shoulders we found sonographic signs of tendovaginitis, and in 14 we found degenerative changes. The x-ray films revealed a great variation in the medial and total opening angle of the groove, whereas width, depth, and humeral head diameter showed sex-related differences. Radiologic signs of groove degeneration correlated in 43.6% with biceps tendon disease on the sonogram.	4

**Shoulder Pain-Atraumatic  
EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
72. Beall DP, Williamson EE, Ly JQ, et al. Association of biceps tendon tears with rotator cuff abnormalities: degree of correlation with tears of the anterior and superior portions of the rotator cuff. <i>AJR Am J Roentgenol.</i> 2003;180(3):633-639.	Observational-Dx	111 patients	To examine the relationship and association of abnormalities seen in the long head of the biceps brachii tendon to abnormal findings in the rotator cuff.	Twenty-three patients were identified with partial- or full-thickness tears of the long head of the biceps tendon. The sensitivity, specificity, and accuracy of unenhanced MR imaging of the shoulder for detecting these bicipital tears were 52%, 86%, and 79%, respectively. When a tear was present in the biceps tendon, the prevalence of supraspinatous, infraspinatus, and subscapularis tendon tears was 96.2%, 34.6%, and 47.1%, respectively. Patients with biceps tendon tears were significantly more likely to also have subscapularis tendon tears ( $p < 0.0001$ ) and supraspinatous tendon tears ( $p < 0.008$ ) than those patients who did not have biceps tendon tears. No significant relationship was found between the presence or absence of a biceps tendon tear and the presence or absence of a infraspinatus or teres minor tendon tear ( $p = 0.17$ ).	3
73. Dubrow SA, Streit JJ, Shishani Y, Robbin MR, Gobezie R. Diagnostic accuracy in detecting tears in the proximal biceps tendon using standard nonenhancing shoulder MRI. <i>Open Access J Sports Med.</i> 2014;5:81-87.	Observational-Dx	66 patients	To evaluate the accuracy of noncontrast magnetic resonance imaging (MRI) compared to arthroscopy for the diagnosis of pathology involving the intra-articular portion of the LHB tendon.	MRI identified 29/66 (43.9%) of patients as having a pathologic lesion of the LHB tendon (19 partial and ten complete tears) while diagnostic arthroscopy identified tears in 59/66 patients (89.4%; 50 partial and 16 complete). The sensitivity and specificity of MRI for detecting partial tearing of the LHB were 27.7% and 84.2%, respectively (positive predictive value =81.2%, negative predictive value =32.0%). The sensitivity and specificity of MRI for complete tears of the LHB were 56.3% and 98.0%, respectively (positive predictive value =90.0%, negative predictive value =87.5%).	3

**Shoulder Pain-Atraumatic  
EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
74. Mohtadi NG, Vellet AD, Clark ML, et al. A prospective, double-blind comparison of magnetic resonance imaging and arthroscopy in the evaluation of patients presenting with shoulder pain. <i>J Shoulder Elbow Surg.</i> 2004;13(3):258-265.	Observational-Dx	58 patients	To determine the diagnostic ability of magnetic resonance imaging (MRI) compared with a reference standard, arthroscopy, in patients presenting with shoulder pain consistent with the signs and symptoms of shoulder impingement.	The prevalence of supraspinatus tendon, long head of the biceps tendon, and acromioclavicular joint pathology in this population was high: 79.3%, 66%, and 56%, respectively. MRI was highly accurate in detecting full-thickness supraspinatus tears and acromioclavicular joint pathology. However, it had poor concordance with arthroscopy in diagnosing pathology in the biceps tendon and in classifying the curvature of the acromion. A smaller number of other abnormal structures were identified in this population of patients, including labral abnormalities (superior labral anterior-posterior and Bankart tears), Hill-Sachs lesions, and articular surface damage.	2
75. Zanetti M, Weishaupt D, Gerber C, Hodler J. Tendinopathy and rupture of the tendon of the long head of the biceps brachii muscle: evaluation with MR arthrography. <i>AJR Am J Roentgenol.</i> 1998;170(6):1557-1561.	Observational-Dx	42 patients	To assess the diagnostic role of MR arthrography in patients with tendinopathy or rupture of the long biceps tendon.	The most reliable MR findings for tendinopathy were caliber changes (sensitivity was 59% for observer 1 and 82% for observer 2; specificity was 88% and 64%, respectively) and signal abnormalities (sensitivity, 77% and 88%, respectively; specificity, 75% and 43%, respectively) in the parasagittal plane. Absence of visualization of the tendon in the parasagittal plane was a reliable sign for rupture (sensitivity, 86% and 86%, respectively; specificity, 94% and 87%, respectively). The overall sensitivity for detecting abnormalities (tendinopathy or rupture) was 92% for observer 1 and 89% for observer 2. Specificity was 56% and 81%, respectively.	2
76. Woertler K. Multimodality imaging of the postoperative shoulder. <i>Eur Radiol.</i> 2007;17(12):3038-3055.	Review/Other-Tx	N/A	To review the most commonly used surgical procedures for treatment of anterior glenohumeral instability, lesions of the labral-bicipital complex, subacromial impingement, and rotator cuff lesions.	No results stated in abstract.	4



