| Bibliographic Cite | PMID Link | Literature Type | Level of Evidence | Purpose | Population | Intervention and Outcome Measures | Results/ Recommendations | Study Limitiations |
|---|---|---|---|---|---|---|---|---|
| Gyftopoulos S, Cardoso MD, Rodrigues TC, et al. Postoperative imaging of the rotator cuff: A systematic review and meta-analysis. AJR Am J Roentgenol. 2022; 219(5):717-723. | 35642759 | Systematic Review and Meta-analysis | moderate | To evaluate MRI and US in terms of diagnosing retear of a repaired rotator cuff tendon using a systematic review and meta-analysis. | Inclusion criteria consisted of original research studies that assessed the diagnostic accuracy of MRI and US (index tests) for the diagnosis of rotator cuff tendon retear after prior rotator cuff repair using surgical findings as the reference standard. Eight studies (MRI, n = 6; US, n = 2) satisfied inclusion and exclusion criteria, consisting of 304 total patients (MRI, n = 221; US, n = 83) and 309 shoulders (MRI, n = 226; US, n = 83). | A comprehensive literature search was performed on the main concepts of MRI (including noncontrast MRI and MR arthrography), US, and rotator cuff repairs. QUADAS-2 was used to assess methodologic quality. Meta-analyses were performed to compare MRI and US studies in the diagnosis of all retears and of full-thickness retears. Study variation was analyzed using the Cochran Q test and I2 statistic. | Two studies had high risk of bias in terms of applicability to clinical practice because of patient selection. Five studies had potential risk of bias in two categories, whereas two had potential risk of bias in three categories. For all retears, mean sensitivity and specificity for MRI were 81.4% (95% CI, 73.3–87.5%) and 82.6% (95% CI, 76.3–87.5%) and 83.7% (95% CI, 67.4–92.7%) and 90.7% (95% CI, 73.6–97.1%) for US. For full-thickness retears, mean sensitivity and specificity for MRI were 85.9% (95% CI, 80.2–90.2%) and 89.1% (95% CI, 84.6–92.4%) and 89.7% (95% CI, 75.6–96.1%) and 91.0% (95% CI, 75.5–97.1%) for US. There was no significant difference in terms of sensitivity or specificity for either comparison (p = .28–.76). Authors conclude that the analyses revealed no significant difference between US and MRI for the diagnosis of rotator cuff tendon tears after prior cuff repair. | First, the included studies varied in factors such as study design and imaging techniques. Second, there was possible publication bias if studies were not published because of negative results. Third, the US sample was small, with only two studies and a total of 83 shoulders included in the analysis. The difference in size between the US and MRI groups may have resulted in selection bias, as the patients in each group may not be similar to each other. |
| Lenza M, Buchbinder R, Takwoingi Y, Johnston RV, Hanchard NCA, Faloppa F. Magnetic resonance imaging, magnetic resonance arthrography and ultrasonography for assessing rotator cuff tears in people with shoulder pain for whom surgery is being considered. Cochrane Database of Systematic Reviews 2013, Issue 9. Art. No.: CD009020. | 24065456 | Systematic Review | moderate | To compare the diagnostic test accuracy of MRI, MRA and US for detecting any rotator cuff tears (i.e. partial or full thickness) in people with suspected rotator cuff tears for whom surgery is being considered. | We included all prospective diagnostic accuracy studies that assessed MRI, MRA or US against arthroscopy or open surgery as the reference standard, in people suspected of having a partial or full thickness rotator cuff tear. We excluded studies that selected a healthy control group, or participants who had been previously diagnosed with other specific causes of shoulder pain such as osteoarthritis or rheumatoid arthritis. | Two review authors independently extracted data on study characteristics and results of included studies, and performed quality assessment according to QUADAS criteria. Our unit of analysis was the shoulder. For each test, estimates of sensitivity and specificity from each study were plotted in ROC space and forest plots were constructed for visual examination of variation in test accuracy. Meta-analyses were performed using the bivariate model to produce summary estimates of sensitivity and specificity. We were unable to formally investigate potential sources of heterogeneity because of the small number of studies. | We included 20 studies of people with suspected rotator cuff tears (1147 shoulders), of which six evaluated MRI and US (252 shoulders), or MRA and US (127 shoulders) in the same people. Overall, the methodological quality of the studies was judged to be low or unclear. Meta-analyses were not possible for studies that assessed MRA for detection of any rotator cuff tears or