

**Imaging After Shoulder Arthroplasty  
EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
1. Kim SH, Wise BL, Zhang Y, Szabo RM. Increasing incidence of shoulder arthroplasty in the United States. <i>J Bone Joint Surg Am.</i> 2011;93(24):2249-2254.	Review/Other-Tx	N/A	To examine recent trends in shoulder hemiarthroplasty and TSA along with the common reasons for these surgical procedures in the United States.	While the annual number of hemiarthroplasties grew steadily, the number of TSAs showed a discontinuous jump ( $P<0.01$ ) in 2004 and increased with a steeper linear slope ( $P<0.01$ ) since then. As a result, more TSAs than hemiarthroplasties have been performed annually since 2006. Approximately 27,000 TSAs and 20,000 hemiarthroplasties were performed in 2008. More than two-thirds of TSAs were performed in adults with an age of 65 years or more. Osteoarthritis was the primary diagnosis for 43% of hemiarthroplasties and 77% of TSAs in 2008, with fracture of the humerus as the next most common primary diagnosis leading to hemiarthroplasty.	4
2. Bohsali KI, Wirth MA, Rockwood CA, Jr. Complications of total shoulder arthroplasty. <i>J Bone Joint Surg Am.</i> 2006;88(10):2279-2292.	Review/Other-Tx	N/A	To review complications of TSA.	No results stated in abstract.	4
3. Ha AS, Petscavage JM, Chew FS. Current concepts of shoulder arthroplasty for radiologists: Part 2--Anatomic and reverse total shoulder replacement and nonprosthetic resurfacing. <i>AJR Am J Roentgenol.</i> 2012;199(4):768-776.	Review/Other-Dx	N/A	To provide a review of the indications for shoulder arthroplasty, describe preoperative imaging assessment, present new and modified designs of shoulder arthroplasty, illustrate normal and abnormal postoperative imaging findings, and review key radiographic measurements.	Knowledge of the physiologic purpose, orthopedic trends, imaging findings, and complications is important in assessing shoulder prostheses.	4
4. Jazayeri R, Kwon YW. Evolution of the reverse total shoulder prosthesis. <i>Bull NYU Hosp Jt Dis.</i> 2011;69(1):50-55.	Review/Other-Dx	N/A	A historical review of the evolution of reverse shoulder arthroplasty is presented, as well as the currently expanding indications for its application.	N/A	4
5. Gonzalez JF, Alami GB, Baque F, Walch G, Boileau P. Complications of unconstrained shoulder prostheses. <i>J Shoulder Elbow Surg.</i> 2011;20(4):666-682.	Review/Other-Tx	47 citations	To review the literature for complications of unconstrained shoulder prostheses.	No results stated in abstract.	4

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6. Shields E, Iannuzzi JC, Thorsness R, Noyes K, Voloshin I. Perioperative complications after hemiarthroplasty and total shoulder arthroplasty are equivalent. <i>J Shoulder Elbow Surg.</i> 2014;23(10):1449-1453.	Observational-Tx	1,718 patients	To retrospectively compare perioperative complications after hemiarthroplasty and TSA using the National Surgical Quality Improvement Program (NSQIP) database.	The database returned 1,718 patients (hemiarthroplasty in 30.4% [n = 523] and TSA in 69.6% [n = 1,195]). The major complication rates in the hemiarthroplasty group (5.2%, n = 29) and TSA group (5.1%, n = 61) were similar ( $P = .706$ ). Rates of blood transfusions for postoperative bleeding in patients undergoing hemiarthroplasty (2.3%, n = 12) and TSA (2.9%, n = 35) were indistinguishable ( $P = .458$ ). Venous thromboembolism was a rare complication, occurring in 0.4% of patients in each group (2 hemiarthroplasty patients and 5 TSA patients, $P > .999$ ). On multivariate analysis, the operative procedure was not associated with major complications ( $P = .349$ ); however, emergency case, pulmonary comorbidity, anemia with a hematocrit level lower than 36%, and wound class of III or IV increased the risk of a major complication ( $P < .05$ for all).	2
7. Cheung E, Willis M, Walker M, Clark R, Frankle MA. Complications in reverse total shoulder arthroplasty. <i>J Am Acad Orthop Surg.</i> 2011;19(7):439-449.	Review/Other-Dx	N/A	To review complications in reverse TSA.	No results stated in abstract.	4
8. Wiater BP, Moravek JE, Jr., Wiater JM. The evaluation of the failed shoulder arthroplasty. <i>J Shoulder Elbow Surg.</i> 2014;23(5):745-758.	Review/Other-Dx	N/A	To review failed shoulder arthroplasty.	The failed shoulder arthroplasty is a complex clinical entity that requires a diligent workup and a thorough knowledge of mechanisms of failure.	4
9. Sheridan BD, Ahearn N, Tasker A, Wakeley C, Sarangi P. Shoulder arthroplasty. Part 2: normal and abnormal radiographic findings. <i>Clin Radiol.</i> 2012;67(7):716-721.	Review/Other-Dx	N/A	To review the normal and abnormal appearances of shoulder arthroplasty and guide the radiology trainee and non-musculoskeletal radiologist in what to look for in the failing implant.	No results stated in abstract.	4

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10. Namdari S, Hsu JE, Baron M, Huffman GR, Glaser D. Immediate postoperative radiographs after shoulder arthroplasty are often poor quality and do not alter care. <i>Clin Orthop Relat Res.</i> 2013;471(4):1257-1262.	Observational-Dx	283 patients (Group 1) 241 patients (Group 2)	To determine whether (1) postanesthesia care unit (PACU) radiographs can reasonably serve as a baseline for future studies; and (2) routine postanesthesia care unit radiographs change clinical care. (3) Also determined the charges associated with routine postanesthesia care unit radiographs and formal radiographic interpretation of these images.	All images in Group 1 were single-view radiographs (88% internal rotation), most were underpenetrated (71%); no images changed postoperative management or were considered adequate to serve as a baseline. Group 2 radiographs were multiview radiographs, and 83% were deemed adequate to serve as baseline radiographs. Radiographic interpretation of immediate postoperative radiographs did not change the clinical course or treatment. The charges billed from radiographic evaluation in this study were \$64,524 for Group 1.	3
11. Gregory T, Hansen U, Khanna M, et al. A CT scan protocol for the detection of radiographic loosening of the glenoid component after total shoulder arthroplasty. <i>Acta Orthop.</i> 2014;85(1):91-96.	Observational-Dx	11 patients	To evaluate whether CT using a specific patient position in the CT scanner provides a better method for assessing radiolucencies in TSA.	The protocol almost completely eliminated metal artifacts in the CT images and allowed accurate assessment of periprosthetic lucency of the glenoid fixation. Positioning of the patient within the CT scanner as described was possible for all 11 patients. A radiolucent line was identified in 54 of the 55 observed CT scans and osteolysis was identified in 25 observations. The average radiolucent line Mole score was 3.4 (SD 2.7) points with plain radiographs and 9.5 (SD 0.8) points with CT scans ( $P=0.001$ ). The mean intra-observer variance was lower in the CT scan group than in the plain radiograph group ( $P=0.001$ ).	3
12. Pessis E, Campagna R, Sverzut JM, et al. Virtual monochromatic spectral imaging with fast kilovoltage switching: reduction of metal artifacts at CT. <i>Radiographics.</i> 2013;33(2):573-583.	Review/Other-Dx	N/A	To review virtual monochromatic spectral imaging with fast kilovoltage switching.	More recently, dual-energy CT has been proposed as a means of reducing beam-hardening artifacts. The use of dual-energy CT scanners allows the synthesis of virtual monochromatic spectral images. Monochromatic images depict how the imaged object would look if the x-ray source produced x-ray photons at only a single energy level. For this reason, virtual monochromatic spectral imaging is expected to provide improved image quality by reducing beam-hardening artifacts.	4

