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Bilateral magnetic resonance imaging findings in individuals with unilateral shoulder pain

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Background: Magnetic resonance imaging (MRI) is commonly used to diagnose structural abnormalities in the shoulder. However, subsequent findings may not be the source of symptoms. The aim of this study was to determine comparative MRI findings across both shoulders of individuals with unilateral shoulder symptoms.
Materials and methods: We prospectively evaluated 123 individuals from the community who had self-reported unilateral shoulder pain with no signs of adhesive capsulitis, no substantial range-of-motion deficit, no history of upper-limb fractures, no repeated shoulder dislocations, and no neck-related pain. Images in the coronal, sagittal, and axial planes with T1, T2, and proton density sequences were generated and independently and randomly interpreted by 2 examiners: a board-certified, fellowship-trained orthopedic shoulder surgeon and a musculoskeletal radiologist. Absolute and relative frequencies for each MRI finding were calculated and compared between symptomatic and asymptomatic shoulders. Agreement between the shoulder surgeon and the radiologist was also determined.
Results: Abnormal MRI findings were highly prevalent in both shoulders. Only the frequencies of full-thickness tears in the supraspinatus tendon and glenohumeral osteoarthritis were higher (approximately 10%) in the symptomatic shoulder according to the surgeon's findings. Agreement between the musculoskeletal radiologist and shoulder surgeon ranged from slight to moderate (0.00-0.51).
Conclusion: Most abnormal MRI findings were not different in frequency between symptomatic and asymptomatic shoulders. Clinicians should be aware of the common anatomic findings on MRI when considering diagnostic and treatment planning.

This study was approved by the Federal University of São Carlos Ethics Committee (report No. 1.394.925).

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Shoulder pain is highly prevalent in individuals seeking health care.[45] The pathoanatomic model, whereby the clinician identifies a specific tissue pathology and presumes that to be the source of pain, is predominant in the process to establish the diagnosis and guide the treatment of shoulder pain by different professionals.[2,49] As such, during diagnosis, magnetic resonance imaging (MRI) is commonly used to identify structural abnormalities in the shoulder. MRI allows high-resolution imaging of soft tissues and presents high sensitivity and diagnostic accuracy for detecting structural alterations in surgically confirmed studies.[22,36] However, some authors are calling the pathoanatomic diagnostic model into question because of the poor association between pathoanatomic findings and symptoms in individuals with painful shoulders.[12,13,37]

Previous studies have shown bilateral alterations in the MRI findings in individuals with unilateral symptoms[23,28,29,46,52] and in asymptomatic individuals.[7,10,18,20,24,26,29-34,40,42,44,47,51,52] These results suggest that many findings may be incidental and not the cause of symptoms. However, the prevalence of alterations in the MRI findings cannot be extrapolated to the general population with shoulder pain because most investigations have assessed only athletes[9,30] or small and/or age-restricted samples.[6,9,18,30,41,46]

A more comprehensive description of the alterations found in individuals with unilateral shoulder pain will be an important addition to the literature as previous side-to-side comparative studies focused primarily on partial- and full-thickness tears of the supraspinatus (SST) and infraspinatus (IST) tendons.[6,9,18,23,25,28,29,32,33,41,51,52] Furthermore, a description of bilateral pathoanatomic findings from a substantive representative sample of unilaterally involved individuals can help clinicians interpret the clinical utility of MRI findings. This is important because of growing concerns about overuse of MRI and a need to avoid unnecessary costs in health care provision.[1,8,21]

The primary objective of this study was to determine and compare the MRI-identified frequency of tissue pathology bilaterally in individuals with unilateral shoulder pain. The secondary objective was to determine the agreement of MRI findings between a board-certified, fellowship-trained shoulder surgeon and a radiologist. Our hypotheses were that (1) both shoulders would present a high prevalence of alterations and (2) substantial agreement would occur between the shoulder surgeon and radiologist.

Materials and methods

Participants and eligibility criteria

An observational study was conducted in which patients from the community who had self-reported unilateral shoulder pain were recruited. The study followed the recommendations of the Declaration of Helsinki. All individuals who agreed to participate signed informed consent forms.

