Journal of Orthopaedics and Clinical Research

Lee CS, et al., 2023- J Orth Clin Res

Case Report

Long-term Functional and Pain Outcomes Following Arthroscopic Partial-Thickness Rotator Cuff Tear Completion and Repair

Christopher S Lee*, Alexandria J Lichtl, Michelle L Dilley, Paige M Dyrek, William B Stetson

Stetson Lee Orthopaedics and Sports Medicine, Burbank, CA

***Corresponding Author:** Christopher S Lee, Stetson Lee Orthopaedics and Sports Medicine, Burbank, CA.

Received Date: 08-15-2023

Accepted Date: 09-30-2023

Published Date: 09-19-2023

Abstract

Objective: There remains little consensus on the optimal treatment approach for partial-thickness rotator cuff tears and few studies have examined the long-term outcomes of different surgical repair techniques. The purpose of this study is to identify the long-term functional and pain outcomes of arthroscopic tear completion followed by repair. The authors hypothesize that this technique will allow patients to have long-term pain relief and return to a pre-injury level of function.

Methods: Patients (n=16) who underwent arthroscopic tear completion and repair for a partial-thickness rotator cuff tear were included in this case series. Each patient returned for a one-time follow-up visit, with an average follow-up time of 7.09 years, at which time physical and neurological exams were performed, quality of life was assessed through subjective questionnaires, American Shoulder and Elbow Society (ASES) and the University of California at Los Angeles (UCLA) shoulder scores were obtained, and magnetic resonance imaging was performed.

Results: The average ASES score was 85.3, with 81% of patients reporting that they were able to return to a pre-injury level of function. Half of the patients reported the highest possible UCLA shoulder score of 35. Physical examination showed that patients had excellent strength and range of motion. Magnetic resonance imaging demonstrated continuity of the repair in all but one patient. However, 25% of patients reported return of symptoms since surgery, including pain and limited mobility.

Conclusion: At an average of 7.09 years follow-up, most patients were found to have full mobility, pre-injury level of activity, and maintenance of rotator cuff integrity in the surgically treated shoulder. However, one fourth of patients reported return of symptoms. The authors conclude that the tear completion and repair technique can lead to long-term functional improvement, but has less favorable results in terms of subjective pain level and quality of life.

Citation: Lee CS, Lichtl AJ, Dilley ML, Dyrek PM, Stetson WB. Long-term Functional and Pain Outcomes Following Arthroscopic Partial-Thickness Rotator Cuff Tear Completion and Repair. J Orth Clin Res. 2023;1(2):112-21.
DOI: https://doi.org/10.37191/Mapsci-JOCR-1(2)-013

Keywords: Arthroscopy; Shoulder; Rotator cuff; Partial thickness; Magnetic resonance imaging; Adult; Treatment outcomes; Range of motion; Function.

Introduction

Partial rotator cuff tears are a common source of shoulder pain and can result from degenerative overuse or acute injury. While the true incidence of partial rotator cuff tears is unknown, it has been found to range from 13% to 32% in imaging and cadaveric studies [1-4]. This high incidence is clinically significant, since partial rotator cuff tears can cause pain, stiffness, and difficulty with overhead motions, thereby decreasing mobility and quality of life for patients [1]. The presence of partial rotator cuff tears is also directly correlated with age, which is an important factor to note in light of an aging population [5].

Although there is substantial literature surrounding the management of full-thickness rotator cuff tears, there is comparatively little data on the optimal clinical approach for treating partial-thickness tears [1,6,7]. Conservative measures, such as activity modification, anti-inflammatories, physical therapy, and steroid injections can be useful in treating patients with partial rotator cuff tears. Several arthroscopic treatment options have been documented in the literature, including: tear debridement with or without acromioplasty [8-10], arthroscopic or mini-open rotator cuff repair with or without acromioplasty [10-15], transtendinous in situ repair [15-18], and conversion to a full-thickness tear followed by repair [6,7,13-16]. A review comparing rotator cuff debridement, tear completion and repair, and transtendon repair for partial rotator cuff tears concluded that no single approach was superior [19]. Studies have examined the long-term outcomes (>5 year follow-up) for acromioplasty and in-situ repairs of partial-thickness rotator cuff tears [9,20]. However, the body of knowledge on outcomes following partial cuff takedown and repair is largely limited to ≤5 year follow-up [21,22]. The current study intends to address this gap in the literature by evaluating the outcomes of arthroscopic partial-thickness rotator cuff tear completion and repair at >5 year follow-up. The authors hypothesize that for partial rotator cuff tears that have failed conservative treatment, arthroscopic tear completion and repair will yield results that allow patients to have long-term pain relief and return to a pre-injury level of function.