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13. Pache G, Krauss B, Strohm P, et al. Dual-energy CT virtual noncalcium technique: detecting posttraumatic bone marrow lesions--feasibility study. <i>Radiology</i> . 2010;256(2):617-624.	Observational-Dx	21 patients	To evaluate traumatized bone marrow with a dual-energy CT virtual noncalcium technique.	After exclusion of 16 regions owing to artifacts, MRI revealed 59 bone bruises in the remaining 236 regions (19/114 femoral, 40/122 tibial). Fractures were present in 8 patients. Visual rating revealed areas under the curve of 0.886 and 0.897 in the femur and 0.974 and 0.953 in the tibia for observers 1 and 2, respectively. For CT numbers, the respective areas under the curve were 0.922 and 0.974. If scores of 1 and 2 (strong or mild bone bruise) were counted as positive, sensitivities were 86.4% and 86.4% and specificities were 94.4% and 95.5% for observers 1 and 2, respectively. The kappa statistic demonstrated good to excellent agreement (femur, kappa = 0.78; tibia, kappa = 0.87).	1

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14. Hayter CL, Koff MF, Shah P, Koch KM, Miller TT, Potter HG. MRI after arthroplasty: comparison of MAVRIC and conventional fast spin-echo techniques. <i>AJR Am J Roentgenol.</i> 2011;197(3):W405-411.	Observational-Dx	122 patients	To evaluate the quality of images obtained with a prototype imaging technique, multiacquisition variable-resonance image combination, compared with fast spin-echo images in the evaluation of patients who have undergone hip, shoulder, or knee arthroplasty.	Visualization of the synovium was significantly better on multiacquisition variable-resonance image combination images than on fast spin-echo images of the hip ( $P<0.0001$ ), shoulder ( $P<0.01$ ), and knee ( $P<0.01$ ). Synovitis was detected only on the multiacquisition variable-resonance image combination images of 9 subjects (12%) who had undergone hip arthroplasty and 5 subjects (18%) who had undergone shoulder arthroplasty. Visualization of the periprosthetic bone was significantly better on multiacquisition variable-resonance image combination images of the hip ( $P<0.0001$ ), shoulder ( $P<0.0001$ ), and knee ( $P<0.01$ ). Osteolysis was detected only on the multiacquisition variable-resonance image combination images of 12 subjects (16%) who had undergone hip arthroplasty, 6 (22%) who had undergone shoulder arthroplasty, and 5 (24%) who had undergone knee arthroplasty. Visualization of the supraspinatus tendon was significantly better on multiacquisition variable-resonance image combination images ( $P<0.0001$ ). Supraspinatus tendon tears in 12 subjects (44%) were detected only on multiacquisition variable-resonance image combination images.	3
15. Nwawka OK, Konin GP, Sneag DB, Gulotta LV, Potter HG. Magnetic resonance imaging of shoulder arthroplasty: review article. <i>HSS J.</i> 2014;10(3):213-224.	Review/Other-Dx	N/A	To illustrate the benefits of MRI whether used alone or as an adjunct to other imaging modalities, in aiding the clinician in the complex decision making process.	MRI is a valuable tool in the assessment for pathology in the shoulder following arthroplasty.	4
16. Sperling JW, Potter HG, Craig EV, Flatow E, Warren RF. Magnetic resonance imaging of painful shoulder arthroplasty. <i>J Shoulder Elbow Surg.</i> 2002;11(4):315-321.	Observational-Dx	42 shoulder arthroplasties	To determine the utility of a modified MR technique in identifying pathology after shoulder arthroplasty.	At the time of revision surgery, there were full-thickness rotator cuff tears in 11/21 shoulders; MRI correctly predicted these in 10/11 shoulders. Full-thickness subscapularis tears were the most common finding (8/11 shoulders). Of the 21 shoulders, 10 did not have a rotator cuff tear, and MRI correctly predicted the absence of a tear in 8 of 10. MRI also correctly predicted glenoid cartilage wear in 8 of 9 shoulders.	3

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17. Zanetti M, Hodler J. MR imaging of the shoulder after surgery. <i>Radiol Clin North Am.</i> 2006;44(4):537-551, viii.	Review/Other-Dx	N/A	To describe postoperative MR findings relating to surgery in shoulder impingement syndrome, including rotator cuff lesions, shoulder instability, and arthroplasty.	No results stated in abstract.	4
18. Sofka CM, Adler RS. Original report. Sonographic evaluation of shoulder arthroplasty. <i>AJR Am J Roentgenol.</i> 2003;180(4):1117-1120.	Review/Other-Dx	11 patients	The authors reviewed their experience using sonography to evaluate the rotator cuff after arthroplasty.	Sonography is a useful method of imaging the rotator cuff after arthroplasty. Extended field-of-view imaging and tissue harmonic imaging aided in diagnosis by improving visualization of regional anatomic landmarks and increasing conspicuity of small tendon tears.	4
19. Haddock TA, van Holsbeeck MT, Girish G, et al. Value of ultrasound before joint aspiration. <i>AJR Am J Roentgenol.</i> 2013;201(3):W453-459.	Review/Other-Dx	N/A	To illustrate and discuss the value of US screening before joint aspiration.	Before joint aspiration, US assessment of the overlying and surrounding soft tissues requires little time and is relatively inexpensive. Bursal fluid collections, soft-tissue abscesses, and other fluid collections that would be undetected with fluoroscopy or blind aspiration can thus be identified. US screening before joint aspiration can aid diagnosis and decrease the risk of iatrogenic complications.	4
20. Wukich DK, Abreu SH, Callaghan JJ, et al. Diagnosis of infection by preoperative scintigraphy with indium-labeled white blood cells. <i>J Bone Joint Surg Am.</i> 1987;69(9):1353-1360.	Observational-Dx	50 patients	The authors reviewed the records of patients who had suspected osteomyelitis or suspected infection about a total joint prosthesis and who underwent scintigraphy with Tc-99m methylene diphosphonate and scintigraphy with In-111 oxide-labeled WBCs before an open surgical procedure.	Group I was composed of 24 patients each of whom had prosthesis in place and complained of pain. Group II was composed of 26 patients for whom a diagnosis of chronic osteomyelitis had to be considered. With the indium scans alone, there was only 1 false-negative result (in Group II), but there were 18 false-positive results (8 patients in Group II and 10 patients in Group I). Although scintigraphy with indium-labeled WBCs is quite sensitive, it is not specific in detecting chronic osteomyelitis; a negative scan should be considered highly suggestive that osteomyelitis is not present. Specificity can be increased by interpreting the indium scan in conjunction with the technetium scan.	3