**Shoulder Pain-Atraumatic  
EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
77. Bancroft LW, Wasyliw C, Pettis C, Farley T. Postoperative shoulder magnetic resonance imaging. <i>Magn Reson Imaging Clin N Am.</i> 2012;20(2):313-325, xi.	Review/Other-Dx	N/A	To give a pictorial review of various expected postoperative findings in the shoulder and complications related to repair of the rotator cuff and labrum.	No results stated in abstract.	4
78. Expert Panel on MR Safety, Kanal E, Barkovich AJ, et al. ACR guidance document on MR safe practices: 2013. <i>J Magn Reson Imaging.</i> 37(3):501-30, 2013 Mar.	Review/Other-Dx	N/A	Guidance document on MR safety practices to help guide MR practitioners regarding MR safety issues and provide a basis for them to develop and implement their own MR policies and practices.	N/A	4
79. Mohana-Borges AV, Chung CB, Resnick D. MR imaging and MR arthrography of the postoperative shoulder: spectrum of normal and abnormal findings. <i>Radiographics.</i> 2004;24(1):69-85.	Review/Other-Dx	N/A	To survey conventional and new surgical procedures for the repair of shoulder impingement and instability; describe normal and abnormal findings at postoperative follow-up imaging; and compare the advantages and limitations of different MR imaging techniques and sequences in evaluation of the postoperative shoulder.	No results stated in abstract.	4
80. Spielmann AL, Forster BB, Kokan P, Hawkins RH, Janzen DL. Shoulder after rotator cuff repair: MR imaging findings in asymptomatic individuals--initial experience. <i>Radiology.</i> 1999;213(3):705-708.	Review/Other-Dx	15 patients	To assess the magnetic resonance (MR) imaging appearance of the successfully repaired rotator cuff in an asymptomatic population.	Three (10%) of 30 supraspinatus and infraspinatus tendons had normal signal intensity, and 16 (53%) had mildly increased signal intensity on fast spin-echo T2-weighted fat-saturated images, compatible with tendonitis or tendinosis. Three partial and four complete tears of the supraspinatus tendon and two partial and two complete tears of the infraspinatus tendon were seen. Other findings included subacromial-subdeltoid effusion (10 subjects), joint effusions (five subjects), and bone marrow edema (six subjects).	4

**Shoulder Pain-Atraumatic  
EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
81. Tudisco C, Bisicchia S, Savarese E, et al. Single-row vs. double-row arthroscopic rotator cuff repair: clinical and 3 Tesla MR arthrography results. BMC Musculoskelet Disord. 2013;14:43.	Observational-Tx	40 patients	To retrospectively evaluate the clinical and 3 Tesla MRA results in two groups of patients operated on for a medium-sized full-thickness rotator cuff tear with two different techniques.	The mean follow-up was 40 months in the SR group and 38.9 months in the DR group. The mean postoperative CMS was 70 in the SR group and 68 in the DR group. The mean SST score was 9.4 in the SR group and 10.1 in the DR group. The re-tear rate was 60% in the SR group and 25% in the DR group. Leakage of the contrast medium was observed in all patients.	1
82. Gulotta LV, Nho SJ, Dodson CC, Adler RS, Altchek DW, MacGillivray JD. Prospective evaluation of arthroscopic rotator cuff repairs at 5 years: part I--functional outcomes and radiographic healing rates. J Shoulder Elbow Surg. 2011;20(6):934-940.	Observational-Tx	106 patients	To prospectively evaluate the effectiveness of all-arthroscopic repairs.	At 5-years, 106 patients completed follow-up, representing 55% of the patients originally enrolled but 77% of those who returned for evaluation at 1 year. ASES scores improved from 52.6 +/- 23.2 preoperatively to 92.6 +/- 14.8 at 5 years (P < .001). Paired analyses showed no differences between the ASES scores at 2 and 5 years, but the scores improved from 1 to 5 years (P = .002). Between years 2 and 5, passive forward elevation decreased from 173 degrees +/- 10.3 degrees to 168.6 degrees +/- 16.8 degrees (P = .02) and external rotation decreased from 73.6 degrees +/- 21.3 degrees to 67.8 degrees +/- 19.6 degrees (P = .04). Patients improved a full motor grade in forward elevation and external rotation and this remained stable over time. The healing rates for all patients were 64.3% at 1 year, 75.4% at 2 years, and 81.2% at 5 years. Paired analyses showed increased healing rates from 1 to 5 years (P = .001) and from 2 to 5 years (P = .05).	2

