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ORIGINAL ARTICLE

Rotator cuff tear imaging in patients over 70 years: Specific MRI findings?

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KEYWORDS
Rotator cuff tear;
Magnetic resonance imaging;
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Summary
Background: During the symposium held by the French Arthroscopy Society on rotator cuff tears in patients over 70 years of age, the absence of studies into potential specific pathological features in this age group was pointed out. Here, our main objective was to describe magnetic resonance imaging (MRI) findings in this patient population.
Hypothesis: Tendons and muscles are smaller, lamellar dissection more prominent, and dystrophic changes more marked in patients over 70 years of age.
Material and method: We retrospectively studied 50 patients with isolated supraspinatus tears, including 25 younger than 50 and 25 older than 70 years of age. Tear size and retraction were evaluated according to Patte; tendon thickness, lamellar dissection, and fatty infiltration according to Goutallier; muscle size according to Thomazeau; and the tangent sign according to Zanetti.
Results: In contradiction to our study hypothesis, lateral tendon thickness was similar in the two age groups. Medial thickness of the tendon-muscle junction, however, was greater in the younger group. Lamellar dissection was more marked and fatty infiltration more severe in the older group. As expected, marked muscle wasting and a positive tangent sign were noted in over two-thirds of patients in the older group.
Conclusion: This preliminary study in a small number of patients identified specific MRI features of supraspinatus tears in patients older than 70 years compared to younger patients. A larger study would be useful to confirm these findings.
Level of evidence: Level II.

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Introduction

In all likelihood, the potential for healing after rotator cuff repair in older patients depends on the presence and severity of degenerative tendon lesions and muscle fatty degeneration. During the symposium on rotator cuff repair in patients older than 70 years held in December 2012 by the French Arthroscopy Society (Société française d'arthroscopie, SFA) in Lille, France, the absence of studies on potential specific pathological characteristics of rotator cuff tears in this age group was pointed out.

Here, our main objective was to describe the magnetic resonance imaging (MRI) features of rotator cuff tears in patients older than 70 years. Our secondary objective was to compare the MRI features in two very different age groups, younger than 50 years and older than 70 years, to look for age-related differences. Our working hypothesis was that older patients had thinner tendons and greater severity of lamellar dissection and dystrophic lesions.

Background data on rotator cuff imaging

Standard radiographs

When investigating rotator cuff tears, standard radiography remains the first-line imaging study. Standard radiographs provide an overall assessment of the joint and allow easy comparison with the contralateral shoulder. The results are not compromised by metallic artefacts, and both static and dynamic studies can be performed in some cases. Standard radiography is relatively inexpensive. The findings assist in the differential diagnosis, as well as in the identification of concomitant abnormalities such as gleno-humeral osteoarthritis (poorly assessed by MRI at Fukuda stages II and III), sub-acromial space narrowing, aggressive acromial variants, and degenerative lesions of the acromio-clavicular joint.

Magnetic resonance imaging (MRI)

Proper interpretation of MRI used to assess osteoarticular disease requires knowledge of the main sequences.