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21. Johnson JA, Christie MJ, Sandler MP, Parks PF, Jr., Homra L, Kaye JJ. Detection of occult infection following total joint arthroplasty using sequential technetium-99m HDP bone scintigraphy and indium-111 WBC imaging. <i>J Nucl Med.</i> 1988;29(8):1347-1353.	Observational-Dx	28 patients with 29 joint arthroplasties	To examine the sensitivity and specificity of In-111 WBC imaging in the preoperative determination of periprosthetic infection in patients with painful loose total joint arthroplasties.	The sensitivity of preoperative aspiration cultures was 12%, with a specificity of 81% and an accuracy of 58%. The sensitivity of In-111 WBC imaging alone was 100%, with a specificity of 50% and an accuracy of 65%. When correlated with the bone scintigraphy and read as sequential Tc-99m HDP/In-111 WBC imaging, the sensitivity was 88%, specificity 95%, and accuracy 93%.	3
22. Palestro CJ, Kim CK, Swyer AJ, Capozzi JD, Solomon RW, Goldsmith SJ. Total-hip arthroplasty: periprosthetic indium-111-labeled leukocyte activity and complementary technetium-99m-sulfur colloid imaging in suspected infection. <i>J Nucl Med.</i> 1990;31(12):1950-1955.	Observational-Dx	72 patients with 92 (68 primary, 24 revision) cemented THAs	To report the patterns of periprosthetic labeled leukocyte activity in 92 cemented total-hip arthroplasties, as well as the results of combined In-111-labeled leukocyte and Tc-99m sulfur colloid imaging of 50 of these arthroplasties.	Though present in all 23 infected arthroplasties, periprosthetic activity was also present in 77% of uninfected arthroplasties, and was greater than the contralateral zone 51% of the time. When analyzed by zone, head zone activity was the best criterion for infection (87% sensitivity, 94% specificity, 92% accuracy). 50 of the arthroplasties were studied with combined labeled leukocyte/sulfur colloid imaging. Using incongruence of images as the criterion for infection, the sensitivity, specificity, and accuracy of the study were 100%, 97%, and 98%, respectively. While variable periprosthetic activity makes labeled leukocyte imaging alone unreliable for diagnosing hip arthroplasty infection, the addition of sulfur colloid imaging results in a highly accurate diagnostic procedure.	3
23. Hansford BG, Stacy GS. Musculoskeletal aspiration procedures. <i>Semin Intervent Radiol.</i> 2012;29(4):270-285.	Review/Other-Dx	N/A	To discuss the appropriate indications, contraindications, and general technique for accessing the major joints via imaging guidance. For each joint, we discuss pertinent anatomy, appropriate imaging modalities, and preferred approaches to gaining intra-articular access. Additionally, the article discusses some of the more frequently encountered juxta-articular and intramuscular fluid collections that can be accessed and aspirated via percutaneous intervention, with mention of the importance of recognizing extremity sarcomas that can mimic these benign collections.	One of the most commonly performed image-guided musculoskeletal interventions is the diagnostic and therapeutic percutaneous aspiration and drainage of multiple types of intra-articular, juxta-articular, and intramuscular pathologic fluid collections. These procedures may be performed under fluoroscopic, US, CT, or even MR guidance depending on the location to be accessed, type of pathology, patient characteristics, and physician preferences.	4

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24. Lin HM, Learch TJ, White EA, Gottsegen CJ. Emergency joint aspiration: a guide for radiologists on call. <i>Radiographics</i> . 2009;29(4):1139-1158.	Review/Other-Dx	N/A	To review the clinical and imaging findings of septic arthritis and briefly discuss various other disease entities that may have a similar appearance at imaging. Thus, the article provides a guide for radiologists who may be asked to perform emergent aspirations either during their daily work or while on call.	No results stated in abstract	4
25. Fox TJ, Foruria AM, Klika BJ, Sperling JW, Schleck CD, Cofield RH. Radiographic survival in total shoulder arthroplasty. <i>J Shoulder Elbow Surg</i> . 2013;22(9):1221-1227.	Observational-Dx	151 shoulders	To assess radiographic and clinical failure in shoulder arthroplasty, identifying factors predictive of loosening.	52/151 glenoid components (34%) showed a shift in position or a complete lucent line $\geq 1.5$ mm. 4 humeral components (3%) shifted or showed a 2-mm lucency in 3 zones. Component survival (Kaplan-Meier) free from radiographic failure at 5 and 10 years were 99% (95% CI) (98%–100%) and 67% (95% CI) (58%–78%). Glenoid components with lines at the keel on initial radiographs were at risk for radiographic failure, HR 4.6, 95% CI, 1.2-17.2, $P=.02$ . No associations were found between radiographic survival and age, gender, diagnosis, glenoid erosion, and preoperative or early subluxation. Late subluxation superiorly was associated with the glenoid at risk for radiographic failure ( $P=.006$ ). Glenoid component survivals free from revision at 5 and 10 years for the 302 shoulders were 99% (95% CI) (97%–100%) and 93% (95% CI) (90%–97%).	2
26. Vidil A, Valenti P, Guichoux F, Barthas JH. CT scan evaluation of glenoid component fixation: a prospective study of 27 minimally cemented shoulder arthroplasties. <i>Eur J Orthop Surg Traumatol</i> . 2013;23(5):521-525.	Review/Other-Dx	26 patients (27 shoulders)	To evaluate the bone integration of the flanged central peg, using CT scan to measure bone ingrowth, and to show a correlation with good clinical results and longevity of the glenoid component.	Improvement of postoperative Constant score and radiographic good results were correlated with satisfactory subjective results reported by patients. The authors observed radiolucent lines under glenoid component in 3 cases. 26 CT scans were available at 1 year: it showed complete bone integration around the central peg in 21 cases and partial peripheral bone integration in 4 cases. Only 1 patient had any tissue integration around the peg, probably because of his implantation near cortical bone of scapular spine.	4