Recruitment was performed by advertisements on local websites and printed flyers at the university and in the community. A total of 347 individuals were considered eligible; of these, 224 were excluded for the following reasons: appointment missed (53), neck-related pain (43), upper trapezius muscle complaints (32), bilateral shoulder pain (31), fracture or trauma (25), recurrent glenohumeral dislocation (19), adhesive capsulitis (12), MRI phobia (6), administration of physical therapy treatment (2), and MRI contraindication (1). Therefore, 123 individuals (246 shoulders) with chronic intermittent unilateral shoulder pain for 35.8 months on average (standard deviation, 58.5 months; range, 1-360 months) since first onset participated in this study. The average age of the participants was 39.4 years (standard deviation, 15.23 years; range, 18-77 years), 15 individuals were aged 60 years or older, and 66 participants were men. All participants had to report pain including pain at the anterolateral or lateral aspect of the shoulder that was exacerbated by movement. Individuals with atraumatic self-reported unilateral shoulder pain for at least 4 weeks since first onset and full active arm elevation (approximately 150° or greater) evaluated by a digital inclinometer[5] were included in the study. We excluded participants with bilateral complaints; a history of fractures or surgery in the upper limbs; metallic implants in the trunk, arms, or head; vascular clips; shoulder dislocation within the past 2 years; clinical signs of adhesive capsulitis based on a deficit in glenohumeral internal and external rotation; self-reported neck pain; or neck-related symptoms based on a positive Spurling test. The eligibility criteria were determined by 1 of 2 physical therapists with at least 3 years of clinical experience related to musculoskeletal disorders, who obtained a history from and completed a clinical examination of each participant.

MRI assessment

All participants underwent a standardized imaging protocol using a Magnetom Essenza MRI machine (Siemens, Erlangen, Germany) with a field strength of 1.5 T, field of view of 18 cm, and dedicated shoulder array coil for high-resolution, motion-free images. Images with a slice thickness of 3.5 to 4.0 mm through T1, T2, and proton density (PD) spin echo sequences, as well as a T2 gradient echo sequence, of both symptomatic and asymptomatic shoulders were obtained. All scans included slices in the sagittal, coronal, and axial planes without contrast. The participants were positioned supine with the head toward the scanner bore, arms resting at the side of the body, and humerus in neutral or slight external rotation. Anonymized, recoded, and randomized images were independently read by a board-certified orthopedic surgeon with 12 years of shoulder-specialized experience after fellowship training and by a radiologist. All data provided by the radiologist were manually retrieved from the clinical report. The radiologist read all scans according to his standard clinical practice, whereas the shoulder surgeon followed a structured online-based form to ensure a comprehensive analysis.

MRI definitions

The MRI findings were comprehensively assessed as follows: Rotator cuff tendinopathy was identified as a thickened tendon with hyperintense signal alteration predominantly in a T1- or PD-weighted fast spin echo sequence, increased signal intensity on T2 images, or high signal on PD images that does not become as high as the fluid signal on T2 images. When a focal or diffuse region of intrasubstance intermediate signal on T1 images that persisted on T2 images with or without increased thickness was identified, tendinopathy was also diagnosed.[16]

Partial-thickness tearing was observed by the presence of tendon discontinuity along its superior (bursal) or inferior (articular) surface with an extra-articular fluid-filled gap on T2 images. A full-thickness tear was differentiated from a partial-thickness tear by the presence of discontinuity of the tendon with a fluid-filled gap that extended from the articular to the bursal surface observed mainly on T2 images.[16] Musculotendinous retraction was defined to be present when the musculotendinous junction was located more medially than its usual footprint location. The extension of musculotendinous retraction was classified as stage 1 (proximal end close to the bony insertion), stage 2 (proximal end at the level of the humeral head), or stage 3 (proximal end at the level of the glenoid).[15]

Fatty infiltration was classified into 1 of 4 stages: stage 1, muscle with some fatty streaks; stage 2, increased fatty infiltration but more healthy muscle than fat; stage 3, fatty infiltration with as much fatty tissue as healthy muscle; or stage 4, more fatty tissue than healthy muscle.[19] SST atrophy was identified by the presence of the tangent sign.[24]