Methods

Inclusion and exclusion criteria

In this study, patients who underwent arthroscopic takedown and repair for an isolated partial-thickness rotator cuff tear performed between November 2002 and May 2008 were included. Institutional review board approval was received and informed consent was obtained from all participating patients. History, physical examination, X-ray, and magnetic resonance imaging (MRI) performed in the orthopaedic office were used to diagnose partial-thickness rotator cuff tears pre-operatively. Patients who had associated intra-articular pathologies aside from a partial rotator cuff tear were excluded. All subjects underwent a course of conservative treatment which included physical therapy and subacromial space

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cortisone injections if indicated. Those who did not improve with these measures elected to proceed with an arthroscopic partial rotator cuff repair by a single, fellowship trained orthopaedic surgeon.

Surgical procedure

All surgeries were performed in an out-patient surgery center, with patients placed in the lateral decubitus position. Using a standard posterior viewing portal and anterior working portal, diagnostic arthroscopies were performed. After debridement of the articular-sided tendon, rotator cuff tear depth was measured with a 4.5-mm-wide full radius shaver and a calibrated arthroscopic probe with a 4-mm tip. To locate the corresponding bursal-sided rotator cuff, a suture marker was placed in the center of the rotator cuff defect. A spinal needle was used for the passage of a No. 1 polydioxanone (PDS) suture as a suture marker. The arthroscope was then placed into the subacromial space, and after thorough bursectomy, a comprehensive evaluation of the corresponding bursal-sided rotator cuff was carried out with a probe. After the partial-thickness rotator cuff tears were visualized, they were classified as described by Snyder and colleagues (Table 1) [23,24]. Patients who were found to have significant partial articular-sided tearing (A-3 or A-4), significant bursal-sided tearing (B-3 or B-4), or articular-sided tearing with bursal-sided tearing adding to a severity of three or more were then treated by takedown and repair. The surgeon made this decision intra-operatively.

Location of Tear	
A	Articular Surface
B	Bursal Surface
Severity of Tear	
0	Normal cuff with smooth covering of synovium and bursa
1	Minimal superficial bursal or synovial irritation or slight capsular fraying in a small, localized area; usually <1 cm
2	Actually fraying and failure of some rotator cuff fibers in addition to synovial, bursal, or capsular injury; usually 1-2 cm
3	More severe rotator cuff injury, including fraying and fragmentation of tendon fibers, often involving the entire surface of a cuff tendon (most often supraspinatus); usually 2-3 cm
4	Very severe partial rotator tear that usually contains a sizable flap tear in addition to fraying and fragmentation of tendon tissue and often encompasses more than a single tendon; usually >4 cm

Table 1: Snyder Classification of Partial Rotator Cuff Tears[23,24] .

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All partial-thickness rotator cuff tears were then converted to full-thickness tears using an arthroscopic shaver from the bursal-side. After completion of the partially torn rotator cuff tear, the footprint was then cleared of soft tissue with gentle burring of the greater tuberosity to create a bleeding bed. A single triple-loaded metal suture anchor was then placed in the footprint of the greater tuberosity near the articular margin. Repairs were performed in a single-row, low-tension technique with careful consideration to restore the anatomy of the rotator cuff tendon. At the end of the procedure, the arm was internally and externally rotated to ensure complete repair of the rotator cuff tendon to the greater tuberosity footprint. The portals were closed and subcutaneous tissues were injected with 20 ccs of 0.25% Marcaine with epinephrine. A sterile dressing was applied followed by an Ultrasling (DonJoy, CA) and the patient, in the supine position, was returned to the post-anesthesia room in stable condition.

Rehabilitation

Patients were kept in an Ultrasling with an abduction pillow for the first two weeks following surgery. During this time, they were only allowed to perform daily pendulum home exercises with active elbow flexion and extension. After two weeks, the slings were discontinued and the patients participated in formal physical therapy for passive and active assisted range of motion.

At two months post-operatively, patients began active range of motion and scapular stabilization exercises with rotator cuff strengthening. At six months, patients were allowed to slowly return to activities as tolerated with no heavy lifting.