**Shoulder Pain-Atraumatic  
EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
83. Gulotta LV, Nho SJ, Dodson CC, Adler RS, Altchek DW, MacGillivray JD. Prospective evaluation of arthroscopic rotator cuff repairs at 5 years: part II--prognostic factors for clinical and radiographic outcomes. J Shoulder Elbow Surg. 2011;20(6):941-946.	Observational-Tx	106 patients	To report prognostic factors for successful clinical and radiographic outcomes at 5 years.	At 5 years, 106 patients completed follow-up. There were no pre- or intraoperative variables that were predictive of an ASES score >90. Factors predictive of a radiographic defect were larger size of the lesion (OR 1.72, 95% CI 1.04-2.85, P = .03), multiple tendon involvement (OR 5.56, 95% CI 1.23-25.22, P = .02), older age (OR 1.15, 95% CI 1.04-1.28, P = .01), concomitant biceps (OR 16.16, 95% CI 3.01-86.65, P = .001), and acromioclavicular joint procedures (OR 6.70, 95% CI 1.46-30.73, P = .01). Radiographic healing did not correspond to clinical outcomes. Resolution of a radiographic defect was seen in 14 patients. Younger age (OR 0.84, 95% CI 0.74-0.95, P = .004) and single-tendon tears (OR 7.59, 95% CI 1.71-84.45, P = .04) were predictive.	2
84. IASP Task Force on Taxonomy. IASP Taxonomy. 2012; Available at: <a href="http://www.iasp-pain.org/Taxonomy">http://www.iasp-pain.org/Taxonomy</a> .	Review/Other-Dx	N/A	To list the taxonomy as written by the International Association for the Study of Pain	No abstract available.	4
85. Ahlawat S, Wadhwa V, Belzberg AJ, Batra K, Chhabra A. Spectrum of suprascapular nerve lesions: normal and abnormal neuromuscular imaging appearances on 3-T MR neurography. AJR Am J Roentgenol. 2015;204(3):589-601.	Review/Other-Dx	N/A	To review the normal anatomy and imaging features of various neuromuscular abnormalities related to suprascapular neuropathy.	No results stated in abstract.	4
86. Boykin RE, Friedman DJ, Higgins LD, Warner JJ. Suprascapular neuropathy. J Bone Joint Surg Am. 2010;92(13):2348-2364.	Review/Other-Tx	N/A	To review the management of patients with suprascapular neuropathy.	No results stated to abstract.	4

**Shoulder Pain-Atraumatic  
EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
87. Bredella MA, Tirman PF, Fritz RC, Wischer TK, Stork A, Genant HK. Denervation syndromes of the shoulder girdle: MR imaging with electrophysiologic correlation. <i>Skeletal Radiol.</i> 1999;28(10):567-572.	Review/Other-Dx	5 patients	To investigate the use of MR imaging in the characterization of denervated muscle of the shoulder correlated with electrophysiologic studies.	Acute/subacute denervation was best seen on T2-weighted fast spin-echo images with fat saturation, showing increased SI related to neurogenic edema. Chronic denervation was best seen on T1-weighted spin-echo images, demonstrating loss of muscle bulk and diffuse areas of increased signal intensity within the muscle. Three patients showed MR imaging and electrophysiologic findings of Parsonage Turner syndrome. One patient demonstrated an arteriovenous malformation within the spinoglenoid notch, impinging on the suprascapular nerve with associated atrophy of the infraspinatus muscle. The fifth patient demonstrated fatty atrophy of the teres minor muscle caused by compression by a cyst of the axillary nerve and electrophysiologic findings of an incomplete axillary nerve block.	4
88. Dong Q, Jacobson JA, Jamadar DA, et al. Entrapment neuropathies in the upper and lower limbs: anatomy and MRI features. <i>Radiol Res Pract.</i> 2012;2012:230679.	Review/Other-Dx	N/A	To illustrate the normal anatomy of peripheral nerves in the upper and lower limbs and to review the MRI features of common disorders affecting the peripheral nerves, both compressive/entrapment and noncompressive, involving the suprascapular nerve, the axillary nerve, the radial nerve, the ulnar nerve, and the median nerve in the upper limb and the sciatic nerve, the common peroneal nerve, the tibial nerve, and the interdigital nerves in the lower limb.	No results stated in abstract.	4