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27. Franklin JL, Barrett WP, Jackins SE, Matsen FA, 3rd. Glenoid loosening in total shoulder arthroplasty. Association with rotator cuff deficiency. <i>J Arthroplasty</i> . 1988;3(1):39-46.	Review/Other-Dx	7 cases and 16 controls	Cases of TSA exhibiting major glenoid radiolucent lines or actual translation of the glenoid component were evaluated to identify factors associated with glenoid loosening.	6 of the patients had severe, incompletely reconstructable rotator cuff tears present at the time of surgery, and one patient developed a cuff tear within 1 year of surgery. The amount of superior migration of the humeral component was closely correlated with the degree of glenoid loosening. With superior displacement of the humeral component, superior tipping of the glenoid component was observed: a "rocking horse" glenoid. The control group had no glenoid loosening an average of 5 years after operation. Upward riding of the prosthetic humeral head in patients with rotator cuff deficiency may contribute to loosening of the glenoid component in TSA.	4
28. Walch G, Badet R, Boulahia A, Khoury A. Morphologic study of the glenoid in primary glenohumeral osteoarthritis. <i>J Arthroplasty</i> . 1999;14(6):756-760.	Observational-Dx	113 osteoarthritic shoulders	To study the natural course and the possibility of making a prognostic classification of glenoid morphology in primary glenohumeral osteoarthritis.	3 main glenoid types were defined: Type A, Type B, Type C. Type A (59%) was marked by a well-centered humeral head and a balanced distribution of strengths against the surface of the glenoid. The symmetric erosion was explained by the absence of subluxation. In Type B (32%), the posterior subluxation of the humeral head was responsible for the asymmetric load against the glenoid and was implicated in the development of primary glenohumeral osteoarthritis, particularly the exaggerated posterior wear pattern. Type C (9%) was defined by a glenoid retroversion of more than 25 degrees, regardless of erosion; retroversion was primarily of dysplastic origin and explained the early event of osteoarthritis. In primary glenohumeral osteoarthritis, this classification of the glenoid can discriminate retroversion between posterior erosion and dysplasia.	4

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29. Lazarus MD, Jensen KL, Southworth C, Matsen FA, 3rd. The radiographic evaluation of keeled and pegged glenoid component insertion. <i>J Bone Joint Surg Am.</i> 2002;84-A(7):1174-1182.	Observational-Dx	328 patients	To evaluate the ability of a group of experienced shoulder surgeons to achieve complete cementing and support in a series of patients managed with keeled and pegged glenoid components.	Radiolucencies were extremely common, with only 20 of the 328 glenoids demonstrating no radiolucencies. On a numeric scale (with 0 indicating no radiolucency and 5 indicating gross loosening), the mean radiolucency score was 1.8 +/- 0.9 for keeled components and 1.3 +/- 0.9 for pegged components ( $P=0.0004$ ). After defining categories of "better" and "worse" cementing, the authors found that pegged components more commonly had "better cementing" than did keeled components ( $P=0.0028$ ). Incomplete seating was also common, particularly among patients with keeled components. 95 of the 121 pegged components that had been inserted by the most experienced surgeon had "better cementing," compared with 85 of the 168 pegged components that had been inserted by the remaining surgeons ( $P<0.00001$ ).	2
30. Martin SD, Zurakowski D, Thornhill TS. Uncemented glenoid component in total shoulder arthroplasty. Survivorship and outcomes. <i>J Bone Joint Surg Am.</i> 2005;87(6):1284-1292.	Review/Other-Dx	147 consecutive TSAs performed in 132 patients	To evaluate the results of TSA with an uncemented glenoid component and to identify predictors of glenoid component failure.	Radiolucency was noted around the glenoid component and/or screws in 53 of the 140 shoulders. The mean modified ASES (American Shoulder and Elbow Surgeons) score (and SD) improved from 15.6 +/- 11.8 points preoperatively to 75.8 +/- 17.5 points at the time of follow-up. 85 shoulders were not painful, 42 were slightly or mildly painful, 10 were moderately painful, and 3 were severely painful. 15 (11%) of the glenoid components failed clinically, and 10 of them also had radiographic signs of failure. 11 other shoulders had radiographic signs of failure but no symptoms at the time of writing. 3 factors had a significant independent association with clinical failure: male gender ( $P=0.02$ ), pain ( $P<0.01$ ), and radiolucency adjacent to the flat tray ( $P<0.001$ ). In addition, the annual risk of implant revision was nearly 7 times higher for patients with radiographic signs of failure. Clinical survivorship was 95% at 5 years and 85% at 10 years.	4

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31. Favard L, Katz D, Colmar M, Benkalfate T, Thomazeau H, Emily S. Total shoulder arthroplasty - arthroplasty for glenohumeral arthropathies: results and complications after a minimum follow-up of 8 years according to the type of arthroplasty and etiology. <i>Orthop Traumatol Surg Res.</i> 2012;98(4 Suppl):S41-47.	Observational-Tx	198 shoulders	To evaluate the rate of complications and the functional improvement with different types of shoulder arthroplasties after a minimum follow-up of 8 years.	In the group with primary osteoarthritis of the shoulder, there were 8 complications (11%) including 6 (8.3%) requiring implant revision. In the group of rotator cuff arthropathies, there were 9 (14.7%) complications including 4 (6.5%) requiring implant revision. In the group with rheumatoid arthritis, there was 1 complication, and no surgical revision was necessary. There were no complications in the group with avascular necrosis. Glenoid migration occurred in 28.5% of anatomic TSA, and 3.4% of reverse arthroplasties. This difference was significant ( $P<0.001$ ). The Constant-Murley score was significantly improved in all etiologies.	2
32. Cil A, Veillette CJ, Sanchez-Sotelo J, Sperling JW, Schleck CD, Cofield RH. Survivorship of the humeral component in shoulder arthroplasty. <i>J Shoulder Elbow Surg.</i> 2010;19(1):143-150.	Review/Other-Tx	1423 patients	To determine long-term survivorship of humeral components and investigate the risk factors associated with humeral component removal or revision.	There were 108 revisions and 17 removals of the humeral component. Estimates of survivorship free of revision or removal of the humeral component for any reason was 94.8% (95% CI, 93.6–96.0) at 5 years, 92.0% (95% CI, 90.4–93.6) at 10 years, 86.7% (95% CI, 84.2–89.4) at 15 years, and 82.8% (95% CI, 78.5–87.5) at 20 years. Younger age, male gender, replacement due to post-traumatic arthritis, an uncemented component, and use of a metal-backed glenoid component increased the likelihood of humeral component failure.	4
33. Melis B, DeFranco M, Ladermann A, et al. An evaluation of the radiological changes around the Grammont reverse geometry shoulder arthroplasty after eight to 12 years. <i>J Bone Joint Surg Br.</i> 2011;93(9):1240-1246.	Observational-Tx	65 patients	To analyze radiological changes and differences between cemented and uncemented components of Grammont reverse shoulder arthroplasties (DePuy).	A scapular notch was observed in 60 shoulders (88%) and was associated with the superolateral approach ( $P=0.009$ ). Glenoid radiolucency was present in 11 (16%), bony scapular spur and/or ossifications in 51 (75%), and subsidence of the stem and humeral radiolucency in more than 3 zones were present in 3 (8.8%) and in 4 (11.8%) of 34 cemented components, respectively, and in 1 (2.9%) and 2 (5.9%) of 34 uncemented components, respectively. Radiological signs of stress shielding were significantly more frequent with uncemented components ( $P<0.001$ ), as was resorption of the greater ( $P<0.001$ ) and lesser tuberosities ( $P=0.009$ ).	2