partial thickness tears. We found no statistically significant differences in sensitivity or specificity between MRI and US for detecting any rotator cuff tears (P = 0.13), or for detecting partial thickness tears (P = 1.0). Similarly, for the comparison between MRI, MRA and US for detecting full thickness tears, there was no statistically significant difference in diagnostic performance (P = 0.7). For any rotator cuff tears, the summary sensitivity and specificity were 98% (95% CI 92% to 99%) and 79% (95% CI 68% to 87%) respectively forMRI (6 studies, 347 shoulders), and 91% (95% CI 83% to 95%) and 85% (95% CI 74% to 92%) respectively for US (13 studies, 854 shoulders). For full thickness tears, the summary sensitivity and specificity were 94% (95% CI 85% to 98%) and 93% (95% CI 83% to 97%) respectively for MRI (7 studies, 368 shoulders); 94% (95% CI 80% to 98%) and 92% (95% CI 83% to 97%) respectively for MRA (3 studies, 183 shoulders); and 92% (95% CI 82% to 96%) and 93% (95% CI 81% to 97%) respectively for US (10 studies, 729 shoulders). | 1) We observed considerable variation in results between studies, especially for US studies.<br>2. Criteria for test positivity (index tests and reference standard) varied between studies<br>3. We could not formally investigate potential sources of heterogeneity due to the number of studies available for each test or because most studies reported the same value for a covariate.<br>4. Our findings were based on small studies with poor reporting of patient characteristics and study design.<br>5. Because there were few comparative studies, test comparisons relied on indirect evidence which may be confounded by dif ferences in patient and study design characteristics.<br>6. No study evaluated MRA, MRI and US in the same population. |
| Liu F, Dong J, Shen WJ, et al. Detecting rotator cuff tears: A network meta-analysis of 144 diagnostic studies. Orthop J Sports Med. 2020; 8(2):2325967119900356. | 32076627 | Meta-analysis | moderate | To determine which of 3 commonly used imaging modalities is optimal for the diagnosis of rotator cuff tears (RCTs). | The inclusion criteria were studies that (1) involved human patients; (2) assessed the diagnostic performance of imaging modalities for RCTs; (3) provided raw data to calculate diagnostic parameters, including the true positive, false positive, false negative, and true negative; and (4) included a surgical (open or arthroscopic) reference standard, that is, surgical findings to prove/disprove the imaging findings. The exclusion criteria were the following: (1) commentaries, letters, case reports, reviews, or congress proceedings; (2) studies involving animal and cadaveric experiments; (3) studies providing insufficient data to calculate diagnostic parameters; and (4) non–English language studies. | Studies evaluating the performance of magnetic resonance imaging (MRI), magnetic resonance arthrography (MRA), and ultrasound (US) used in the detection of RCTs were retrieved from the PubMed/MEDLINE and Embase databases. Diagnostic data were extracted from articles that met the inclusion/exclusion criteria. A network meta-analysis was performed using an armbased model to pool the absolute sensitivity and specificity, relative sensitivity and specificity, and diagnostic odds ratio as well as the superiority index for ranking the probability of these techniques. | A total of 144 studies involving 14,059 patients (14,212 shoulders) were included in this network meta-analysis. For the detection of full-thickness (FT) tears, partial-thickness (PT) tears, or any tear, MRA had the highest sensitivity, specificity, and superiority index. For the detection of any tear, MRI had better performance than US (sensitivity: 0.84 vs 0.81, specificity: 0.86 vs 0.82, and superiority index: 0.98 vs 0.22, respectively). With regard to FT tears, MRI had a higher sensitivity and superiority index than US (0.91 vs 0.87 and 0.67 vs 0.28, respectively) and a similar specificity (0.88 vs 0.88, respectively). The results for PT tears were similar to the detection of FT tears. A sensitivity analysis was performed by removing studies involving only 1 arm for FT tears, PT tears, or any tear, and the results remained stable. Conclusion: This network meta-analysis of diagnostic tests revealed that high-field MRA had the highest diagnostic value for detecting any tear, followed by low-field MRA, high-field MRI, high-frequency US, low-field MRI, and low-frequency US. These findings can help guide clinicians in deciding on the appropriate imaging modality. | The authors acknowledge several limitations in this network metaanalysis: "we assessed the diagnostic value of the imaging modalities alone. The roles of patient history and physical examination results were not evaluated. Real-life