

Arthrogram or No Arthrogram? MRI versus MR Arthrogram Accuracy and Precision in Determining Labral Tear Extent as a Function of Time from Shoulder Dislocation

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INTRODUCTION:

It remains unclear the comparative diagnostic utility of non-arthrogram and arthrogram Magnetic Resonance Imaging (MRI) in determining labral tear size in the shoulder in relation to time from shoulder injury. Hypothetically, routine non-arthrogram MRI can accurately detect labral pathology in the setting of acute shoulder injury due to persistence of hemarthrosis or effusion acting as fluid contrast. However, as time progresses and effusion resolves, the diagnostic value of routine MRI may drop. It is unclear the time from injury at which point an MR arthrogram may present with improved clinical value. The aim of this study was to determine the comparative accuracy and precision of routine MRI and MR arthrogram in measuring labral tear size as a function of time from shoulder injury, and to identify a post-injury timepoint after which MR arthrogram supersedes MRI in diagnostic utility for labral tear extent.

METHODS:

We retrospectively evaluated a consecutive series of patients who underwent primary arthroscopic labral repair between January 2012 and December 2021 who have also completed a preoperative MRI or MR arthrogram of the shoulder. Patients with an identifiable date of anterior shoulder instability event were included. Patients were excluded if diagnostic imaging was obtained more than 60 days after the most recent date of injury, if surgery performed more than six months after date of imaging, or if they had missing imaging data. To determine labral tear extent on MR, three musculoskeletal radiologists well-versed in shoulder imaging independently interpreted tear extent using the clock-face convention. Arthroscopic labral tear location and size were used as gold standard comparison. Error in accuracy of the radiology interpretation was defined as deviation of expected tear location (sum of the absolute error in the start- and endpoints of the tear on the clock face, in degrees), as compared to gold standard. Error in precision of radiology interpretation was defined as the deviation of expected tear length (absolute difference in tear length measured on the clock face, in degrees) as compared to gold standard. Errors in accuracy and precision were compared between MRI and MR arthrogram, as a function of time from dislocation.

RESULTS: Ninety-seven patients met inclusion and exclusion criteria with an average age of 21.8 ± 7.4 years. In total, 32 routine MRI and 65 MR arthrogram were independently assessed by radiologists. Intra-class correlation among radiology raters were moderate (0.61, $p < 0.001$) and high (0.78, $p < 0.001$) for accuracy and precision of labral tear extent interpretation, respectively. Average time from injury to imaging was 15.6 ± 12.3 days, while average time from imaging to primary stabilization surgery was 46.7 ± 39.6 days. According to multivariate analysis, increased intraoperative lesion length, decreased time between injury and imaging, and arthrogram status were significantly associated with increased radiology read accuracy and precision ($p < 0.05$). An association was observed between the time from injury to imaging and arthrogram status ($p = 0.018$), suggesting that the ordering surgeons preferred arthrogram for delayed imaging. For routine MRI, error in accuracy increased by 3.4° per day from time of injury (Fig 1, $p < 0.001$), and error in precision increased by 2.3° per day (Fig 2, $p < 0.001$). MR arthrogram, however, was not temporally influenced in accuracy (Fig 1, $p = 0.23$) or precision (Fig 2, $p = 0.12$). Significant comparative loss of accuracy and precision of routine MRI occurs at approximately 2 weeks after acute shoulder dislocation.

DISCUSSION AND CONCLUSION:

When determining labral tear size in the shoulder, MR arthrogram is not temporally limited in its accuracy and precision relative to time of injury. Comparatively, routine MRI may be similarly diagnostic of labral tear extent as MR arthrogram up to approximately 2 weeks post-acute shoulder injury, after which it significantly loses accuracy and precision.

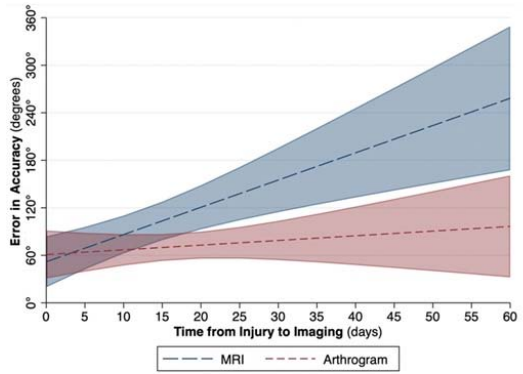


Fig 1. Error in accuracy of MRI versus MR arthrogram in determining labral tear location. Error in accuracy was defined as deviation of expected tear location (sum of the absolute error in the start- and endpoints of the tear on the clock face, in degrees), as compared to arthroscopic tear location. Shaded regions represent 95% confidence interval.

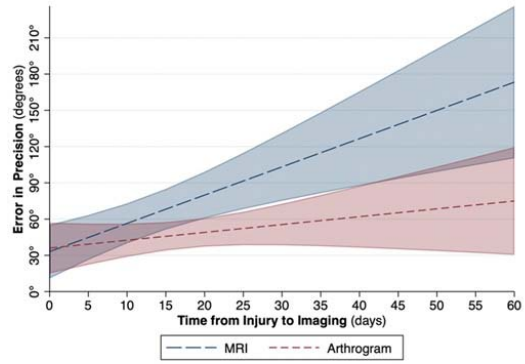


Fig 2. Error in precision of MRI versus MR arthrogram in determining labral tear size. Error in precision was defined as the deviation of expected tear length (absolute difference in tear length measured on the clock face, in degrees) as compared to arthroscopic tear length. Shaded regions represent 95% confidence interval.