\* See Last Page for Key

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34. Bauer TW, Parvizi J, Kobayashi N, Krebs V. Diagnosis of periprosthetic infection. <i>J Bone Joint Surg Am.</i> 2006;88(4):869-882.	Review/Other-Dx	N/A	A review on tests used to diagnose periprosthetic infections.	No results stated in abstract.	4
35. Pottinger P, Butler-Wu S, Neradilek MB, et al. Prognostic factors for bacterial cultures positive for <i>Propionibacterium acnes</i> and other organisms in a large series of revision shoulder arthroplasties performed for stiffness, pain, or loosening. <i>J Bone Joint Surg Am.</i> 2012;94(22):2075-2083.	Review/Other-Dx	193 shoulder arthroplasty revisions	The authors determined clinically relevant prognostic evidence that could help to guide treatment decisions.	108 of the 193 revision arthroplasties were associated with positive cultures; 70% of the positive cultures demonstrated growth of <i>Propionibacterium acnes</i> . The rate of positive cultures per shoulder increased with the number of culture specimens obtained from each shoulder. 55% of the positive cultures required observation for more than 1 week. Male sex, humeral osteolysis, and cloudy fluid were each associated with significant increases of $\geq 600\%$ in the likelihood of obtaining a positive <i>Propionibacterium acnes</i> culture. Humeral loosening, glenoid wear, and membrane formation were associated with significant increases of $>300\%$ in the likelihood of obtaining a positive <i>Propionibacterium acnes</i> culture.	4
36. Sperling JW, Kozak TK, Hanssen AD, Cofield RH. Infection after shoulder arthroplasty. <i>Clin Orthop Relat Res.</i> 2001;382:206-216.	Review/Other-Tx	Group 1–20 patients (21 shoulders); Group 2–6 patients (6 shoulders); Group 3–2 patients (2 shoulders); Group 4–3 patients (3 shoulders)	To examine infection after shoulder arthroplasty.	Reinfection has not occurred in any of these patients. At final follow-up, patients with a prosthesis in situ had better pain relief and shoulder function than patients treated with resection arthroplasty. Delayed reimplantation may offer the best hope for pain relief, eradication of infection, and maintenance of shoulder function.	4
37. Tigges S, Stiles RG, Roberson JR. Appearance of septic hip prostheses on plain radiographs. <i>AJR Am J Roentgenol.</i> 1994;163(2):377-380.	Review/Other-Dx	20 hip prostheses	To evaluate the spectrum of plain radiographic findings in patients with septic hip prostheses.	Findings were normal in 10 prostheses, but nonfocal lucencies mimicking mechanical loosening were seen in 4 cases. 2 cases showed focal bone loss, indistinguishable from aggressive granulomatosis. A variety of findings, including subsidence and periostitis, were seen in the remaining 4 prostheses.	4
38. Zimmerli W, Trampuz A, Ochsner PE. Prosthetic-joint infections. <i>N Engl J Med.</i> 2004;351(16):1645-1654.	Review/Other-Dx	N/A	To offer guidance in establishing the diagnosis of prosthetic joint infections correctly and an algorithm to summarize the appropriate medical and surgical options.	No results stated in abstract.	4

**Imaging After Shoulder Arthroplasty  
EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
39. Small KM, Siegel EJ, Miller LR, Higgins LD. Imaging characteristics of lesser tuberosity osteotomy after total shoulder replacement: a study of 220 patients. <i>J Shoulder Elbow Surg.</i> 2014;23(9):1318-1326.	Review/Other-Dx	362 patients	To retrospectively assess lesser tuberosity osteotomy healing from routine postoperative radiographs and CT scans when available, at a minimum of 6 months of follow-up.	Of 362 patients investigated, 220 had a minimum of 6 months of radiographic follow-up. The lesser tuberosity osteotomy site was not seen in 37 patients; of the remaining 183, 159 patients (86.89%) demonstrated bony union, 8.80% of whom were smokers; 16 patients (8.74%) demonstrated nondisplaced nonunion, 6.3% of whom were smokers; and 8 patients (4.3%) demonstrated displaced nonunion, 25.0% of whom were smokers. Overall, 19 of the 24 nonunions were in male patients (79.1%) and 5 were in female patients (20.8%).	4
40. Amstutz HC, Campbell P, Kossovsky N, Clarke IC. Mechanism and clinical significance of wear debris-induced osteolysis. <i>Clin Orthop Relat Res.</i> 1992(276):7-18.	Review/Other-Dx	N/A	To review the mechanism and clinical significance of wear debris induced osteolysis.	Macrophages activated by the phagocytosis of particulate wear debris are the key cells in this process, which can potentially occur in any implant system regardless of implant design or fixation mode. This is because each implant system creates wear debris from the articulating surfaces and the interfaces. The clinical consequences of wear debris cover a broad spectrum from radiolucencies to massive osteolysis and implant failure. For this reason, the reduction of wear debris should be a primary goal of orthopedic research in the future.	4
41. Harris WH, Schiller AL, Scholler JM, Freiberg RA, Scott R. Extensive localized bone resorption in the femur following total hip replacement. <i>J Bone Joint Surg Am.</i> 1976;58(5):612-618.	Review/Other-Dx	4 total hip replacements	To observe extensive localized bone resorption within the femur after 4 total hip replacements.	While the exact mechanism of this serious complication is unclear, the findings suggest that a benign, noninflammatory, adverse tissue response can occur in relation to the femoral components of total hip replacements that are not rigidly fixed. In all 4 hips, reimplantation of a new total hip replacement was successful after follow-up of 13 to 18 months.	4