situations, such as MRI with physical tests and US with physical tests, were not analyzed side by side. Several subgroup analyses, such as specific tendon-based analyses, were implemented based on insufficient data, which makes the results open to question. Insufficient data alsomade it impossible to conduct several subgroup analyses, including the diagnostic value of<br>3 imagingmodalities for different types of partial tears, such as superficial tears, partial articular supraspinatus tendon avulsion lesions, or interstitial tears. Unfortunately, many other imaging diagnostic measures could not be included in our analysis because of the limited number of studies; these included arthro–computed tomography, which is considered by some surgeons to be the gold standard for diagnosing FT RCTs, and standard radiography, which is regarded as the first choice for the diagnosis of shoulder pain. Additionally, the diagnostic ability of these imaging modalities in evaluating rotator cuff repair postoperatively was not studied." |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Malavolta EA, Assuncao JH, Conforto Gracitelli ME, Yen TK, Bordalo-Rodrigues M, Ferreira Neto AA. Accuracy of magnetic resonance imaging (MRI) for subscapularis tear: A systematic review and meta-analysis of diagnostic studies. Arch Orthop Trauma Surg. 2019; 139(5):659-667. | 30539284 | Systematic Review and Meta-analysis | low | To determine, through a systematic review and meta-analysis, the diagnostic accuracy of MRI in the detection of subscapularis tendon tears. | All diagnostic accuracy studies that directly compared the accuracy of a MRI (index test) to arthroscopic surgical findings (reference test) for subscapularis tendon tear were included. Inclusion criteria for these studies were: absolute (raw) data on subscapularis tears (full or partial thickness, or both) in the form of true positives (TPs), true negatives (TNs), false positives (FPs), and false negatives (FNs), either provided or extractable; arthroscopy surgical reference standards; and diagnostic imaging studies interpreted by radiologists or orthopedic surgeons. Both prospective and retrospective studies were included, even when the analysis was performed after surgery. Cadaver, animal, and pediatric subject studies were excluded. We also excluded studies that presented data on rotator cuff tears, but had no adequate data on subscapularis tears for meta-analysis. Studies that primarily investigated the rotator cuff but presented data on subscapularis tears as a secondary outcome were included. | A systematic review of PubMed, EMBASE, and MEDLINE databases up to April 2017 was performed. All studies assessing the sensitivity and specificity of the MRI (index test) compared to arthroscopic surgical findings (reference test) for subscapularis tendon tear were included. A meta-analysis was performed to calculate pooled sensitivity, specificity, sROC curve, and diagnostic odds ratio values. | A total of 497 citations were identified. After applying the eligibility criteria, 14 articles were included, including 1858 shoulders with 613 subscapularis tears. For overall subscapularis tears, sensitivity was 0.68 (95% CI 0.64–0.72) and specificity was 0.90 (95% CI 0.89–0.92). Sensitivity was 0.93 (95% CI 0.83–0.98) for full-thickness tears and 0.74 (95% CI 0.66–0.82) for partial tears. Specificity was 0.97 (95% CI 0.94–0.98) for full-thickness tears and 0.88 (95% CI 0.85–0.91) for partial tears. Analyzing only studies with field of strength ≥ 1.5 T, sensitivity was 0.80 (95% CI 0.76–0.84) and specificity 0.84 (95% CI 0.81–0.87). MRI is an accurate method for diagnosing subscapularis tendon tears; however, its accuracy is lower than that of overall rotator cuff tears, due to its lower sensitivity. | Our study has several limitations. The number of included studies is relatively small when compared to systematic reviews evaluating the rotator cuff tears in general, including posterosuperior tears. Most studies included have a retrospective design, and none describe surgeon blinding, which increases the risk of collection bias. The group of patients studied is not standardized, and some articles evaluate only patients with rotator cuff disorders, while others evaluate all types of arthroscopy. The time between MRI and arthroscopy, which ranged from 1 day to 6 months, may also be a possible criticism. |