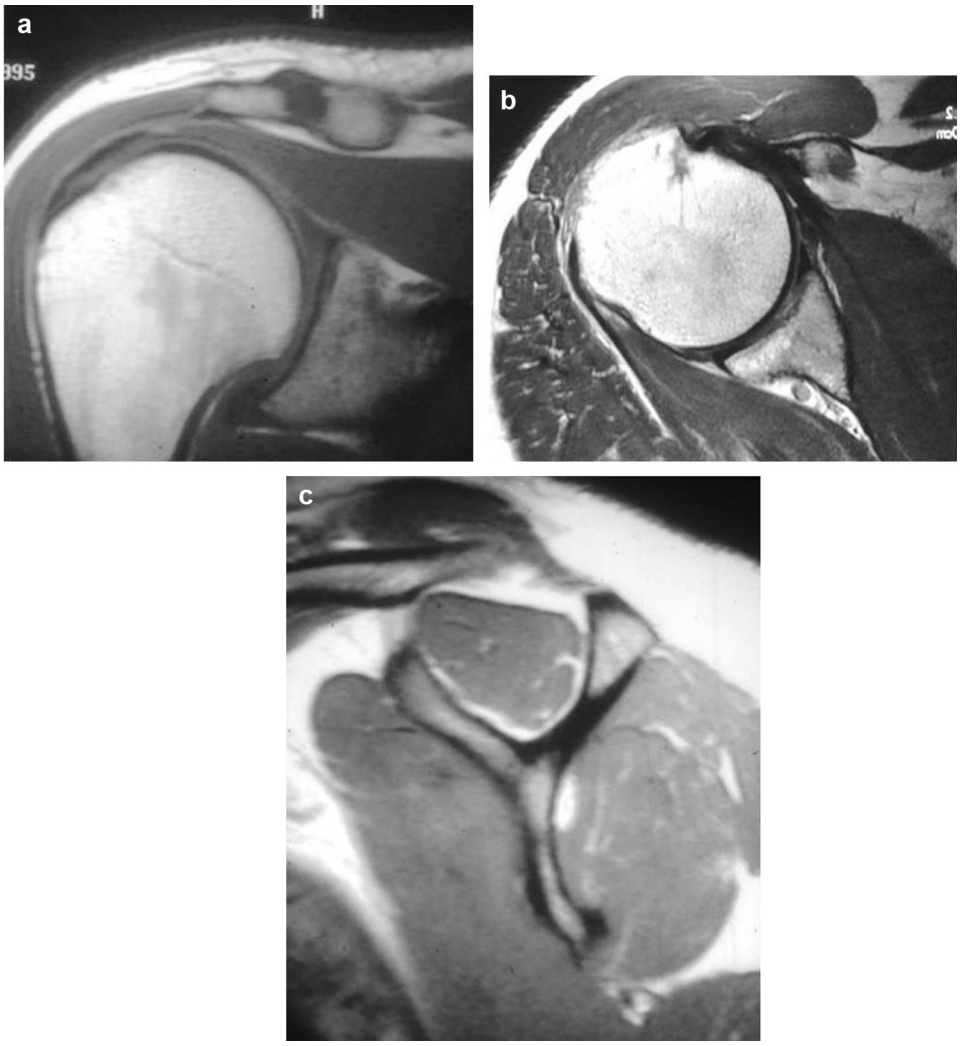

Figure 1 a, b, and c: T1-weighted images in the oblique coronal, axial, and oblique sagittal planes, respectively.

Figure 2 a: conventional T2 spin-echo sequence (marked fluid/fat signal intensity gradient); b: turbo T2 spin-echo sequence (small fluid/fat signal intensity gradient); c: Fat-Sat T2 sequence.

T1-weighted images (T1-WIs) (Fig. 1) provide an overall morphological and anatomic assessment via the acquisition of oblique coronal (Fig. 1a), axial (Fig. 1b), or oblique sagittal (Fig. 1c) sections. T1 and proton-density sequences visualise the fatty tissue as white areas but fail to clearly delineate the tendons. T1-WIs are chiefly useful for evaluating fatty degeneration of the rotator cuff muscles. Thus, Goutallier's criteria for classifying fatty muscle degeneration [1] are best assessed on T1 or proton-density images.

T2-WIs (Fig. 2a) have longer acquisition times but clearly differentiate fluid from fatty tissue. Turbo sequences (Fig. 2b) are faster but fail to distinguish fluid from fat. An alternative is the use of Fat-Sat sequences (Fig. 2c) showing tissues in black and fluid (inflammation) in white and suppressing the fat images. Rotator cuff tears are clearly visible on these sequences, which cannot, however, serve to evaluate fatty degeneration.

Material and method

We retrospectively studied 50 patients with isolated supraspinatus tears selected from the MRI database of the new Union Hospital in Toulouse, France (department headed by Dr Gérard Richardi). Among them, 25 were younger than 50 years of age and 25 older than 70 years of age. The younger group had 17 (68%) males and 8 (32%) females and the older group 9 (36%) males and 16 (64%) females.

Figure 3 Classification of tendon retraction in the coronal plane. Stage 1: proximal stump close to bony insertion*; stage 2: proximal stump at level of humeral head*; stage 3: proximal stump at level of glenoid*.
According to Patte [2].

Figure 4 Tendon thickness measurements in zones E1 and E2.

Tear size and retraction were evaluated according to Patte [2]: stage 1, tendon stump at the level of the bony attachment site; stage 2, tendon stump retracted to the level of the humeral head; and stage 3, tendon stump retracted to the level of the glenoid cavity (Fig. 3).