Data collection and analysis

Patients who were identified as having isolated partial rotator cuff tears treated by arthroscopic tear completion and repair between 2002 and 2008 were included in the study. A total of 16 patients returned to the office for a one-time follow-up visit, at which point written consent was obtained. At follow-up, subjective symptoms were assessed through history of present illness. American Shoulder and Elbow Society (ASES) and University of California at Los Angeles (UCLA) shoulder scores were also obtained and physical and neurological exams were documented by a single orthopaedic surgeon who did not perform the surgery. In order to reduce bias, the orthopaedic surgeon who performed the examinations was blinded to which patients were included in the study.

The ASES score was used as a validated measure to assess post-operative shoulder function and pain outcomes [25]. The authors tabulated each patient's ASES score using the pain visual analog scale (VAS) and 10 activity of daily living (ADL) functional questions, with a maximum score of 100 points. The UCLA score was used as a validated outcome to assess shoulder function following a rotator cuff repair [25,26].

The score was determined using physical examination findings and patient self-report measures on pain, satisfaction, and function. Participants with UCLA scores less than 27, between 27 and 34, and with 35 were classified as fair/poor, good/excellent, or maximum

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score, respectively. The small number who has missing ASES and/or UCLA scores were excluded from calculations of averages for these measurements. All patients were also invited to have an MRI of the affected shoulder to evaluate the integrity of the repairs that were performed. All imaging was done at the office on an Esoate 0.27 Tesla scanner and interpreted separately by two musculoskeletal (MSK) fellowship trained radiologists, who were also blinded to which patients were included in the study.

Results

Participants

Between 2002 and 2008, a total of 86 patients were identified as having undergone an arthroscopic partial-thickness rotator cuff tear completion followed by repair performed by a single orthopaedic surgeon. Due to the long follow-up time in this study, many of these patients could not be included due to missing data or the inability to return to the office. Seventeen patients were excluded because the operative reports had been destroyed.

Another 29 patients were excluded because they had incomplete data on post-operative rehabilitation. Of the remaining 40 patients with complete data, 16 were able to return for follow-up. The average time from the date of surgery to date of evaluation was 7.09 years, with a range of six to 11.4 years. The surgeries involved the dominant arm in 10 out of the 16 patients (62.5%). One fourth of the patients were female and the average age of the patient population at the time of surgery was 56 years, with a range of 30-73 years. A review of the patients' medical records suggests that all patients adhered to the post-operative protocol.

Clinical examination and assessments

At the one-time follow-up visit, a history of present illness was obtained for each patient. Twelve patients (75%) of patients reported improvement of the pain and shoulder functionality since surgery. Four patients (25%) reported that their symptoms had returned, either gradually without discrete injury or acutely without discrete injury.

Each patient also completed the ASES questionnaire. One patient did not record a pain assessment on the VAS. Excluding this patient, 60% of patients reported that they were pain-free at the time of examination. 81% of participants reported that they had little to no difficulty lifting 10-lbs above the shoulder while 87.5% reported that they had little to no difficulty throwing a ball overhead with the affected limb (Table 2). Seven patients (46.6%) recorded an ASES Self-Assessment score of 100, with the average ASES score being 85.3.

In addition, 81% of patients reported that they were able to return to a pre-injury level of activity. UCLA scores were not obtained from two patients. Excluding these patients, 78.5% reported experiencing occasional or no pain and 92.8% of patients returned to normal activities or with slight restrictions only. Seven out of the 14 patients (50%) who completed the UCLA shoulder score reported the highest possible score of 35 (Table 3).

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Activity (ADL's)	Affected Arm (range)
Put on a coat	2.88(2-3)
Sleep on affected side	2.25(0-3)
Wash back/do up bra in back	2.38(0-3)
Manage toileting	2.94(2-3)
Comb hair	2.88(2-3)
Reach high shelf	2.50(0-3)
Lift 10 lbs. above shoulder	2.25(0-3)
Throw a ball overhand	2.31(0-3)
Do usual work	2.68(1-3)
Do usual sport	2.13(0-3)

Table 2: Self-Reported ASES Scores.

Total UCLA Score	% Reporting (out of 14)
<27 (fair/poor)	7.14(1)
≤ 27 and ≤ 34 (good/excellent)	42.8(6)
=35 (maximum possible score)	50.0(7)

Table 3: UCLA Shoulder Scores.

A physical examination was also performed on each patient by an orthopaedic surgeon who did not perform the surgery. All patients exhibited full external and internal rotation strength (5/5).

