J Shoulder Elbow Surg (2012) 21, 859-866

ELSEVIER

Journal of Shoulder and Elbow Surgery

www.elsevier.com/locate/ymse

Serial structural and functional assessments of rotator cuff repairs: do they differ at 6 and 19 months postoperatively?

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Background: Some studies have shown that rotator cuff tendon (RCT) retears occur early after surgery and ultimate failure strength is reached at between 3 and 6 months. However, few clinical studies have been reported to support their theory. The purpose of this study was to determine whether the RCT integrity after repair showed any difference at 6 months and at 19 months postoperatively.

Methods: Thirty-one patients who underwent complete repair for full-thickness RCT tears that were medium-sized tears or larger and had 2 postoperative follow-up magnetic resonance imaging (MRI) scans were included in this study. Retear, fatty degeneration, and muscle atrophy were evaluated during the first and second MRI sessions. Clinical assessment was performed by use of the American Shoulder and Elbow Surgeons score, Constant score, and pain visual analog scale preoperatively and at the time of the first and second MRI scans.

Results: The mean time for the two consecutive MRI scans was 5.9 months (range, 3.1-8.3 months) and 19.7 months (range, 10.1-24.3 months). On the first MRI scans, 24 patients had no retear, 5 had partial retears, and 2 had full-thickness retears. In terms of rotator cuff retears, the 2 sets of MRI scans showed exactly the same statuses. The only statistically significant improvement was a reduction in tendinosis on the second MRI scans. In addition, significant improvements in clinical status were observed between the 2 periods.

Conclusion: Our study shows that the structural status of RCTs after arthroscopic repair can be assessed at 6 months after surgery. Furthermore, although functional status improved with time after 6 months, the structural status of repaired cuffs remained unchanged.

Level of evidence: Level IV, Case Series, Treatment Study.

Keywords: Shoulder; rotator cuff repair; repair integrity; serial MRI

Open, mini-open, or arthroscopic repairs of full-thickness rotator cuff tears are commonly performed surgeries. Good to excellent anatomic and functional results are possible after repairing small- to medium-sized full-thickness rotator cuff tears.[1-4,18,19] The retear rate is substantially lower for small- to

This study was approved by the Institutional Review Board of Samsung Medical Center (IRB study 2009-12-002).

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1058-2746/$ - see front matter © 2012 Journal of Shoulder and Elbow Surgery Board of Trustees.
doi:10.1016/j.jse.2011.05.027

medium-sized tears,[7,26] whereas for large to massive tears, it is much higher, as assessed by use of imaging methods.[7,11,23,27] Although retears may not be associated with frank clinical failure, the clinical results of shoulders with a structurally successful repair are significantly superior to those of shoulders with rotator cuff retears.[11,23]

Several authors have shown experimentally or in animal studies that retears occur soon after surgery and that ultimate failure strength is reached at between 3 and 6 months postoperatively.[9,17,25] However, no clinical study has been conducted to confirm these findings.

Various clinical studies have been performed to assess the functional and anatomic outcome of rotator cuff repair.[2,7,8,10,14,15] However, all of these studies assessed the integrity and anatomic outcome of rotator cuff repair using postoperative magnetic resonance imaging (MRI), computed tomography (CT), or ultrasonography at various times after surgery. To our knowledge, no clinical study has determined the time at which rotator cuffs heal or retear. Furthermore, no suggestions have been made regarding the timing of postoperative MRI, CT, or ultrasonography for determining the structural status of a repaired cuff.

The aim of this study was to confirm that rotator cuffs either regain integrity or retear within 6 months after repair and subsequently maintain this status. Our hypothesis was that after repair, rotator cuffs maintain their structural status at 6 and 19 months postoperatively irrespective of clinical improvements over time.