A labral lesion was identified by a hyperintense signal within the labrum or a morphologic irregularity. Anatomic variations such as a sublabral foramen or Buford complex were not considered lesions. A superior labrum anterior-posterior (SLAP) lesion was defined as a superior labral lesion with anterior and posterior extension, including the origin of the long head of the biceps (LHB) tendon.[16]

LHB tendinopathy was diagnosed by the observation of a thickened tendon on PD or T1 images or hyperintense intratendinous signal without signal alterations on T2 images. A partial biceps tear was defined as a T2 hyperintense or T1 hypointense signal alteration. A full-thickness biceps tear was defined by retraction of the tendon and its absence in the bicipital groove (extra-articular part) observed on axial T2 images, as well as absence of the intra-articular tendon in the oblique sagittal plane.[16]

Acromioclavicular (AC) joint alterations such as osteoarthritis (OA) or joint hypertrophy were observed in the coronal oblique and sagittal oblique planes. Cysts and fluid at the AC joint were observed on T2 images. Signs of tissue proliferation such as osteophytes, joint space narrowing, margin irregularity, and bone sclerosis were identified on T1 images.[10,47]

Glenohumeral OA was identified based on findings such as joint narrowing, subchondral sclerosis, osteophyte formation, subchondral cysts, posterior glenoid wear, hypointense glenoid sclerosis, or chondral erosion. These lesions are typically found as hyperintense signals on T2 or axial PD images.[16]

Glenohumeral synovitis was identified by the presence of high signal intensity in the capsule on T2 or PD images in the coronal and axial planes. Adhesive capsulitis was identified by the presence of evident synovitis and axillary recess reduction observed in the coronal plane on T2 images. Proximal humeral alterations such as cysts were described by the presence of high signal intensity and well-demarcated rounded or ovoid points visualized in 2 planes on T2 images.[50] Increased subacromial fluid was reported when the subacromial bursa contained signal intensity equal to the signal of joint fluid or water on T2 images.[17] Acromial morphology was described following the classification of Epstein et al,[14] divided into 3 types: type I, flat; type II, smoothly curved; and type III, hooked.

Statistical analyses

All analyses were performed with IBM SPSS Statistics (version 23; IBM, Armonk, NY, USA). The χ^2 test for independence with Yates continuity correction was used to compare MRI findings of symptomatic and asymptomatic shoulders. The Fisher exact test was used to compare sides when the expected count was below 5. $P < .05$ was considered statistically significant. Agreement in the findings between the shoulder surgeon and the radiologist was assessed by total observed agreement and the Cohen κ index of agreement.[7] Total observed agreement was defined as the sum of simultaneous positive and negative classifications divided by the number of total observations.[4] The level of agreement based on κ was classified as no ($\leq$0), slight (0.01-0.20), fair (0.21-0.40), moderate (0.41-0.60), substantial (0.61-0.80), or almost perfect (0.81-1.00) agreement.[7]

The influence of bias and the prevalence of answers from both examiners on the κ index were verified by the bias index and prevalence index, respectively. The prevalence index was defined as the difference between the simultaneous positive and negative answers divided by the number of total observations. The bias index was defined as the difference between positive and negative answers from both evaluators divided by the number of total observations.[4]

Results

Bilateral prevalence data

MRI alterations were highly observed on all scans, and similar prevalence data were generally noted in both symptomatic and asymptomatic shoulders (Tables I and II). Rotator cuff tendinopathy and alterations in the AC joint

Table I Prevalence and comparison of MRI alterations in symptomatic vs. asymptomatic shoulders