For each tear, we measured tear size in the coronal plane, lateral and medial tendon thicknesses, and the E1/E2 ratio of lateral over medial tendon thickness (Fig. 4). The percentage of patients with lamellar dissection assessed according to Goutallier et al. [3] was recorded in each group. Fatty degeneration was evaluated based on the classification by Goutallier et al. [1] (Fig. 5). Muscle size was estimated using the S1/S2 ratio as described by Thomazeau et al. [4] (Fig. 6). In each group, we determined the percentage of patients with a positive tangent sign as described by Zanetti et al. [5] (Fig. 7).

Numerical data were entered into Excel spreadsheets and statistical analyses were run using XLSTAT Version 2013.1.01. Values of *P* lower than 0.05 were considered to indicate significant differences.

Results

Table 1 compares the MRI findings in the two age groups. In contradiction to our working hypothesis, lateral tendon thickness was not significantly different between the two groups. Medial thickness at the tendon-muscle junction, however, was significantly greater in the younger group, as shown by the E1/E2 ratio. Lamellar dissection was more common among the older patients, who had greater severity of muscle fatty degeneration. As expected, marked muscle wasting was noted in the older group, where over two-thirds of patients had a positive tangent sign (Table 1).

Discussion

This is a preliminary study in a limited sample size done as an ancillary to the multicentre study of rotator cuff repair

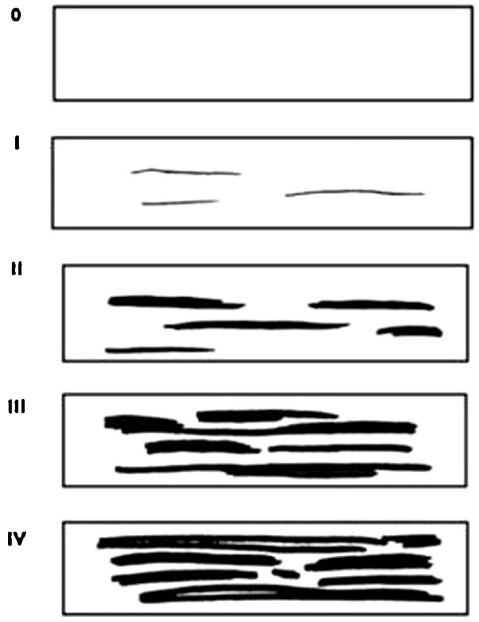

Figure 5 Classification of rotator cuff muscle fatty degeneration on computed tomography images. Stage 0: normal muscle with no fatty streaks; stage I: some fatty streaks; stage II: more muscle than fat; stage III: as much muscle as fat; stage IV: more fat than muscle.
According to Goutallier et al. [1].

outcomes conducted by the French Arthroscopy Society in 144 patients older than 70 years, whose main characteristics are listed in Table 2.

Lower tendon thickness values were noted in the multicentre cohort, but the measurements were probably

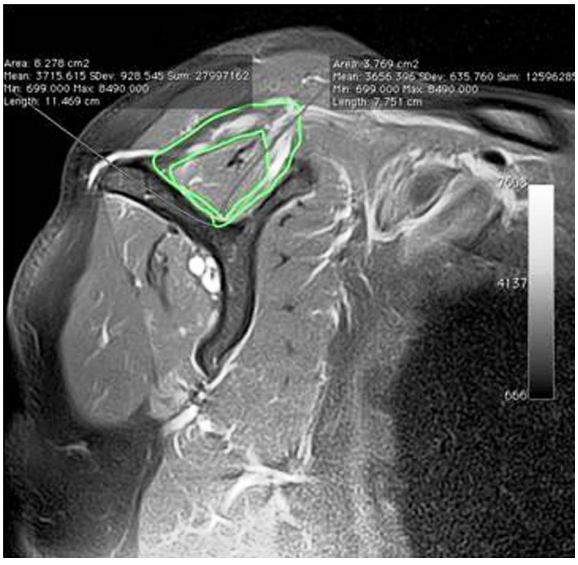

Figure 6 Classification of supraspinatus muscle wasting on MRI images. S1 is the surface area of the supraspinatus muscle and S2 the surface area of the supraspinatus fossa; S1/S2 is the occupation ratio. Stage I: normal muscle or slight wasting, S1/S2 = 1.00 to 0.60; stage II: moderate wasting, S1/S2 = 0.60 to 0.40; stage III: severe wasting, S1/S2 < 0.40.
According to Thomazeau et al. [4].

Table 1 Comparison of the MRI findings in the two age groups.