**Imaging After Shoulder Arthroplasty  
EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
42. Schmalzried TP, Jasty M, Harris WH. Periprosthetic bone loss in total hip arthroplasty. Polyethylene wear debris and the concept of the effective joint space. <i>J Bone Joint Surg Am.</i> 1992;74(6):849-863.	Review/Other-Dx	34 hips	To examine hips in which there had been prosthetic replacement. In all hips, there was careful documentation of the anatomical location of the material that had been obtained for histological analysis, and the specific purpose of the removal of the tissue was for examination to determine the cause of the resorption of bone.	The number of macrophages in a microscopic field was directly related to the amount of particulate polyethylene debris that was visible by light microscopy. Although the gross radiographic appearances of linear bone loss and lytic bone loss were different, the histological appearance of the regions in which there was active bone resorption was similar. Regardless of the radiographic appearance and anatomical origin of the specimen, bone resorption was found to occur in association with macrophages that were laden with polyethylene debris.	4
43. Kepler CK, Nho SJ, Bansal M, et al. Radiographic and histopathologic analysis of osteolysis after total shoulder arthroplasty. <i>J Shoulder Elbow Surg.</i> 2010;19(4):588-595.	Review/Other-Dx	52 patients	To analyze clinical, radiographic, and histologic data from failed TSAs to determine factors associated with osteolysis.	In the osteolysis group, 20% had screw fixation compared with 2.5% without osteolysis ( $P=.039$ ). The radiolucency score was significantly higher in the osteolysis group: 12.7 +/- 2.0 vs 8.7 +/- 3.7 ( $P=.003$ ). Wear analysis of the osteolysis group demonstrated significant increases in third-body particles compared with those implants without osteolysis ( $P=.004$ ). Histology available from retrieved implants demonstrated particulate debris in 62% of patients with osteolytic lesions vs 67% without osteolytic lesions ( $P>.05$ ).	4

**Imaging After Shoulder Arthroplasty  
EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
44. Wirth MA, Agrawal CM, Mabrey JD, et al. Isolation and characterization of polyethylene wear debris associated with osteolysis following total shoulder arthroplasty. <i>J Bone Joint Surg Am.</i> 1999;81(1):29-37.	Observational-Tx	3 shoulders	To evaluate the interface membranes surrounding three total shoulder prostheses that had been removed because of progressive aseptic loosening associated with osteolysis.	The particles from the hips had a mean equivalent circle diameter (and standard error of the mean) of 0.62 +/- 0.03 micrometer, were predominantly globular in shape, and had low mean values for aspect ratio (1.46 +/- 0.02) and elongation (1.85 +/- 0.03) and relatively high values for roundness (0.74 +/- 0.01) and form factor (0.87 +/- 0.01). In contrast, the particles from the shoulders had a mean equivalent circle diameter of 1.04 +/- 0.03 micrometers. In addition, they had relatively high values for aspect ratio (2.36 +/- 0.07) and elongation (4.96 +/- 0.23) and correspondingly low values for roundness (0.54 +/- 0.01) and form factor (0.67 +/- 0.01), indicating that they were more fibrillar in shape. The particles from the shoulders and those from the hips were significantly different ( $P < 0.0001$ ) with respect to all of the descriptors except outline fractal dimension. The particles from the shoulders, in general, were larger and more fibrillar than the particles from the hips.	2
45. Mallo GC, Burton L, Coats-Thomas M, Daniels SD, Sinz NJ, Warner JJ. Assessment of painful total shoulder arthroplasty using computed tomography arthrography. <i>J Shoulder Elbow Surg.</i> 2015;24(10):1507-1511.	Observational-Dx	14 patients	To assess the accuracy of CT arthrography when evaluating glenoid component stability in the setting of postarthroplasty shoulder pain.	CT arthrography suggested glenoid component loosening in 8/14 patients (57.1%), and arthroscopic inspection identified loosening in 10/14 patients (71.4%). In 3/10 patients (30%), CT arthrography suggested a well-fixed glenoid component, but gross loosening was identified during arthroscopy. In this study, CT arthrography yielded a sensitivity of 70%, a specificity of 75%, a positive predictive value of 87.5%, and a negative predictive value of 50.0%.	3

**Imaging After Shoulder Arthroplasty  
EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
46. Singh JA, Sperling JW, Schleck C, Harmsen WS, Cofield RH. Periprosthetic infections after total shoulder arthroplasty: a 33-year perspective. <i>J Shoulder Elbow Surg.</i> 2012;21(11):1534-1541.	Observational-Tx	2,207 patients underwent 2,588 primary TSAs	To examine the rates and predictors of deep periprosthetic infections after primary TSA.	Mean follow-up was 7 years (SD, 6 years), and the mean body mass index was 30 kg/m <sup>2</sup> (SD, 6 kg/m <sup>2</sup> ). The American Society of Anesthesiologists class was 1 or 2 in 61% of cases. 32 confirmed deep periprosthetic infections occurred during follow-up. In earlier years, <i>Staphylococcus</i> predominated; in recent years, <i>Propionibacterium acnes</i> was almost as common. The 5-, 10-, and 20-year prosthetic infection-free rates were 99.3% (95% CI, 98.9–99.6), 98.5% (95% CI, 97.8–99.1), and 97.2% (95% CI, 96.0–98.4), respectively. On multivariable analysis, a male patient had a significantly higher risk of deep periprosthetic infection (HR, 2.67 [95% CI, 1.22–5.87]; <i>P</i> =.01) and older age was associated with lower risk (HR, 0.97 [95% CI, 0.95–1.00] per year; <i>P</i> =.05).	2
47. Sperling JW, Hawkins RJ, Walch G, Zuckerman JD. Complications in total shoulder arthroplasty. <i>J Bone Joint Surg Am.</i> 2013;95(6):563-569.	Review/Other-Tx	N/A	To review complications in TSA.	No results stated in abstract.	4
48. Farshad M, Gerber C. Reverse total shoulder arthroplasty—from the most to the least common complication. <i>Int Orthop.</i> 2010;34(8):1075-1082.	Review/Other-Tx	N/A	To identify and understand the most common and most serious complications of reverse TSA and to review current methods of prevention and treatment.	Reverse TSA is associated with a high rate of complications. Their incidence and the results of their treatment are inconsistently reported. To document and then prevent complications, a standardized monitoring tool including clear definitions and assessment instructions appears necessary.	4



**Imaging After Shoulder Arthroplasty  
EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
49. Jerosch J, Schneppenheim M. Management of infected shoulder replacement. <i>Arch Orthop Trauma Surg.</i> 2003;123(5):209-214.	Review/Other-Tx	12 patients	To present treatment options and results for patients with infected shoulder alloarthroplasties.	The time between explanation and reimplantation ranged between 4 weeks and 6 months. With the temporary spacer, an anatomically stable condition could be established for all patients, and reconstruction of the humeral length even in long implants was possible. All patients underwent physiotherapy with the temporary spacer in place. A positive intraoperative microbiologic specimen was only found in 4 patients. In both group 1 and 2 patients, the infection healed, and thus the original implant could be kept in situ. In 8 patients, the temporary spacer was removed and exchanged for a regular implant. The postoperative raw Constant score at the time of the last follow-up examination was 48, due mainly to a loss of motion and power. All shoulders were stable, and the elbow function was good.	4
50. Dodson CC, Craig EV, Cordasco FA, et al. Propionibacterium acnes infection after shoulder arthroplasty: a diagnostic challenge. <i>J Shoulder Elbow Surg.</i> 2010;19(2):303-307.	Review/Other-Dx	11 patients	To review a series of patients diagnosed with Propionibacterium acnes infection after shoulder arthroplasty in order to describe its clinical presentation, the means of diagnosis, and provide options for treatment.	5 patients had an initial diagnosis of infection and underwent implant removal, placement of an antibiotic spacer, and staged reimplantation after a course of intravenous antibiotics. In the remaining 6 patients, surgical treatment varied according to the clinical diagnosis. When infection was recognized by intraoperative cultures, antibiotics were initiated. The average initial erythrocyte sedimentation rate and C-reactive protein values were 33 mm/h and 2 mg/dL, respectively. The average number of days from collection to a positive culture was 9. All cultures were sensitive to penicillin and clindamycin and universally resistant to metronidazole.	4