MRI abnormalities	Radiologist		χ^2 or Fisher exact test	Shoulder surgeon		χ^2 or Fisher exact test
	Symptomatic shoulders (n = 123), n (%)	Asymptomatic shoulders (n = 123), n (%)		Symptomatic shoulders (n = 123), n (%)	Asymptomatic shoulders (n = 123), n (%)	
Rotator cuff tendinopathy	114 (92.7)	109 (88.6)	$\chi^2 = 0.76$, $P = .38$	92 (74.8)	89 (73.0)	$\chi^2 = 0.03$, $P = .85$
Partial-thickness tear	33 (26.8)	25 (20.3)	$\chi^2 = 1.10$, $P = .29$	38 (31.1)	27 (22.0)	$\chi^2 = 2.20$, $P = .13$
Full-thickness tear	7 (5.7)	1 (0.8)	$\chi^2 = 3.23$, $P = .06$	25 (20.5)	10 (8.1)	$\chi^2 = 6.66$, $P = .01$*
Subacromial fluid	67 (54.5)	69 (56.1)	$\chi^2 = 0.00$, $P = .95$	75 (61.0)	65 (52.8)	$\chi^2 = 1.34$, $P = .24$
AC joint alterations	113 (91.9)	110 (89.4)	$\chi^2 = 0.05$, $P = .80$	98 (79.7)	90 (73.2)	$\chi^2 = 1.10$, $P = .29$
Labrum alterations	54 (43.9)	51 (41.5)	$\chi^2 = 0.09$, $P = .75$	81 (66.4)	82 (67.2)	$\chi^2 = 0.00$, $P > .99$
LHB alterations	14 (11.4)	7 (5.7)	$\chi^2 = 1.82$, $P = .17$	16 (13.1)	15 (12.2)	$\chi^2 = 0.00$, $P = .98$
Fatty infiltration	25 (20.3)	23 (18.7)	$\chi^2 = 0.02$, $P = .87$	8 (6.5)	3 (2.4)	$\chi^2 = 1.52$, $P = .21$
SST atrophy	1 (0.8)	1 (0.8)	$\chi^2 = 0.00$, $P > .99$	4 (3.3)	1 (0.8)	$\chi^2 = 0.81$, $P = .37$
Humeral tuberosity cysts	16 (13.0)	17 (13.8)	$\chi^2 = 0.00$, $P > .99$	29 (23.6)	23 (18.9)	$\chi^2 = 0.56$, $P = .45$
Glenohumeral OA	2 (1.6)	1 (0.8)	$\chi^2 = 0.00$, $P > .99$	13 (10.7)	4 (3.3)	$\chi^2 = 4.11$, $P = .04$*
Acromial morphology						
Type I	9 (7.3)	14 (11.4)	$\chi^2 = 0.83$, $P = .36$	75 (61.0)	82 (66.7)	$\chi^2 = 0.63$, $P = .42$
Type II	88 (71.5)	87 (70.7)	$\chi^2 = 0.00$, $P > .99$	29 (23.6)	25 (20.3)	$\chi^2 = 0.21$, $P = .64$
Type III	15 (12.2)	14 (11.4)	$\chi^2 = 0.05$, $P = .81$	19 (15.4)	16 (13.0)	$\chi^2 = 0.13$, $P = .71$

MRI, magnetic resonance imaging; *AC*, acromioclavicular; *LHB*, long head of biceps; *SST*, supraspinatus muscle; *OA*, osteoarthritis.
* $P < .05$ when both sides were compared.

were highly prevalent in both shoulders based on the radiologist's findings (approximately 90%) and shoulder surgeon's findings (approximately 75%). No significant difference in the prevalence of the MRI findings between sides was noted considering the radiologist's readings, with the exception of partial-thickness IST tears (Table II). Overall, the shoulder surgeon reported a higher prevalence of full-thickness tears of the SST tendon and glenohumeral OA in the symptomatic shoulders compared with the asymptomatic shoulders.

Agreement between examiners

Observed agreement between the radiologist and shoulder surgeon varied from 44.71% to 98.14%. The best observed agreements (approximately 90%) were obtained for SST atrophy, glenohumeral OA, and LHB alterations. The best κ indexes were observed for partial-thickness tears (κ = 0.38), LHB alterations (κ = 0.44), and cysts in the humeral tuberosities (κ = 0.51). The κ index ranged between 0.00 and 0.51. The percentage of agreement and κ statistics are provided in Supplementary Table S1.