| Roy J-S, Braen C, Leblond J, Desmeules F, Dionne CE, MacDermid JC, Bureau NJ, Fremont P. Diagnostic accuracy of ultrasonography, MRI and MR arthrography in the characterisation of rotator cuff disorders: A systematic review and meta-analysis. British Journal of Sports Medicine 2015; 49(20):1316-1328. | 25677796 | Meta-analysis | high | The primary objective of this study was to perform a systematic review with a meta-analysis on the diagnostic accuracy of US, MRI and MRA for the characterization of tendinopathy, partial thickness RC tears and full-thickness RC tears in individuals with shoulder pain. Secondary objectives were to compare the accuracy of these imaging modalities depending on the inclusion criteria of participants in the studies, as well as regarding the technological characteristics of the equipment used in the included studies. Finally, since US is used at the point of care, another secondary analysis was to assess the diagnostic accuracy by radiologists and non radiologists. | Articles were included if they met the following inclusion criteria: (1) included adult participants with shoulder pain; (2) used MRI, MRA or US as index test, and surgery (arthroscopy or open surgery) as reference standard; (3) reported on diagnostic accuracy of medical imaging for the characterisation of an RC disorder (tendinitis/tendinosis/tendinopathy (subacromial impingement syndrome), full or partial RC tears). | A systematic search in three databases was conducted. Two raters performed data extraction and evaluation of risk of bias independently, and agreement was achieved by consensus. Hierarchical summary receiver-operating characteristic package was used to calculate pooled estimates of included diagnostic studies. Data were extracted for participants' characteristics, index test used including specific equipment's characteristics, reference standard (who administered the tests, time between the tests). Data on diagnostic accuracy were also extracted. The risk of bias was evaluated for each article with the QUADAS 2. | Diagnostic accuracy of US, MRI and MRA in the characterisation of full-thickness RC tears was high with overall estimates of sensitivity and specificity over 0.90. As for partial RC tears and tendinopathy, overall estimates of specificity were also high (>0.90), while sensitivity was lower (0.67–0.83). Diagnostic accuracy of US was similar whether a trained radiologist, sonographer or orthopaedist performed it. Results show the diagnostic accuracy of US, MRI and MRA in the characterisation of fullthickness RC tears. Since full thickness tear constitutes a key consideration for surgical repair, this is an important characteristic when selecting an imaging modality for RC disorder. When considering accuracy, cost, and safety, US is the best option. | With the statistical package used in the present study, we were able to calculate confidence and credible intervals for the overall sensitivity and specificity, but not for the likelihood ratios. No method was found to calculate CIs around the likelihood ratios that are derived from overall estimates of sensitivity and specificity. Other limitations include that 47 studies were specifically excluded because of incomplete data reporting (unable to construct a 2×2 table). There were also recurrent sources of bias on three of the four items of the QUADAS 2 tool, which shows poor reporting of participants' characteristics and study design for the included studies. |
| Smith TO, Drew BT, Toms AP. A meta-analysis of the diagnostic test accuracy of MRA and MRI for the detection of glenoid labral injury. Archives of Orthopaedic and Trauma Surgery 2012a; 132(7):905-919. | 22395821 | Meta-analysis | moderate | To determine the diagnostic accuracy of MRI or MRA in the detection of gleniod labral lesions. | To be included in the meta-analysis, studies had to compare the ability of MRI or MRA (index test) to assess gleniod labral tears, when verified with a surgical procedure (arthroscopy or open surgery—reference test). In general, subjects were recruited into these studies with a presentation of shoulder instability and a clinical suspicion of a labral tear. To avoid verification bias, we only included studies which evaluated each test (MRI or MRA) on their entire study cohort. We included studies based on all study designs, English and all foreign language publications, while excluding for cadaver, animal and paediatric subject studies. | A systematic review was undertaken of the electronic databases Cochrane Central Register of Controlled Trials, MEDLINE, EMBASE, AMED and CINAHL, in addition to a search of unpublished literature databases. All studies which compared the ability of MRI or MRA (index test) to assess gleniod labral tears or lesions, when verified with a surgical procedure (arthroscopy or open surgery—reference test) were included. Data extraction and methodological appraisal using the QUADAS tool were both conducted by two reviewers independently. Data were analysed through a summary receiver operator characteristic curve and pooled sensitivity and specificity analysis were calculated with 95% confidence intervals. | Sixty studies including 