**Imaging After Shoulder Arthroplasty  
EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
51. Singh JA, Sperling J, Schleck C, Harmsen W, Cofield R. Periprosthetic fractures associated with primary total shoulder arthroplasty and primary humeral head replacement: a thirty-three-year study. <i>J Bone Joint Surg Am.</i> 2012;94(19):1777-1785.	Observational-Tx	2,207 patients treated with 2,588 primary TSAs and 1,349 patients treated with 1,431 humeral head replacements	To assess the frequency of, and risk factors for, periprosthetic fractures during and after shoulder arthroplasty.	72 medical-record-confirmed periprosthetic fractures occurred in association with the TSAs. These consisted of 47 intraoperative fractures (40 humeral fractures, 5 glenoid fractures, and 2 fractures for which the site was unclear) and 25 postoperative fractures (20 humeral fractures, 3 glenoid fractures, and 2 fractures for which the site was unclear). There were 33 fractures associated with the humeral head replacements. 15 were intraoperative (8 humeral fractures and 7 glenoid fractures), and 18 were postoperative (16 humeral fractures and 2 glenoid fractures). In the multivariable regression analysis of the TSAs, female sex (OR, 4.19; 95% CI, 1.82 to 9.62; $P<0.001$ ; a 2.4% rate for women vs 0.6% for men) and the underlying diagnosis ( $P=0.04$ ; posttraumatic arthritis: OR, 2.55; 95% CI, 0.92 to 7.12) were associated with a significantly higher risk of intraoperative humeral fracture in general, and female sex was associated with the risk of intraoperative humeral shaft fracture (OR, infinity; $P<0.001$ ). In combined analyses of all patients (treated with either TSA or humeral head replacement), a higher Deyo-Charlson index was significantly associated with an increased risk of postoperative periprosthetic humeral shaft fracture (OR, 1.27; 95% CI, 1.11 to 1.45); $P<0.001$ ), after adjusting for the type of surgery (TSA or humeral head replacement).	3
52. Steiner GM, Sprigg A. The value of ultrasound in the assessment of bone. <i>Br J Radiol.</i> 1992;65(775):589-593.	Review/Other-Dx	N/A	Case report on the value of US in the assessment of bone.	No results stated in abstract.	4

**Imaging After Shoulder Arthroplasty  
EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
53. Armstrong A, Lashgari C, Teefey S, Menendez J, Yamaguchi K, Galatz LM. Ultrasound evaluation and clinical correlation of subscapularis repair after total shoulder arthroplasty. <i>J Shoulder Elbow Surg.</i> 2006;15(5):541-548.	Observational-Dx	23 patients (30 shoulders)	To document the subscapularis healing rate by use of postoperative US and correlate healing to physical examination findings.	Of 30 shoulders, 26 (87%) had an intact subscapularis as determined by US. By use of US as the gold standard, the abdominal-compression test had 7 false-positive results, 3 false-negative results, 19 true-negative results, and 1 true-positive result. The sensitivity of the abdominal-compression test was 25%, and the specificity was 73%. The negative predictive value was 86%, and the positive predictive value was 13%. The abdominal-compression test demonstrated a low sensitivity, specificity, and positive predictive value in this study for the assessment of subscapularis function after TSA.	3
54. Beltran J, Gray LA, Bools JC, Zuelzer W, Weis LD, Unverferth LJ. Rotator cuff lesions of the shoulder: evaluation by direct sagittal CT arthrography. <i>Radiology.</i> 1986;160(1):161-165.	Review/Other-Dx	direct sagittal CT - 42 patients, 6 healthy volunteers, 2 cadaver shoulders Axial CT - 41 patients	To compare the accuracy of Axial CT and direct sagittal CT in the evaluation of rotator cuff lesions of the shoulder.	17 patients had normal shoulders. Axial CT scanning and direct sagittal CT together enabled correct identification of all lesions and were markedly superior to plain-film arthrography. Direct sagittal CT enabled diagnosis of all cases of complete rotator cuff tear plus 3 cases of incomplete tear and 3 of rotator cuff atrophy not identified by the other techniques. Axial CT scanning was better than direct sagittal CT for diagnosis of Bankart lesions.	4
55. Goutallier D, Postel JM, Bernageau J, Lavau L, Voisin MC. Fatty muscle degeneration in cuff ruptures. Pre- and postoperative evaluation by CT scan. <i>Clin Orthop Relat Res.</i> 1994(304):78-83.	Review/Other-Dx	63 patients	A preoperative CT scan grading muscular fatty degeneration in 5 stages was done in 63 patients scheduled for repair of a torn rotator cuff. The results were compared with postoperative evaluation done after a mean of 17.7 months in 57 patients. Postoperative arthrographies were also performed in 56 patients.	Preoperative CT scans demonstrated that infraspinatus fatty degeneration can occur in the presence of large anterosuperior tears even when the infraspinatus tendon is not torn; it worsens with time. The subscapularis rarely degenerates, and when it does it degenerates moderately, even when its tendon is not torn. After an effective surgical repair, moderate supraspinatus degeneration regressed in 6 of 14 patients; that of the infraspinatus never regressed but rather, increased, in three patients.	4

**Imaging After Shoulder Arthroplasty  
EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
56. van de Sande MA, Stoel BC, Obermann WR, Tjong a Lieng JG, Rozing PM. Quantitative assessment of fatty degeneration in rotator cuff muscles determined with computed tomography. <i>Invest Radiol.</i> 2005;40(5):313-319.	Experimental-Dx	30 shoulders	To determine whether a quantitative measurement of muscle density using CT was more reliable and reproducible.	A strong correlation was found between the quantitative measure and the visual rating ( $R^2 = 0.94$ ; $P < 0.0001$ ). The SD of the differences in muscle density did not exceed 2.3 Hounsfield units, and the mean rotator cuff interclass correlation coefficient (0.98) was substantially greater than that of the visual rating (0.63).	3
57. Gupta RK, Mehta VS, Banerji AK, Jain RK. MR evaluation of brachial plexus injuries. <i>Neuroradiology.</i> 1989;31(5):377-381.	Review/Other-Dx	10 cases	Cases of brachial plexus injury were subjected to MR to demonstrate the roots, trunks, divisions or cord abnormalities.	Initial experience suggests that MR may be the diagnostic procedure of choice for complete evaluation of brachial plexus injuries.	4
58. Roger B, Travers V, Laval-Jeantet M. Imaging of posttraumatic brachial plexus injury. <i>Clin Orthop Relat Res.</i> 1988(237):57-61.	Observational-Dx	220 patients	The authors present the results of 103 myelographies, 48 CT scans combined with standard myelography, and 25 series of images obtained by MRI. To evaluate precisely the type and level of injury, the accuracy of these 3 techniques was compared with clinical and operative findings.	The accuracy of myelography was considered good in 84% of the cases, but 4% were evaluated as false positive results and 12% as false negative or doubtful results. The combined CT scan and myelography reduced the number of doubtful results and accuracy reached 94.25%, but they did not visualize the roots distal to the spinal foramina. MRI correlated well with CT scan images and, in addition, offered visualization of distal radicular injuries.	3

