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ORIGINAL ARTICLE

The natural course of nonoperatively treated rotator cuff tears: an 8.8-year follow-up of tear anatomy and clinical outcome in 49 patients

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Background: The natural course of nonoperatively treated rotator cuff tears is not fully understood. We explored the long-term development of tear anatomy and assessed functional outcomes.
Methods: Eighty-nine small to medium-sized full-thickness tears of the rotator cuff, all primarily treated by physiotherapy, were identified retrospectively. Twenty-three tears needed surgical treatment later on, and 17 patients were unable to meet for follow-up. The remaining 49 still unrepaired tears were re-examined after 8.8 (8.2-11.0) years with sonography. Re-examination by magnetic resonance imaging was possible for 37 patients. Shoulder function was assessed with shoulder scores. Primary outcome measures were progression of tear size, muscle atrophy, and fatty degeneration and the Constant score (CS).
Results: Mean tear size increased by 8.3 mm in the anterior-posterior plane ($P = .001$) and by 4.5 mm in the medial-lateral plane ($P = .001$). Increase of tear size was −5 to +9.9 mm in 33 patients, 10 to 19.9 mm in 8 patients, and ≥20 mm in 8 patients. The CS was 81 points for tear increases <20 mm and 58.5 points for increases ≥20 mm ($P = .008$). Muscle atrophy and fatty degeneration progressed in 18 and 15 of the 37 patients, respectively. In tears with no progression of atrophy, the CS was 82 points compared with 75.5 points in tears with progression ($P = .04$).
Conclusions: Anatomic tear deterioration was found in the majority of patients, but it was often moderate. Large tear size increases and progression of muscle atrophy were correlated to a poorer functional outcome.
Level of evidence: Level II; Prognosis Study

Keywords: Rotator cuff tear; natural course; tear anatomy; clinical outcome; long-term follow-up; sonography

Permission for conducting the study was obtained from the Norwegian Center for Research Data (29144/3/LT). Our Committee for Medical and Health Research Ethics decided that this study represents "a quality assurance/control of an established practice" and that approval from the Data Protection Official for Research (Norwegian Center for Research Data) will be sufficient (ethical committee registration No. 2011/1931).

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The proper treatment of small to medium-sized tears of the rotator cuff is still a matter of debate. Both surgical and conservative treatment options exist. Primary conservative treatment may be supported by 2 recent level I studies that reported results for conservative treatment comparable to tendon repair for tears up to 3 cm in diameter.[13,21] On the other hand, leaving a rotator cuff tear unrepaired may not be without risk in the long term. It has been shown that some unrepaired tears

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progress in tear size, deteriorate in muscle quality, and redevelop symptoms.[17,18,24,26,29,31] As anatomic tear progression can lead to a poorer surgical prognosis, early surgical treatment may be recommended to forestall irreversible rotator cuff changes.[4,9,10,16,27] However, scientific evidence to justify recommending early surgical treatment has not yet been presented. Existing studies of unrepaired rotator cuff tears have follow-up times of up to 5 years only, and some of them have been performed on asymptomatic tears.[6,12,17,18,21,24,26,29] Although anatomic tear deterioration was found in these studies, reported tear size progression and muscle degeneration were often moderate and were not always accompanied by redevelopment of symptoms. Based on these studies, it is not possible to anticipate how many of these tears would in fact require surgical treatment later on. Also, it is not clear if the anatomic deterioration would reach a stage that affects the reparability of the tear. The aim of this study was therefore twofold. First, we wanted to assess the long-term development of tear anatomy of nonoperatively treated small to medium-sized rotator cuff tears and to correlate the results to clinical outcomes. Second, we wanted to find out how many tears would deteriorate anatomically to a stage that indicates a poor prognosis for tendon repair. Our study hypothesis was that a large number of tears would deteriorate anatomically, that these tears would show a poor outcome at follow-up, and that the anatomic deterioration would reach a level that affects tear reparability.

Materials and methods

Patients and procedures

This retrospective cohort study was performed in 1 Norwegian secondary care institution as a sonographic and magnetic resonance imaging (MRI) analysis of the natural course of conservatively treated rotator cuff tears during a period of at least 8.2 years. Written informed consent was obtained from all study participants before follow-up.