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EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
89. Kim SJ, Hong SH, Jun WS, et al. MR imaging mapping of skeletal muscle denervation in entrapment and compressive neuropathies. [Review]. <i>Radiographics</i> . 31(2):319-32, 2011 Mar-Apr.	Review/Other-Dx	N/A	To describe the MR imaging patterns of denervated muscles caused by specific entrapment or compressive neuropathies in the upper and lower extremities and to demonstrate the potential utility of MR imaging for the diagnosis of those neuropathies by mapping muscle denervation.	No results stated in abstract.	4
90. Chalian M, Faridian-Aragh N, Soldatos T, et al. High-resolution 3T MR neurography of suprascapular neuropathy. <i>Acad Radiol</i> . 2011;18(8):1049-1059.	Review/Other-Dx	13 patients	To illustrate the imaging findings on high-resolution 3T magnetic resonance neurography (MRN) in patients with suprascapular nerve (SSN) neuropathy.	Two cases were excluded due to suboptimal imaging related to motion degradation and poor signal-to-noise ratio. MRN depicted asymmetric enlargement and/or abnormal T2 hyperintensity of C5 nerve root (10/13 cases), C6 nerve root (10/13 cases), both C5 and C6 nerve roots (7/13 cases), upper trunk (11/13 cases) and SSN (11/13 cases), and other brachial plexus segments involvement (4/13 cases). MR findings of denervation changes in the ipsilateral supraspinatus and infraspinatus muscles were detected in 12/13 cases. In all seven cases where contrast-enhanced images were available, MRN demonstrated enhancement of the denervated muscles but did not provide any additional information regarding the nerve abnormality. None of the MRN studies revealed a mass lesion along the course of the SSN.	4
91. Chhabra A, Andreisek G, Soldatos T, et al. MR neurography: past, present, and future. <i>AJR Am J Roentgenol</i> . 2011;197(3):583-591.	Review/Other-Dx	N/A	To review the historic perspective of MRN, the current imaging trends of this modality, and the future directions and applications that have shown potential for improved imaging and diagnostic capabilities.	No results stated in abstract.	4

**Shoulder Pain-Atraumatic  
EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
92. Chiou HJ, Chou YH, Wu JJ, et al. Alternative and effective treatment of shoulder ganglion cyst: ultrasonographically guided aspiration. <i>J Ultrasound Med.</i> 1999;18(8):531-535.	Observational-Tx	15 patients	To evaluate the therapeutic effect of sonographically guided aspiration of shoulder ganglion cyst.	Initial sonographic imaging showed the cyst, which appeared as a localized fluid accumulation and was located between the deltoid muscle and the subscapularis tendon in seven patients, between the deltoid muscle and the biceps tendon in one patient, below the coracoacromial ligament in five patients, and over suprascapular notch area in one patient. The ganglion cysts ranged in size from 3.5 to 30 mm. The amount of aspirated fluid in each cyst varied from 0.4 to 12 ml (mean, 2.6 ml +/- 3.1) with a clear or light yellowish color and a jelly-like appearance. No major complications occurred during or after this procedure. The symptom (pain) was improved after sonographically guided aspiration in each patient. Follow-up study showed complete relief of pain in four patients, marked improvement in nine patients, and mild improvement but still persistent shoulder pain in two patients. Duration of follow-up study ranged from 2 to 24 months (mean, 6.4 months +/- 6.9). The success rate for sonographically guided aspiration was 86% on the basis of marked symptom improvement or relief.	2
93. Hashimoto BE, Hayes AS, Ager JD. Sonographic diagnosis and treatment of ganglion cysts causing suprascapular nerve entrapment. <i>J Ultrasound Med.</i> 1994;13(9):671-674.	Review/Other-Dx	N/A	To discuss the sonographic diagnosis and treatment of these ganglion cysts and the use of sonographically guided aspiration of these cysts.	No results stated in abstract.	4
94. Martinoli C, Bianchi S, Prato N, et al. US of the shoulder: non-rotator cuff disorders. <i>Radiographics.</i> 2003;23(2):381-401; quiz 534.	Review/Other-Dx	N/A	To review the major types of non-rotator cuff abnormalities that can be diagnosed with US, with emphasis on musculoskeletal anatomy, US technique, and main US findings.	No results stated in abstract.	4