**Imaging After Shoulder Arthroplasty  
EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
59. 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 MR neurography in patients with suprascapular nerve neuropathy.	2 cases were excluded due to suboptimal imaging related to motion degradation and poor signal-to-noise ratio. MR neurography 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 suprascapular nerve (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 7 cases where contrast-enhanced images were available, MR neurography demonstrated enhancement of the denervated muscles but did not provide any additional information regarding the nerve abnormality. None of the MR neurography studies revealed a mass lesion along the course of the suprascapular nerve.	4
60. Luigetti M, Pravata E, Colosimo C, et al. MRI neurography findings in patients with idiopathic brachial plexopathy: correlations with clinical-neurophysiological data in eight consecutive cases. <i>Intern Med.</i> 2013;52(18):2031-2039.	Review/Other-Dx	8 patients	To describe the clinical, electrophysiological and radiological findings of 8 consecutive patients with idiopathic brachial plexopathy.	The authors confirmed the primary role of clinical and neurophysiological evaluations in the diagnosis of idiopathic brachial plexopathy and demonstrate the usefulness of brachial plexus MR neurography for confirming the presence of inflammatory changes. In patients with idiopathic brachial plexopathy, MR neurography is a helpful tool for excluding different etiologies, such as compression or tumor formation, and/or confirming inflammatory changes.	4
61. Fuchs B, Weishaupt D, Zanetti M, Hodler J, Gerber C. Fatty degeneration of the muscles of the rotator cuff: assessment by computed tomography versus magnetic resonance imaging. <i>J Shoulder Elbow Surg.</i> 1999;8(6):599-605.	Experimental-Dx	41 patients	To test the hypothesis that parasagittal MRI scans, which are currently used for assessment of rotator cuff muscle atrophy, should allow a reliable assessment of the degree of fatty degeneration of the rotator cuff muscles. The authors investigated the correlation between the established CT-based assessment of fatty degeneration according to Goutallier and the assessment of fatty degeneration on parasagittal MRI scans.	Interobserver reproducibility for grading fatty degeneration was good to excellent for CT and for MRI. The correlation between MRI and CT was fair to moderate and remained unsatisfactory, even if the classification system was simplified with only a 3- rather than a 5-grade scale as originally proposed. The degree of fatty degeneration was significantly related to the amount of atrophy of the respective muscles.	2

**Imaging After Shoulder Arthroplasty  
EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
62. Zanetti M, Gerber C, Hodler J. Quantitative assessment of the muscles of the rotator cuff with magnetic resonance imaging. <i>Invest Radiol.</i> 1998;33(3):163-170.	Review/Other-Dx	70 asymptomatic subjects 30 patients with different stages of rotator cuff tears and 10 patients with glenohumeral instability	To establish a MRI standard for quantification of the muscles of the rotator cuff.	Cross-sectional areas of the muscles of the rotator cuff were variable in asymptomatic subjects. Cross-sectional areas (but not signal intensities) did discriminate patients with different stages of rotator cuff tears from asymptomatic subjects. The tangent sign was negative in all asymptomatic subjects but positive in 4 and 9 of 10 patients with medium and large rotator cuff tears, respectively.	4
63. Demondion X, Herbinet P, Boutry N, Fontaine C, Francke JP, Cotten A. Sonographic mapping of the normal brachial plexus. <i>AJNR Am J Neuroradiol.</i> 2003;24(7):1303-1309.	Review/Other-Dx	12 healthy adult volunteers	To demonstrate that mapping of the brachial plexus may be performed by means of US.	A satisfactory US examination was performed in 10/12 volunteers, leading to a good association with anatomic sections. 2 volunteers were excluded from the study because a clear depiction of the brachial plexus was difficult owing to a short neck and low echogenicity at examination. The association between US images and anatomic sections allowed the authors to map the brachial plexus. The subclavian and deep cervical arteries were useful landmarks for this mapping. The eighth cervical nerve root and the first thoracic nerve root were the most difficult part of the brachial plexus to depict because of their deep location.	4
64. Martinoli C, Gandolfo N, Perez MM, et al. Brachial plexus and nerves about the shoulder. <i>Semin Musculoskelet Radiol.</i> 2010;14(5):523-546.	Review/Other-Dx	N/A	To review the use of MRI and US in the imaging of brachial plexus and nerves about the shoulder.	No results stated in abstract.	4
65. Sheppard DG, Iyer RB, Fenstermacher MJ. Brachial plexus: demonstration at US. <i>Radiology.</i> 1998;208(2):402-406.	Review/Other-Dx	5 healthy volunteers	To determine the feasibility of imaging the brachial plexus with US and to establish a standard examination technique.	The roots, trunks, and cords could be identified in the supraclavicular and infraclavicular regions. The roots within the neural foramina and the epidural space could not be evaluated. US may play a complementary role in the evaluation of patients with brachial plexopathy.	4

**Imaging After Shoulder Arthroplasty  
EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
66. Tagliafico A, Altafini L, Garello I, Marchetti A, Gennaro S, Martinoli C. Traumatic neuropathies: spectrum of imaging findings and postoperative assessment. <i>Semin Musculoskelet Radiol.</i> 2010;14(5):512-522.	Review/Other-Dx	N/A	Article describes the imaging features of traumatic peripheral nerve lesions. The role of diagnostic imaging in stretching injuries, contusion trauma, penetrating wounds, and after surgery is discussed.	A multimodality diagnostic approach including physical examination, electrophysiology, and US and MRI allows an accurate evaluation of most peripheral nerves. Imaging assessment of peripheral nerves trauma is useful for the diagnosis, follow-up, and postoperative evaluation.	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.
- M = Meta-analysis

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Dx = Diagnostic

Tx = Treatment

## Abbreviations Key

CI = Confidence interval

CT = Computed tomography

HR = Hazard ratio

MRI = Magnetic resonance imaging

OR = Odds ratio

SD = Standard deviation

TSA = Total shoulder arthroplasty

US = Ultrasound

WBC = White blood cell