Discussion

The goal of this study was to describe bilateral MRI findings in individuals from the community who had unilateral shoulder pain. This is relevant as clinicians frequently use MRI as a diagnostic tool and imaging findings are deemed part of the clinical picture, thus potentially influencing management. Because of the high accuracy and correlation with surgical reference standards, MRI has a high capability to detect tissue pathology. However, recent studies showing a poor association between symptoms and tissue status have raised questions about the clinical utility of MRI, at least in some cases.[12,13,37] The results of this study demonstrated a high prevalence of bilateral MRI alterations in individuals with unilateral shoulder pain, confirming our hypothesis. Few differences between symptomatic and asymptomatic shoulders were observed. This investigation adds to the literature as a substantial number of MRI scans were assessed by 2 experienced professionals and a more comprehensive description of the MRI alterations is provided. In addition, slight to moderate agreement between examiners was observed. Both of these results cause concern regarding the utility of MRI as the most effective treatment planning tool in the absence of more full-thickness tears or OA. Of further relevance, OA can be determined less expensively on radiographs.

Our study is most generalizable to individuals from the community we sampled. Most of our sample (108 of 123 individuals) was younger than 60 years. As such, we explored our results for the subgroup aged 60 years or older and the subgroup younger than 60 years (Supplementary Tables S2 and S3). Not unexpectedly, many alterations were observed more frequently in older participants, particularly those aged 60 years or older. This included generally higher frequencies of rotator cuff tears, labral and biceps pathology, and OA, consistent with the literature.[29,31,52] However, the same

Table II Detailed comparison of prevalence of MRI alterations in symptomatic vs. asymptomatic shoulders

MRI abnormalities	Radiologist		χ^2 or Fisher exact test	Shoulder surgeon		χ^2 or Fisher exact test
	Symptomatic shoulders (n = 123), n (%)	Asymptomatic shoulders (n = 123), n (%)		Symptomatic shoulders (n = 123), n (%)	Asymptomatic shoulders (n = 123), n (%)	
Tendinopathy						
Supraspinatus tendon	109 (88.6)	107 (87.0)	$\chi^2 = 0.03$, $P = .84$	86 (69.9)	83 (67.5)	$\chi^2 = 0.07$, $P = .78$
Infraspinatus tendon	84 (68.3)	84 (68.3)	$\chi^2 = 0.00$, $P > .99$	14 (11.4)	9 (7.3)	$\chi^2 = 0.76$, $P = .38$
Subscapularis tendon	43 (35.0)	41 (33.3)	$\chi^2 = 0.00$, $P = .93$	14 (11.4)	8 (6.5)	$\chi^2 = 1.24$, $P = .26$
Partial-thickness tear						
Supraspinatus tendon	26 (21.1)	18 (14.6)	$\chi^2 = 1.35$, $P = .24$	24 (19.5)	19 (15.4)	$\chi^2 = 0.45$, $P = .50$
Infraspinatus tendon	13 (10.6)	2 (1.6)	$\chi^2 = 7.10$, $P < .01$*	9 (7.3)	4 (3.3)	$\chi^2 = 1.29$, $P = .25$
Subscapularis tendon	13 (10.6)	14 (11.4)	$\chi^2 = 0.00$, $P > .99$	9 (7.3)	6 (4.9)	$\chi^2 = 0.28$, $P = .59$
Full-thickness tear						
Supraspinatus tendon	7 (5.7)	1 (0.8)	$\chi^2 = 3.23$, $P = .06$	20 (16.3)	4 (3.3)	$\chi^2 = 10.38$, $P < .01$*
Infraspinatus tendon	1 (0.8)	1 (0.8)	$\chi^2 = 0.00$, $P > .99$	9 (7.3)	2 (1.6)	$\chi^2 = 3.42$, $P = .06$
Subscapularis tendon	0 (0.0)	0 (0.0)	NC	9 (7.3)	8 (6.5)	$\chi^2 = 0.00$, $P > .99$
Retraction						
Supraspinatus tendon	7 (5.7)	1 (0.8)	$\chi^2 = 3.23$, $P = .07$	16 (13.0)	3 (2.4)	$\chi^2 = 8.21$, $P < .01$*
Acromioclavicular joint						
Hypertrophy	101 (82.1)	99 (80.5)	$\chi^2 = 0.02$, $P = .87$	25 (20.3)	21 (17.1)	$\chi^2 = 0.24$, $P = .62$
Osteophytes	4 (3.3)	2 (1.6)	$\chi^2 = 0.17$, $P = .68$	44 (35.8)	41 (33.3)	$\chi^2 = 0.07$, $P = .78$
Inflammatory signs	11 (8.9)	4 (3.3)	$\chi^2 = 2.55$, $P = .11$	71 (57.7)	58 (47.2)	$\chi^2 = 2.34$, $P = .12$
Long head of biceps						
Tendinopathy	10 (8.1)	4 (3.3)	$\chi^2 = 1.89$, $P = .16$	9 (7.3)	9 (7.3)	$\chi^2 = 0.00$, $P > .99$
Partial tear	4 (3.3)	2 (1.6)	$\chi^2 = 0.17$, $P = .68$	6 (4.9)	3 (2.4)	$\chi^2 = 0.46$, $P = .50$
Complete tear	1 (0.8)	0 (0.0)	$\chi^2 = 0.00$, $P > .99$	1 (0.8)	3 (2.4)	$\chi^2 = 0.25$, $P = .62$