	< 50 years	> 70 years	*P* value
Tear size in the coronal plane according to Patte, mean (range)	1.4 (1—3)	2.56 (1—3)	
Lateral tendon thickness in mm, mean (range)	3.5 (1.2—5.5)	3.5 (1.0—6.6)	0.92
Medial tendon thickness in mm, mean (range)	5.3 (2.2—7.9)	4.5 (2.6—6.8)	0.02
E1/E2 variance in mm, mean (range)	0.7 (0.3—1.1)	0.8 (0.3—1.6)	0.14
Lamellar dissection, % of patients	24	36	
Fatty degeneration index of the supraspinatus muscle, mean	0.76	2.24	< 0.0001
Muscle wasting? Is this the occupation ratio S1/S2?, mean (range)	0.7 (0.4—1.0)	0.4 (0.1—0.8)	< 0.0001
Positive tangent sign, % of patients	16	72	

MRI: magnetic resonance imaging.

Figure 7 Tangent sign for supraspinatus muscle wasting. Dark: positive tangent sign. The superficial aspect of the supraspinatus muscle does not cross the line tangent to the superior edges of the scapular spine and coracoid process. Light: negative tangent sign. The superficial aspect of the supraspinatus muscle crosses the line tangent to the superior edges of the scapular spine and coracoid process.
According to Zanetti et al. [5].

Table 2 Main characteristics of the 144 patients.

	144 patients > 70 years
Tear size in the coronal plane according to Patte	1.47
Tendon thickness	1.04 mm
Sagittal extension	1.33 cm
Lamellar dissection	85%
Average supraspinatus fatty degeneration	1.42

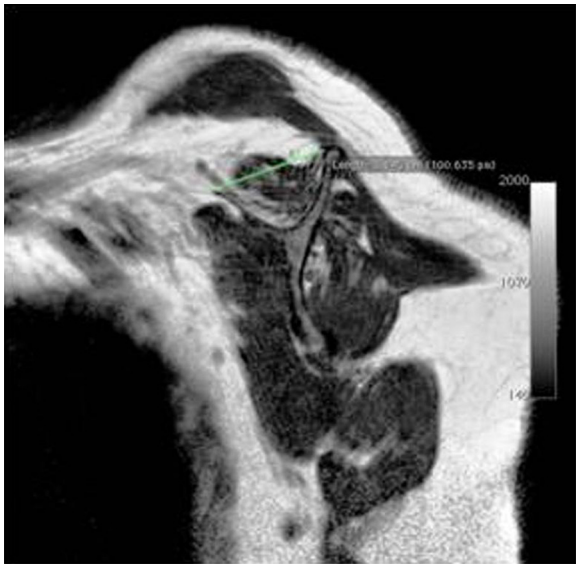

Figure 8 Rotator cuff tear before 50 years of age.

less reproducible given the large scale of the study. The percentage of patients with lamellar dissection was higher than in our population (Table 2).

In our study, the comparison of MRI findings in the two groups was hindered by the fairly substantial difference in coronal retraction between the younger group (1.4 cm) (Fig. 8) and the older group (2.56 cm) (Fig. 9), which probably generated a noticeable variation in muscle fatty degeneration and wasting. Consequently, our data cannot be used for a valid statistical comparison. They can, however, serve as a basis for developing a protocol to compare the features of tendons and muscles in younger and older patients. The differences in rotator cuff pathology across age groups would seem to deserve careful attention when selecting older patients for rotator cuff repair. Correlations between these differences and the clinical and anatomic outcomes of rotator cuff repair could probably be established.

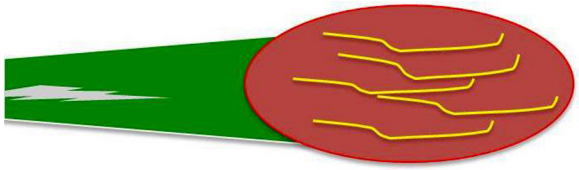

Figure 9 Rotator cuff tear after 70 years of age.

Conclusion

Our preliminary study identified specific MRI features of rotator cuff tears in older patients compared to their younger counterparts. With the exception of muscle alterations, these specific features have not been accurately assessed in earlier work. A study in a larger sample size would be of interest to confirm our findings, particularly the greater retraction in patients older than 70 years with relative preservation of distal tendon thickness contrasting with thinning of the tendon-muscle junction. As reported previously, lamellar dissection, muscle fatty infiltration, and muscle wasting are age-dependent.

Disclosure of interest

The authors declare that they have no conflicts of interest concerning this article.

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