Materials and methods

Patient selection and clinical assessment

From April 2006 to October 2009, arthroscopic rotator cuff repairs were performed for partial- and full-thickness rotator cuff tears in 388 patients at our institution. Our inclusion criteria were (1) full-thickness rotator cuff tear that was medium in size or larger and was repaired with suture anchors, (2) complete repair, and (3) the availability of 2 sets of serial postoperative follow-up MRI scans. There were 221 full-thickness tears that were medium in size or larger. Among them, complete repair with original footprint coverage[28] was performed in 159 patients, near-complete repair with less than 50% footprint coverage in 41, and partial repair with less than 10 mm of the humeral head exposed in 21. Patients with a history of prior shoulder surgery (12 cases), infection (1 case), or fracture (2 cases) were excluded. Of the 159 patients, 93 underwent postoperative MRI once and 31 patients underwent postoperative MRI twice (for research purposes). These 31 patients fulfilled the inclusion criteria and constituted the study cohort.

Of the 31 patients, 21 (67.7%) were women and 10 (32.3%) were men. The mean age of the patients at the time of surgery was 60.7 years (range, 50-72 years). The dominant arm was involved in 19 patients (61.3%). The cause of injury was unknown in 24 patients (77.4%), whereas it was a traumatic in the remaining 7 (22.6%), caused by a fall, slip, or road traffic accident. A day before surgery and at the time of the first and second MRI sessions, clinical assessments were performed by our shoulder physiotherapist (who was unaware of the study objectives and MRI findings) using the American Shoulder and Elbow Surgeons score, Constant score, and pain visual analog scale.

Surgical indication and technique

Surgery was indicated whenever there was pain or loss of function after conservative treatment for 6 months, the presence of a partial- or full-thickness tear by MRI, and no cuff arthropathy. All patients were operated on under general anesthesia in the lateral position. The greatest dimension of each rotator cuff tear was intraoperatively measured with an arthroscopic ruler after debridement. Torn tendons were systematically identified, recorded, mobilized, and reattached to the greater tuberosity by use of a suture anchor with a simple stitch in single-row fashion in 28 patients and double row in 3. Complete coverage of the rotator cuff footprint[27] was performed in all patients. A routine rehabilitation protocol was followed in all patients, with immobilization for 4 weeks followed by active-assisted exercises and then stretching and strengthening exercises.

MRI acquisition

All patients underwent preoperative MRI or magnetic resonance (MR) arthrography and 2 postoperative MRI or MR arthrography sessions. The mean timing of MRI or MR arthrography before surgery was 1.9 months (range, 0.0-9.9 months). Postoperatively, indirect MR arthrography (which used MRI with the intravenous administration of gadopentetate dimeglumine)[13] was performed in 30 patients, and conventional MRI without gadopentetate dimeglumine was performed in 1 patient who had a history of allergic reaction to contrast media.

The first postoperative MRI or MR arthrography session was performed on average at 5.9 months (range, 3.1-8.3 months) after surgery and the second session at a mean of 19.7 months (range, 10.1-24.3 months) after surgery. MRI was performed with a 3.0-T MR imager (Gyroscan Intera Achieva; Philips Medical Systems, Best, The Netherlands) with a dedicated receive-only shoulder coil. The MR images were 3-mm-thick slices with a 1-mm gap between slices, a 15-cm field of view, a matrix size of 224 × 224, and an echo train length of 16. All measurements were performed on a picture archiving and communication system monitor (PACS; GE Healthcare Integrated IT Solutions, Barrington IL, USA) by use of a mouse-point cursor and automated computer calculation for distance and angle.

MR image evaluations

All 3 MRI sets were studied individually and analyzed by 2 orthopedic surgeons unaware of surgical details and clinical results. MR images or MR arthrograms were assessed for type of tear/retear, fatty degeneration/regeneration of muscle, and muscular atrophy/recovery. Oblique-coronal T2-weighted and oblique-sagittal T2-weighted fluid-sensitive images were evaluated to determine the presence of cuff tears. Retears of cuffs after repair were also assessed by use of the same images via the retear classification of Sugaya et al.[22] According to this classification, a type I retear has sufficient thickness with homogeneously low intensity, a type II retear has sufficient thickness with partial high intensity, a type III