**Shoulder Pain-Atraumatic  
EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
95. Greyson ND, Tepperman PS. Three-phase bone studies in hemiplegia with reflex sympathetic dystrophy and the effect of disuse. J Nucl Med. 1984;25(4):423-429.	Observational-Dx	85 patients	To look systematically at a large group of patients and to determine the radionuclide bone-image patterns occurring in them.	Nine patients (10%) had normal three-phase bone images. Fifty-five patients (65%) showed decreased blood flow and blood-pool images of the hands and wrists with normal delayed bone scintigrams, indicating the effect of paralysis or disuse. Twenty-one patients (25%) had diffuse increased uptake with periarticular accentuation, felt to be bone-scintigraphic evidence of reflex sympathetic dystrophy of the hands and wrists; in two patients this occurred before its clinical appearance. Thirteen of the 21 reflex sympathetic dystrophy syndromes (RDS)-involved limbs (62%) had increased blood flow, whereas 8 (38%) had decreased flow. Gross limb blood flow appears to be related to the degree of muscle activity, but flow may be altered by the presence of sympathetic changes. A possible dissociation between whole-limb flow and bone blood flow in paralyzed limbs involved with RDS is discussed. The elbow was involved in only one case, and a true "shoulder hand" distribution was seen in only 11 of 21 cases (52%). Five patients (6%) had leg involvement on whole-body imaging.	4
96. Kline SC, Holder LE. Segmental reflex sympathetic dystrophy: clinical and scintigraphic criteria. J Hand Surg Am. 1993;18(5):853-859.	Observational-Dx	8 patients including an additional 127 hand scans.	To evaluate the potential of three-phase radionuclide bone scan to provide objective evidence of segmental RSD.	The delayed phase of the three-phase radionuclide bone scan was found to be highly sensitive (100%) for this small group of patients. Consecutive bone scans (n = 127) performed during a 6-month period for a variety of upper extremity problems were reviewed, and a segmentally diffuse pattern of tracer uptake was found to be highly specific (98%) for segmental reflex sympathetic dystrophy.	3

**Shoulder Pain-Atraumatic  
EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
97. Park SA, Yang CY, Kim CG, Shin YI, Oh GJ, Lee M. Patterns of three-phase bone scintigraphy according to the time course of complex regional pain syndrome type I after a stroke or traumatic brain injury. Clin Nucl Med. 34(11):773-6, 2009 Nov.	Observational-Dx	50 patients	To evaluate different patterns represented on 3-phase bone scintigraphy (TPBS) according to the time course of complex regional pain syndrome (CRPS) type I (CRPS-I) after a stroke or traumatic brain injury.	In the early acute stage within 6 weeks, minimal uptake on all TPBS phases was observed in the 90% of the patients in the CRPS-I group and in 75% of the patients in the non-CRPS group. In the acute stage of CRPS in the range of 2 to 20 weeks, moderately increased uptake was seen for 78%, 83%, and 83% of the patients in the CRPS group for the 3 phases, respectively. However, only 16% of the patients in the non-CRPS group had moderately increased uptake as seen on all TPBS phases. In the late stage of more than 21 weeks, there was no distinct difference in uptake between the 2 groups. A sequential change during the time course for the CRPS-I group was statistically significant ( $P < 0.05$ ).	3
98. Ringer R, Wertli M, Bachmann LM, Buck FM, Brunner F. Concordance of qualitative bone scintigraphy results with presence of clinical complex regional pain syndrome 1: meta-analysis of test accuracy studies. [Review]. Eur J Pain. 16(10):1347-56, 2012 Nov.	Meta-analysis	12 studies	To summarize the existing evidence quantifying the concordance of qualitative BS in the presence or absence of clinical CRPS 1.	The pooled mean sensitivity of 12 two-by-two tables was 0.87 (95% CI, 0.68-0.97) and specificity was 0.69 (95% CI, 0.47-0.85). The pooled mean sensitivity for the subgroup with clearly defined diagnostic criteria (seven two-by-two tables) was 0.80 (95% CI, 0.44-0.95) and specificity was 0.73 (95% CI, 0.40-0.91).	M