MRI, magnetic resonance imaging; *NC*, not computed.
* $P < .05$ when both sides were compared.

bilateral pattern of occurrence was still observed (substantial involvement in both symptomatic and asymptomatic shoulders for most pathologies). It is important to note that analyses in the subgroup aged 60 years or older are not adequately powered because of the sample size, which was reduced to 15 individuals.

Previous investigations have reported alterations in asymptomatic shoulders using ultrasound (US)[20,23,28,29,31,39,46,51,52] and MRI.[6,9,18,25,32,33,41,43] The most common findings included partial- and full-thickness tears of the SST and IST tendons with a prevalence ranging from 2% to 95%.[7,10,18,24,26,29,30,32-34,42,44,51,52] These past studies focused on describing alterations in only the SST and IST tendons or presented a grouped prevalence of all rotator cuff tendons, hindering a detailed evaluation of which tendons were affected. In our study, partial-thickness tears (approximately 21.1%) and full-thickness tears (approximately 4.5%) of the rotator cuff tendons were also identified in asymptomatic shoulders, though relatively infrequently in the case of full-thickness tears. This finding suggests that although asymptomatic full-thickness tears may occur, symptoms are much more likely to be present if a full-thickness tear is present in the SST or IST. Tables I and II show that other shoulder joint abnormalities were observed as well.

Our investigation questions the clinical utility of MRI for treatment planning because a high prevalence of alterations in asymptomatic shoulders was observed. This finding indicates that although MRI can accurately identify tissue pathology, it cannot discriminate whether that altered anatomy is associated with specific clinical findings. This is of particular importance to physicians, surgeons, and physical therapists who might use the MRI findings to guide the decision toward a treatment plan. Surgeons should be discouraged from deciding on a surgical procedure based on only the MRI findings as patient functionality is the most important factor to be considered in this decision.[3] In addition, patients should be counseled that the alterations found are common and may not be the source of pain. Physical therapists are encouraged to use a pathokinesiologic movement–based or biopsychosocial model to guide diagnosis and treatment planning instead of relying on a pathoanatomic model.[27,38] The pathoanatomic model has limited ability to direct conservative intervention, and most physical therapy treatments have a movement impairment– or pain intervention–based approach.

Overall, only the prevalence of full-thickness tears and glenohumeral OA presented statistically significant differences between the symptomatic and asymptomatic sides. For individuals younger than 60 years, only the prevalence of full-thickness tears was higher in the symptomatic shoulders. This difference was not statistically significant for individuals aged 60 years or older because of the sample size, but the prevalence was 20% and 33% greater on the symptomatic side based on the surgeon's and radiologist's readings, respectively. Considering the similar accuracy between US and MRI for detecting full-thickness tears,[34,36] clinicians could consider the use of US as the primary imaging modality when full-thickness tearing is suspected. US examination represents a less expensive and quicker option to determine the presence or absence of full-thickness tears. If US reveals a full-thickness tear, follow-up MRI could be used more judiciously to provide additional surgical planning information such as identification of concurrent fatty infiltration, atrophy, or OA. In addition, a less expensive evaluation with radiography or a more detailed evaluation of glenohumeral OA with computed tomography could be performed in comparison with MRI.[26,42] It is important to note that the primary issue is not the accuracy of MRI but the lack of a relationship of the MRI findings with symptom status.