The majority of patients had full strength of the supraspinatus, with only two patients experiencing a deficit of 4/5. Compared to the contralateral arm, 81% of surgically treated shoulders exhibited equal or greater degree of flexion and 75% showed equal or greater degree of extension, internal rotation at 0°, and external rotation at 0° and 90°.

Nine patients (56.3%) demonstrated full abduction and internal rotation at 90° (Table 4) and most patients (87.5%) exhibited negative apprehension, relocation, and Hawkin's exams.

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	Flexion (°)	Abduction(°)	Extension(°)	External Rotation (0°)	External Rotation (90°)	Internal Rotation (90°)	Internal Rotation (0°)
Average ROM	156.1	156.6	57.6	56.8	74.3	46.5	L1-L2
Average ROM (unaffected side)	154.7	158.3	57.1	52.2	69.7	45.4	L1-L2

Table 4: Physical examination.

Diagnostic imaging

In order to evaluate the integrity of the repairs, 13 of the 16 patients had MRIs performed on the operated shoulder. One patient was excluded because he had a pacemaker and two refused to have the MRI performed. Continuity of repairs was seen in all but one patient, who sustained a type I re-tear of the repair site.

Discussion

There is a dearth of literature regarding the proper management of partial-thickness tears, despite them being more common than full-thickness rotator cuff tears [27]. Due to this lack of evidence, there remains controversy over the optimal surgical approach to treating these tears. The most commonly reported surgical interventions for partial-thickness tears include transtendon repair and partial tear takedown and repair.

A meta-analysis found that both techniques had excellent clinical outcomes at a mean follow-up of 40.5 months [28]. Articles that advocate for arthroscopic takedown and repair provide convincing results; however, these studies are largely limited by shorter follow-up times (24-60 months) [21,22,29]. To the researcher's knowledge, the current study is the first to assess arthroscopic tear takedown and repair with a maximum follow-up time of over 11.4 years.

In the current study, all surgeries were performed by a single fellowship trained surgeon and only patients with an isolated partial-thickness rotator cuff tear were included. Therefore, variability in surgical technique and shoulder pathology was limited. The post-operative physical examination, UCLA score, and ASES shoulder score evaluations showed that arthroscopic partial tear takedown with repair is an effective surgical technique that has favorable functional outcomes and allows most patients to return to pre-injury activity level.

Overall, the average ASES score of the patient population was 85.3/100 and the average UCLA score was 32.2/35, which is comparable to other published literature examining short-term outcomes [8,15]. The physical examination yielded excellent results in terms of range of motion and strength and all but one post-operative MRI revealed successful maintenance of the repair. However, it is important to note that 25% of participants

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reported that the symptoms of pain and loss of function had returned since surgery and only 60% of patients reported that they were pain-free on the VAS. This shows that despite promising objective results from the physical examination and assessments, subjective measures yielded less positive results. Therefore, this surgical technique was not effective at providing patients with long-term pain relief in the affected shoulder.

Limitations

There are several limitations in this study. Pre-operative ASES or UCLA scores were not obtained for all of the patients and therefore researchers could not compare pre- and post-operative scores. Due to loss to follow-up, selection bias is also present. Since the authors' focus was on surgical technique, the authors did not control for tear location (articular vs. bursal-sided). Only patients with significant partial tearing, as defined by Snyder and colleagues, were treated by takedown technique and included in the study. The increased severity of the partial tears may have negatively impacted long-term outcomes. In addition, the authors did not control for level of activity.

The population size is small and thus may not be an accurate representation of the general population. With an average age of 56 years at the time of surgery, the patient population was also older and therefore the results are not generalizable to younger populations. It would be interesting to examine younger overhead athletes who have undergone arthroscopic takedown and repair to determine ability to return to high activity level. Furthermore, researchers used a relatively low-field MRI and did not use arthrogram technique or metal artifact reducing software (MARS). However, the board-certified MSK radiologists were able to easily read the imaging without needing arthrogram technique or MARS.

Conclusion

Our results show that arthroscopic takedown and repair of significant partial rotator cuff tears is a successful procedure for improving functional ability in older patients who initially fail conservative management. This technique did not, however, yield favorable results in terms of subjective improvement and pain, as 25% of patients reported return of symptoms at follow-up. Therefore, the authors conclude that long-term subjective measures were not as favorable as functional measures and imaging results. With an average follow-up time of 7.09 years, this case series is unique in its evaluation of the long-term effectiveness of a specific surgical technique for treating partial-thickness tears. Further research is needed to compare the long-term results found in this study to other surgical techniques for partial-thickness tears, such as in situ transtendon repair.

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