**Shoulder Pain-Atraumatic  
EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
99. Schurmann M, Zaspel J, Lohr P, et al. Imaging in early posttraumatic complex regional pain syndrome: a comparison of diagnostic methods. Clin J Pain. 23(5):449-57, 2007 Jun.	Observational-Dx	175	To compare the diagnostic power of the aforementioned methods (x-ray, thermography, 3-phase bone scans, and MRI) in identifying patients with clinically diagnosed CRPS I in a group of patients with distal radial fracture.	We evaluated the changes on TPBS according to clinical stages based on time course. In the early acute stage within 6 weeks, minimal uptake on all TPBS phases was observed in the 90% of the patients in the CRPS-I group and in 75% of the patients in the non-CRPS group. In the acute stage of CRPS in the range of 2 to 20 weeks, moderately increased uptake was seen for 78%, 83%, and 83% of the patients in the CRPS group for the 3 phases, respectively. However, only 16% of the patients in the non-CRPS group had moderately increased uptake as seen on all TPBS phases. In the late stage of more than 21 weeks, there was no distinct difference in uptake between the 2 groups. A sequential change during the time course for the CPRS-I group was statistically significant ( $P < 0.05$ ).	2
100. Lee GW, Weeks PM. The role of bone scintigraphy in diagnosing reflex sympathetic dystrophy. J Hand Surg Am. 1995;20(3):458-463.	Meta-analysis	6 studies	To analyze of the literature relating three-phase bone scanning to reflex sympathetic dystrophy in the upper extremity.	The data show a wide variability in scintigraphic accuracy in patients with clinically obvious reflex sympathetic dystrophy. The results of bone scintigraphy correlate best with the clinical diagnosis of reflex sympathetic dystrophy within the first 20-26 weeks of onset. Even then, the sensitivity in the most recent series approximates 50%. After 26 weeks, there is a poor correlation between three-phase bone scanning and reflex sympathetic dystrophy.	M

**Shoulder Pain-Atraumatic  
EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
101. Wertli MM, Brunner F, Steurer J, Held U. Usefulness of bone scintigraphy for the diagnosis of Complex Regional Pain Syndrome 1: A systematic review and Bayesian meta-analysis. [Review]. PLoS ONE. 12(3):e0173688, 2017.	Meta-analysis	27 studies	To assess the impact of different RTs, specifically the Budapest criteria, and the assumed imperfect nature of the RT on the diagnostic accuracy of BS.	The pooled sensitivity was 0.804 (95% credible interval (CI) 0.225-1.0, 21 studies) and specificity 0.853 (95% CI 0.278-1.00). Sensitivity and specificity of BS increased when accounting for the imperfect nature of the RT. However, in studies using Budapest criteria as reference, the sensitivity decreased (0.551; 95% CI 0.046-1) and the specificity increased (0.935; 95% CI 0.306-1). Shorter disease duration and a higher proportion of males were associated with a higher proportion of positive BS (27 studies, disease duration <52 weeks Wilcoxon test p = 0.047, female proportion Spearman correlation -0.63, p = 0.009).	M
102. American College of Radiology. ACR Appropriateness Criteria® Radiation Dose Assessment Introduction. Available at: <a href="https://www.acr.org/-/media/ACR/Files/Appropriateness-Criteria/RadiationDoseAssessmentIntro.pdf">https://www.acr.org/-/media/ACR/Files/Appropriateness-Criteria/RadiationDoseAssessmentIntro.pdf</a> .	Review/Other-Dx	N/A	Guidance document on exposure of patients to ionizing radiation.	No results stated in abstract.	4

## Evidence Table Key

### Study Quality Category Definitions

- *Category 1* The study is well-designed and accounts for common biases.
- *Category 2* The study is moderately well-designed and accounts for most common biases.
- *Category 3* There are important study design limitations.
- *Category 4* The study is not useful as primary evidence. The article may not be a clinical study or the study design is invalid, or conclusions are based on expert consensus. For example:
  - a. The study does not meet the criteria for or is not a hypothesis-based clinical study (e.g., a book chapter or case report or case series description);
  - b. The study may synthesize and draw conclusions about several studies such as a literature review article or book chapter but is not primary evidence;
  - c. The study is an expert opinion or consensus document.
- Meta-analysis
  - a. *Good quality* – the study design, methods, analysis, and results are valid and the conclusion is supported.
  - b. *Inadequate quality* – the study design, analysis, and results lack the methodological rigor to be considered a good meta-analysis study.

## Abbreviations Key

Dx = Diagnostic

Tx = Treatment