

Smith TO, Drew BT, Toms AP. A meta-analysis of the diagnostic test accuracy of MRA and MRI for the detection of glenoid labrum injury. Arch Orthop Trauma Surg 2012;132:905-919.

Design: meta-analysis of the accuracy of diagnostic tests

Research question: is MRA more accurate than MRI at diagnosing glenoid labrum lesions:

PICOS:

- Patient population: patients recruited into published studies with a presentation of shoulder instability and a clinical suspicion of a labral tear
- Intervention: MRI or MRA of the shoulder
- Comparison: findings of labral injury at the time of open or arthroscopic surgery
- Outcomes: comparative test accuracy of MRI and MRA using sensitivity and specificity as criteria of accuracy
- Study types: unrestricted on design, excluding cadaver, animal, and pediatric studies

Study search and inclusion:

- Databases included MEDLINE, EMBASE, CINAHL, the Cochrane Register of Controlled Trials, and others
- Two authors assessed the studies for inclusion; the articles had to compare MRI or MRA with a surgical procedure as the reference test, with the stipulation that the entire study cohort had to be evaluated for each test
- Study quality was assessed with a standardized form which has 14 criteria, including a representative spectrum of patients, clear selection criteria, an appropriate reference (gold) standard to classify the target condition, a time period between the index test and the reference test short enough to be reasonably sure that the target condition has not changed, ensuring that the index test was interpreted without knowledge of the reference test and vice versa, ensuring that the same reference standard was applied regardless of the results of the index tests, reporting of uninterpretable results, accounting for withdrawals from the study, and having the same clinical data available to the test interpreters that would normally be available to clinicians evaluating the patients

Results:

- 296 articles were identified from the literature search, and 60 studies of 4574 patients were deemed to have met the inclusion criteria
- 45 studies reported the accuracy of MRA and 26 reported the accuracy of MRI
- For each imaging type, there was variation in the field strength of the magnet

- For MRA, 4 studies had 0.2T, 1 study had 0.5T, 6 had 1.0T, 30 had 1.5T, and 4 had 3.0T
- For MRI, 4 had 0.2T magnets, 3 had 1.0T, 17 had 1.5T, and 2 had 3.0T
- Most studies (n=41) had a musculoskeletal radiologist interpret the tests; 13 had a general radiologist interpret the tests, and orthopedic surgeons interpreted the tests in 2 studies
- For overall accuracy of the detection of glenoid labral lesions, there was a trend (16 studies for MRI, 30 for MRA) toward greater accuracy of MRA over MRI (the 95% confidence intervals did not overlap)
 - For MRA the sensitivity was 0.88 (95% CI from 0.86 to 0.90); for MRI the sensitivity was 0.76 (95% CI from 0.72 to 0.80)
 - For MRA the specificity was 0.93 (95% CI from 0.92 to 0.95); for MRI the specificity was 0.87 (95% CI from 0.84 to 0.90)
- For anterior labrum lesions, with data from 5 studies for MRI and 11 for MRA, MRI appeared somewhat more accurate than MRA
 - Sensitivity of MRI was 0.92 (95% CI from .088 to 0.96) and for MRA it was 0.84 (95% CI from 0.79 to 0.89); the overlapping confidence intervals may or may not be statistically significant
 - Specificity of MRI was 0.98 (95% CI from 0.98 to 0.99); specificity of MRA was 0.93 (95% CI from 0.90 to 0.95)
- For posterior labral lesions, with data from 4 studies for MRI and 9 for MRA, MRI and MRA were not significantly different, with sensitivities of MRI/MRA being 0.66/0.70 and specificity of 0.98/0.97
- Similar to posterior lesions, with data from 3 studies for MRI and 6 for MRA, the detection of superior labral lesions differed little between MRI/MRA, with sensitivities 0.84/0.89 and specificities 0.74/0.75
- Other comparisons were also made, including SLAP lesions, with data from 9 studies for MRI and 15 for MRA
 - Sensitivity for MRI was 0.79 (95% CI from 0.75 to 0.83); for MRA, it was 0.83 (95% CI from 0.79 to 0.87); the confidence intervals clearly overlap
 - Specificity for MRI was 0.87 (95% CI from 0.83 to 0.91); for MRA it was 0.93 (95% CI from 0.90 to 0.96)

Authors' conclusions:

- The overall accuracy of MRA is superior to that of MRI for the detection of glenohumeral labral lesions
 - For SLAP lesions, MRA is more accurate than MRI
 - For posterior and superior labrum lesions, there appear to be no appreciable differences between MRI and MRA
 - For anterior labral lesions, MRI was more accurate than MRA

- However, these results should be viewed with some caution given the methodological limitations and lack of reporting of some features of the studies which can bias the results
- There was not enough data to compare different field strengths, but a 3T machine may be more accurate than the 1.5T machines which were used in most of the included studies
- The optimum shoulder position for detecting labral lesions is not known; abduction and external rotation may optimize the penetration of contrast material into a labral tear, but this is not certain
- Musculoskeletal radiologists are likely to be more successful in interpreting MRI and MRA; the results of the included studies were predominantly interpreted by musculoskeletal radiologists, and this should be considered when generalizing these findings into clinical practice
- There is some variability in the nomenclature of labral lesions; SLAP lesions could have been the same as superior labral lesions as defined in different studies
- The performance of different magnetic field strengths should be evaluated by further research

Comments:

- The comparisons between MRA and MRI are mostly indirect (there are few direct head-to-head comparisons of MRI and MRA in the same patient population)
 - o The indirect nature of the comparisons means that they could be subject to confounding if different kinds of patients are sent for MRA and MRI
 - o At least 3 of the included studies did compare both MRA and MRI to surgical findings, and all 3 reported MRA more sensitive than MRI
 - Magee 2008 is in English; Herold 2003 and Wallny 1998 are in German but have abstracts in English
 - Magee 2008 was done with a 3T machine, and the goal of the study was to compare MRA and MRI at this field strength to see whether arthrography was necessary with such a strong magnet
 - Both MRA and MRI were close to 100% specific, but MRA had a sensitivity of 0.98 (0.89 to 1.00), while MRI had sensitivity of 0.92 (0.70 to 0.99)
- The comparisons of MRI and MRA are of diagnostic test accuracy only, and not on whether MRA leads to superior clinical outcomes
 - o However, this goal would be very difficult to achieve, since the number of lesions missed by MRI and detected by MRA would be fairly small, and the consequences of the missed diagnoses would be difficult to detect
- More direct head-to-head comparisons would have shed more light on the differential accuracies of MRI and MRA, but the overall analysis is likely to be correct; there is a

marginal difference between MRA and MRI with MRA having higher sensitivity and specificity than MRA

- The analyses do not report confidence intervals for the differences in sensitivity and specificity, but the Cochrane Handbook (Bossuyt 2010) endorses the reporting of confidence intervals for the tests being compared and allows the inference that non-overlapping CI's mean that the differences are not due to chance

Assessment: High quality meta-analysis supporting good evidence that MRA is marginally more sensitive and specific for the detection of many glenohumeral labral lesions, including SLAP lesions

References:

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Herold T, Hente R et al. Indirekte MR-Arthrographie der Schulter-Wertigkeit im Nachweis von SLAP-Läsionen. Fortschr Roentgenstr 2003; 175: 1508–1514

Magee T. 3-T MRI of the Shoulder: Is MR Arthrography Necessary? AJR 2009; 192:86–92.

Wallny T, Sommer T et al. . Klinische und kernspintomographische Diagnostik von Labrumglenoidale-Verletzungen. Unfallchirurg 1998;101:613-618