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ORIGINAL ARTICLE

The timing of retears after arthroscopic rotator cuff repair

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Background: Little is known about the time dependence of the failure rate of surgically repaired rotator cuffs. Retears are significant, as they are common and may lead to less satisfactory outcomes and additional operations. Their timing is critical foundational information for understanding failure mechanisms. However, this remains unclear. Currently, there exist a number of studies that have reported re-tear rates at specific time points. Combining data from these publications can reveal when cuffs re-tear, which will help inform expectations and guidelines for progression of activity after surgery.

Methods: PubMed, Medline, and Embase were searched for studies relating to rotator cuff repair. Abstracts and articles were evaluated on the basis of predefined inclusion and exclusion criteria. Data were extracted from those publications that satisfied all requirements, and regression analysis was performed.

Results: Thirteen articles were included in the final meta-analysis. Retear rates for medium tears increased for approximately 15 months and leveled off at approximately 20%. Retear rates for large tears progressed steadily for about 12 months and approached an upper limit of approximately 40%. Retear rates for massive tears ranged from 20% to 60%, but the distribution of re-tear rate over time for these cuff tears is not clear from these data.

Conclusion: Retear rates for medium and large tears generally increase until at least 10-15 months after surgery, after which they are likely to level off. Retear rates for massive tears are variable and may follow a time course different from that of other tear sizes. Retear rates depend on size of the original tear.

Level of evidence: Level IV; Meta-analysis

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Little is known about the progression of re-tear rate over time of surgically repaired rotator cuffs. Retears after surgery are relatively common, reportedly occurring at a rate of 15%-92%, and are clinically significant because they are associated with less satisfactory clinical outcomes and may lead to

additional operations.^{1,9,11,13,22} They are consequently an important topic of consideration for orthopedic surgeons.

Retears after arthroscopic rotator cuff repair have been shown to be associated with larger preoperative tear size, increased age of the patient, and higher degree of fatty infiltration of the rotator cuff muscles.^{1,13,22} The re-tear rate is also dependent on time, but the timing of retears remains unclear. Understanding when retears occur will allow more informed postsurgical expectations and guidelines for progression of physical activity. This is particularly applicable

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to medium, large, and massive tears, as those that are classified as small tend to heal relatively frequently.^{15,17} Knowledge of rotator cuff retear rates at given time points is also beneficial to those who evaluate clinical trials, which often report a retear rate of a particular cohort at a single time after surgery. By analyzing the progression of retear rate over time, it is possible to significantly expand what is currently known about the timing of retears. This is a critical piece of foundational information on which investigations into the failure mechanisms of surgically repaired cuff tears may then build. Unfortunately, few studies have investigated the distribution over time of rotator cuff retears as a primary question.

Those who have researched this topic have generally reported a steady increase in rotator cuff retears during the first few months after surgery, followed by a decline in the incidence of additional retears.^{5,12} Iannotti et al serially imaged patients at 2, 6, 12, 16, 26, 39, and 52 weeks after surgery and found that 18 of 19 (94.7%) retears in patients with rotator cuff tears measuring 1-4 cm occurred within 26 weeks of surgery.⁵ Miller et al reported similar findings after repair of large rotator cuff tears and imaging at multiple time points up to 2 years postoperatively.¹² In their patients, 9 of 9 retears occurred within 6 months of repair. Whereas these studies on their own provide some valuable insight into the time dependence of rotator cuff retear rate, there still exist many other studies on rotator cuff repair outcomes that have reported a retear rate at a single time after surgery. By collecting the data from these studies and evaluating them together, it is possible to gain additional information about when rotator cuff repairs are likely to fail.

The goal of this study was to supplement the existing literature by gathering the retear rates reported in prior studies at specific time points and evaluating the distribution of retears over time. This will be useful to orthopedic surgeons, patients, and those who will perform future investigations into results after surgical rotator cuff repair.

Materials and methods

PubMed, Medline, and Embase were searched using the terms “rotator cuff retear,” “rotator cuff repair,” “rotator cuff outcome,” “rotator cuff tear,” and “rotator cuff failure.” Publications were evaluated for potential inclusion in this analysis on the basis of inclusion and exclusion criteria that were decided on before the start of the study.

The inclusion criteria were (1) performance of arthroscopic primary rotator cuff repair on (2) full-thickness cuff tears in (3) patients aged 18 years and older. The studies must also (4) report tear size in 1 dimension for single-tendon tears or use DeOrto and Cofield’s classification system of tear size,³ (5) have obtained postoperative magnetic resonance imaging, magnetic resonance arthrography, or computed tomography arthrography on all patients in the cohort, (6) reported the time of postoperative imaging, (7) have clearly defined imaging criteria for determining the presence of full-thickness retear, and (8) be published in 2005 or later. Of note, retear in the context of this study is defined by the

presence of a full-thickness discontinuity on postoperative 3-dimensional imaging. This term is used to refer to those tears that either failed to heal after surgery or healed and retear after repair.

The exclusion criteria were (1) partial-thickness tears, (2) small tears, (3) prior ipsilateral shoulder surgery, (4) isolated subscapularis tears, (5) incomplete repair, (6) use of biologic augmentation (eg, platelet-rich plasma, bone marrow stimulation), and (7) use of patches or grafts in surgery.

Data were extracted from those studies that met the proposed criteria. The retear rate vs. time was graphed, and weighted logarithmic regression was run on the data using sample sizes as the relative weights. All statistical analyses were performed using Stata software (StataCorp LP, College Station, TX, USA), and graphs were created using GraphPad Prism (GraphPad Software, Inc, San Diego, CA, USA).

Results

There were 7059 abstracts reviewed, and 13 articles were selected for inclusion in the analysis. The results of the search process are displayed in [Figure 1](#). Data were extracted from each of the 13 articles. Individual data points from each article are shown in [Table I](#).

Using the 13 articles from which data were extracted, a graph of retear rate vs. time for each tear size category was created. This graph is visible as [Figure 2](#). Based on the results of prior studies on the topic of the relationship of rotator cuff retears and time, a logarithmic regression analysis was performed using the data collected from all 13 papers. The results of the analysis are displayed in [Table II](#).

From the extracted data, it appears that the retear rate for medium tears is rarely substantially higher than 0.2. The retear rate over time appears to increase relatively steadily until about 15 months, after which only a single data point is present in this analysis.

For large tears, the retear rates range from 0.115 to 0.5, with the majority clustered between approximately 0.2 and 0.4. The data in this set do not fit a weighted logarithmic regression curve closely ($r^2 = 0.0585$), but retear rates appear to increase somewhat consistently during the first 12 months postoperatively. An upper limit of approximately 0.4 would capture all but 1 of the data points in this set.

For massive tears, the retear rate ranges from 0.2 to 0.571. Of note, most of the data points in this set are clustered around the time between 10 and 15 months. The approximate upper limit that exceeds all but 1 of the data points in this set is 0.5. Based on the data available, it appears that the retear rate for cuff repairs involving massive tears can vary substantially and may still be increasing at 10-15 months.

Discussion

The results of this study suggest a difference in retear rate over time between tears of different sizes. This is consistent with the many studies that have found that retear rate of rotator

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