Our study also showed a high prevalence of alterations in the AC joint of asymptomatic shoulders (approximately 81%). Other investigations reported a smaller prevalence of AC joint OA (approximately 64%) in asymptomatic shoulders.[25,32,43] These differences may be related to variations in the MRI acquisition protocol, such as sequences, field strength, slice thickness, or even coil or dedicated software enhancements brought by advances in technology.[44] Another possible reason for the discrepancy in results may be the small sample sizes of the previous studies in comparison with ours and the lack of information about the examiners' backgrounds.

Differences in interpretation between examiners

In our study, differences in the prevalence of positive MRI alterations between examiners were observed for rotator cuff tendinopathy, AC joint alterations, fatty infiltration, and labral and full-thickness rotator cuff tears. Overall, the radiologist reported more positive MRI alterations than the shoulder surgeon except regarding labral tears and full-thickness tearing. In addition, the surgeon noted more humeral cysts and glenohumeral OA.

The radiologist's readings indicated a similar frequency of tendinopathy between symptomatic and asymptomatic shoulders and very low frequencies of full-thickness tearing. Whereas the radiologist documented more IST tendinopathy, the surgeon more frequently identified SST tendon retraction in the symptomatic shoulder. Few studies have evaluated the agreement of MRI findings between shoulder surgeons and radiologists or compared a structured research evaluation with a routine image reading. Previous investigations have reported agreement between shoulder or orthopedic surgeons and radiologists to range from fair to moderate.[11,35,40,48] It is possible that the level of agreement observed in our study was influenced by the method of assessment, as the shoulder surgeon used a structured online form to objectively record his interpretation whereas the radiologist used a narrative description as normally occurs in the clinical setting. Although this may be a reason for the low level of agreement, the goal of our study was to evaluate bilateral MRI findings in unilaterally involved individuals, and both evaluators reported high levels of bilateral findings.

Limitations

The main limitation of this study is that our imaging captures a single moment in time and therefore cannot assess the risk of symptom development for the asymptomatic shoulders. Another limitation is the absence of intraobserver analysis. However, the usual diagnostic process occurs without the shoulder surgeon or radiologist having a second opportunity to interpret the scan. In addition, we may not have had enough power to detect small differences—less than 10% but greater than 5%—in the frequencies of some imaging abnormalities between symptomatic and asymptomatic shoulders, such as partial-thickness tearing (6%-9%), subacromial fluid (8.2%), and LHB alterations (5.7%). However, overall our study is well powered and is able to detect side-to-side differences as low as 7.4% (glenohumeral OA). It is also important to keep in mind that side-to-side differences less than 5% are based on only a few individuals in this analysis.

When clinicians are interpreting our data, it is important to remember that location, size, and tear retraction may play a role in the risk of symptom development and functional decline. Our results suggest that full-thickness tears may be related to the symptoms, but tendinopathy was not consistently found more commonly in symptomatic shoulders than in those without symptoms. Further studies are necessary to determine how each of those factors contributes to the development of symptoms. Despite this, our study evaluated MRI alterations in both shoulders in a large sample of individuals with unilateral symptoms and provided prevalence data for all pathologies, which were not available in previous studies.[6,9,23,28,29,33,52]

Conclusion

MRI alterations were similarly observed in both shoulders of individuals with unilateral symptoms, except for full-thickness tears and the presence of glenohumeral OA, which were mostly seen on the symptomatic side. Fair to moderate agreement was observed between a fellowship-trained shoulder surgeon and a radiologist. Clinicians should be aware of the limited enhanced value of MRI in the clinical decision-making process. We encourage clinicians to consider that interventions may be indicated more specifically when functional loss is observed rather than based on the presence of pathoanatomic findings on MRI.

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Supplementary data

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