4,667 shoulders from 4,574 patients were reviewed. There appeared slightly greater diagnostic test accuracy for MRA over MRI for the detection of overall gleniod labral lesions (MRA sensitivity 88%, specificity 93% vs. MRI sensitivity 76% vs. specificity 87%). Methodologically, studies recruited and identified their samples appropriately and clearly defined the radiological procedures. In general, it was not clearly defined why patients were lost during the study, and studies were poor at recording whether the same clinical data were available to the radiologist interpreting the MRI or MRA as would be available in clinical practice. Most studies did not state whether the surgeon interpreting the arthroscopic procedure was blinded to the results of the MR or MRA imaging. Based on the available literature, overall MRA appeared marginally superior to MRI for the detection of glenohumeral labral lesions. | Results should be viewed with some caution given the recurrent methodological limitations in not clearly defining why patients were lost during the studies, limited reporting of the use of clinical data by the reporters, and the blinding, or not, of arthroscopists to pre-operative MR results. One major limitation to this study and the overall evidence base may be the reliance on shoulder arthroscopy for the verification of radiological findings. |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Vopat ML, Peebles LA, McBride T, et al. Accuracy and reliability of imaging modalities for the diagnosis and quantification of Hill-Sachs lesions: A systematic review. Arthroscopy. 2021; 37(1):391-401. | 32798670 | Systematic Review | moderate | To determine the reliability and accuracy of different imaging modalities in assessing Hill-Sachs lesions within the setting of anterior shoulder instability. | Clinical trials and cadaveric studies were considered eligible if they were published in the English language and included the following criteria: accuracy and reliability of humeral head bone loss imaging and clinical relevance in anterior shoulder instability. The exclusion criteria were as follows: animal studies; imaging studies without measures of accuracy, reliability, or clinical predictive power; studies of shoulder injuries without humeral head bone loss; case reports; presentations; abstracts; reviews; editorials; and surveys. | A systematic review was performed according to the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-analyses) guidelines using the PubMed, Scopus, Embase, and Cochrane Library databases. The search terms included “imaging” OR “radiographic” OR “CT” OR “MRI” AND “Hill-Sachs” OR “humeral head bone loss.” Assessment of the methodologic quality of the included studies was performed using the original Quality Assessment of Diagnostic Accuracy Studies (QUADAS) tool. | Forty studies (2,560 shoulders) met the inclusion criteria and were assessed. For diagnosing the presence of Hill-Sachs lesions, computed tomography (CT) arthrography had the highest reported accuracy (median, 91%; range, 66%-100%). For the same assessment, CT arthrography also had the greatest reported sensitivity (median, 94%; range, 50%-100%). For the quantification of Hill-Sachs lesion parameters, reported intraobserver reliabilities were highest for 3-dimensional (3D) CT (intraclass correlation coefficient [ICC] range, 0.916-0.999), followed by 2-dimensional CT (ICC range, 0.858-0.861) and magnetic resonance imaging (MRI) (ICC range, 0.28-0.97). For the same quantification parameters, interobserver reliabilities were also reported for 3D CT (ICC range, 0.772-0.996), 2-dimensional CT (ICC range, 0.721-0.879), and MRI (k range, 0.444-0.700). Intraobserver reliabilities for determining glenoid tracking were only reported for 3D CT (k range, 0.730-1.00; ICC range, 0.803-0.901) and MRI (ICC range, 0.770-0.790). Conclusions: This study shows that the current literature supports a variety of different imaging modalities that provide clinically acceptable accuracy in diagnosing and quantifying Hill-Sachs lesions, as well as determining whether they will cause persistent anterior shoulder instability. | First, because this study was only a systematic review and given the current literature’s heterogeneity, this study was unable to provide a statistical analysis or formal meta-analysis-thus, in turn, limiting our final conclusion provided from this study’s results. Second, this study included results from studies fromlower levels of evidence; this again is because of the limitations in the current literature. Finally, this study did not look at any other financial components in terms of price, utility, and radiation exposure. Thus, all these variables should atleast be considered inmaking the final decision in how to manage one’s patients. |