From May 2001 through November 2006, 1 orthopedic surgeon referred to physiotherapy 89 consecutive patients who were diagnosed sonographically and by MRI with an isolated full-thickness tear of the rotator cuff with a tear size of no more than 3 cm, no involvement of the subscapularis tendon, a negative tangent sign for muscle atrophy,[30] and a fatty degeneration of no more than stage 2 according to Goutallier.[7,8] Tears with more advanced stages of muscle degeneration were excluded because our study question can be answered only by following up tears that still can deteriorate anatomically, not tears for which negative prognostic factors for a repair are already present. Results from sonographic tear size measurement and from muscle assessment by MRI were routinely documented in all patient files and served as a baseline finding.

Physiotherapy was initiated by 1 of our hospital's physiotherapists and was continued for at least 3 months by a local physiotherapist. Routine re-examination was performed after 4 months, and patients with an unsatisfactory result from physiotherapy were considered for surgical treatment. For patients with a satisfactory result, treatment was ended, but they were informed that further treatment, also surgical treatment, could be given if symptoms recurred.

At least 8.2 years after the diagnosis of the tear, all 89 patients were invited to follow-up examinations. Seventeen were unable to attend, 11 because of serious medical conditions unrelated to the shoulder; 4 had died, and 2 patients did not want to participate.

Of the remaining 72 patients, 19 had undergone surgical treatment within the first year after the diagnosis and 4 had undergone surgical treatment at a later point. This left us with a group of 49 patients with a still unrepaired rotator cuff tear and a mean follow-up period of 8.8 years (range, 8.2-11.0 years).

Outcome measures

Tear anatomy

Tear size, muscle atrophy, and fatty degeneration were selected as parameters for the assessment of tear anatomy because they have, in earlier studies, been identified as being related to the development of tear symptoms[17,24,29] and also as being factors of prognostic value for the outcome after tendon repair.[9,15,25,27] Before the start of the study, it was determined that the presence at follow-up of a tear size increase of 10 mm or more in the anterior-posterior plane, a progression to a positive tangent sign, and a progression to stage 3 or 4 of fatty muscle degeneration should be regarded as negative prognostic factors for a tendon repair.[4,9,10,16,27]

Development of tear size was measured in all 49 study patients by comparing sonographic measurement results from the baseline with those from the follow-up. For outcome analyses, tears were classified into 3 groups according to tear size progression in the anterior-posterior plane: no to small progression (−5 to +9.9 mm), medium progression (10 to 19.9 mm), and large progression (≥20 mm). All sonographic examinations, both at baseline and at follow-up, were performed by the same experienced examiner (S.M.) whose accuracy in diagnosing tears of the rotator cuff and in measuring tear sizes has been well documented.[20,22] A Sonoline Antares scanner (Siemens Medical Systems, Erlangen, Germany) equipped with a linear array transducer of 8.5 to 11.5 MHz was used, and a standard examination protocol as described earlier was followed.[20,22] Diagnostic criteria for a rotator cuff tear were used as described in the literature.[3,19] Measurement of tear size was made along a measuring line drawn between the edges of the tear (anterior-posterior plane) or between the lateral margin of the tear and the greater tuberosity (medial-lateral plane).[28] Follow-up examinations were performed blinded for the baseline results, which means that the examiner did not consult the patient files before follow-up.

Development of muscle atrophy and of fatty degeneration at follow-up could be assessed for 37 of the 49 study patients who agreed to undergo a new MRI examination. Baseline information about muscle atrophy and fatty degeneration existed for all patients in written form in the medical file. For 16 patients, the MRI scans from baseline were also available for a second look. As all patients had been diagnosed with a negative tangent sign and a muscle atrophy ≤2 at baseline, and as the correctness of this assessment could be confirmed in all 16 cases with an existing baseline MRI study, deterioration of the muscular condition was diagnosed in cases with a positive tangent sign or a stage 3 or 4 muscle degeneration at follow-up. Follow-up MRI examination was performed on a 1.5T scanner (Siemens Medical Systems) according to a previously published protocol.[23] One experienced musculoskeletal radiologist (R.T.), who was blinded to clinical and sonographic data, analyzed all MRI scans, both the baseline and the follow-up examinations. The tangent sign[30]