A Novel, Fast, Safe, and Effective All-Inside Arthroscopic Rotator Cuff Repair Technique

Results of 1000 Consecutive Cases

Ashleigh Elkins,* MD, Patrick H. Lam,* MD, PhD, and George A.C. Murrell,*[†] MD, DPhil

Investigation performed at the Orthopaedic Research Institute, St George Hospital Campus, University of New South Wales, Sydney, Australia

Background: Arthroscopic rotator cuff repair is a common but technically difficult surgical technique. This study describes a novel arthroscopic rotator cuff repair technique where the repair was performed while visualized entirely from the glenohumeral joint. A single-row knotless tension band inverted mattress suture technique was utilized with fixation obtained via suture anchors. The technique was relatively easy to perform and demonstrated good repair strength and footprint compression in an ex vivo ovine model.

Purpose: To evaluate the safety and efficacy of this technique in 1000 consecutive patients.

Study Design: Case series; Level of evidence, 4.

Methods: This study was a retrospective analysis of prospectively collected data in 1000 consecutive patients. Included patients underwent primary arthroscopic rotator cuff repair by a single surgeon performing the undersurface repair technique and attended 6-month follow-up with ultrasound evaluation to determine repair integrity. Exclusion criteria were irreparable tears, incomplete repairs, tendon reconstruction with a synthetic patch, and revision cases.

Results: The only complication was retear. The overall retear rate at 6 months following repair with the undersurface technique was 8.5%. The mean ± SEM operative time for the technique was 16 ± 0.3 minutes (range, 4-75 minutes). There were no infections. Smaller tears were repaired faster and had better healing rates.

Conclusion: The novel all-inside arthroscopic rotator cuff repair technique was safe and significantly faster and provided better healing rates than other repair techniques. The retear rate of 8.5% is, to the authors' knowledge, the lowest reported rotator cuff retear rate in a large cohort of patients based on a single technique.

Keywords: rotator cuff; repair; tendon; arthroscopic; undersurface

The rotator cuff is the most commonly injured shoulder structure. Tears of the rotator cuff are a frequent cause of shoulder pain and dysfunction.[7,8,13,15,28] The prevalence of rotator cuff tears within the general population is estimated at between 20% and 30%.[30] Over 75,000 rotator cuff repairs are performed annually in the United States.[26] The most common complication of rotator cuff repair is retear, with reported retear rates between 15% and 90%.[7,18]

Rotator cuff repair was initially performed as an open surgical procedure. Traditional open rotator cuff repair techniques utilized sutures to reattach tendon to bone.[20] Disadvantages with open techniques include longer recovery time, postoperative stiffness, disruption of the deltoid, postoperative failure of deltoid repair, and poor cosmetic outcomes.[22] In recent times, a trend toward mini-open and, most recently, all-arthroscopic repair techniques has been observed.[20] Proposed advantages of all-arthroscopic

techniques include improved visualization, preservation of the deltoid and reduced risk of scar formation, less postoperative pain, and potentially shorter recovery and rehabilitation.[18,22] However, the difference in these outcomes for open versus arthroscopic techniques is debatable, and there may be no real difference between the techniques; in addition, pain outcomes tend to be better for arthroscopic techniques only in the first few days postoperatively. Most arthroscopic repair techniques include initial diagnostic arthroscopy of the glenohumeral joint to identify the torn rotator cuff and other concomitant shoulder pathologies, including tears to the labrum and biceps and Bankart lesions. If present, such pathology is usually addressed with the arthroscope within the glenohumeral joint. To repair the rotator cuff, the arthroscope is then repositioned in the subacromial space, and the tendon is approached from its bursal surface. This requires dissection or removal of the subacromial bursa to visualize the torn tendon and usually involves concomitant acromioplasty.[20] Owing to the presence of the subacromial bursa, it can be difficult to visualize the torn tendon. Furthermore, performing an acromioplasty induces bleeding, which can further impair visualization.[29]

Acromioplasty has long been performed routinely with rotator cuff repair. This is related to the theory of extrinsic subacromial impingement, which links the anatomic shape of the acromion to impingement and compression from the bursal side leading to abrasion and tearing of the rotator cuff.[25] However, recent studies suggest that there is little, if any, clinical benefit to performing acromioplasty concurrently with rotator cuff repair, and it is becoming less common.[1,4,10,14,17,24,25]

One of the key drawbacks to many common methods of all-arthroscopic rotator cuff repair methods is that they are technically demanding, as reflected by their long surgical duration. In 2006, rotator cuff repair had the longest operative time of all upper limb day procedures performed in the United States, at 73 minutes.[12] Reported mean operative times for arthroscopic rotator cuff repair techniques range from 32 to 113 minutes.[6,23,27,29] Longer operating times are associated with higher economic costs and potentially adverse clinical outcomes; they may also be associated with infection and thromboembolic complications[29] and, as suggested by a number of studies, possible increased risk of retear.[13,27] However, the incidence of thromboembolic complications is low in arthroscopic rotator cuff repair surgery.

Given the limitations of many common arthroscopic rotator cuff repair techniques, we developed an arthroscopic rotator cuff repair technique in which the entire repair was performed from within the glenohumeral joint. The torn tendon was repaired with a single-row tension band inverted mattress suture technique with knotless Opus Magnum suture anchors (ArthroCare Corp). The technique utilized advances in arthroscopic suture devices, such as the Opus Smart Stitch Device and the Perfect Passer System (ArthroCare Corp). These devices allow the surgeon to deploy sutures through the edge of the torn tendon in an inverted mattress configuration. The technique could be carried out while visualizing the tear from within the glenohumeral joint, without the need to perform an acromioplasty or dissect the subacromial bursa.

A biomechanical study of the undersurface repair technique showed that it produced good repair strength and provided good footprint compression.[2] Preliminary results in small cohorts of patients with this technique were promising, with a markedly reduced operative time as compared with the bursal-sided technique and with a similar retear rate.[23,27,29] However, we were unsure how this technique would hold up, with particular respect to the retear rate, in a large cohort of patients.

The aim of this study was to evaluate the efficacy of the all-inside arthroscopic rotator cuff repair technique in a cohort of 1000 patients. The primary outcome of the study was to quantify the retear rate, as determined by ultrasound at 6 months postsurgery. Secondary outcomes included evaluation of the operative time and complication rates, including infection and reoperation rates.

METHODS

This was a retrospective cohort study that analyzed prospectively collected data from 1000 consecutive patients. The study period was between May 2005 and May 2016. Patients were included if they underwent primary arthroscopic rotator cuff repair with the undersurface inverted mattress technique by the senior author (G.A.C.M.) and returned for a 6-month follow-up appointment where an ultrasound was performed to determine the integrity of the repair. Patients were excluded if they had a bursal-sided repair, a mixed repair combining the undersurface and bursal-sided repair techniques, or a repair with a synthetic polytetrafluorethene patch. Patients who had concurrent Bankart repairs, superior labrum anterior-posterior (SLAP) tear repairs, distal clavicle excision, and fracture reduction were also excluded. Revision rotator cuff repairs were excluded. Patients undergoing concomitant rotator cuff repair and capsular release were included.

Surgical Technique

All rotator cuff repairs were performed arthroscopically by the same surgeon (G.A.C.M.). Patients were referred for surgery if they had a symptomatic full-thickness rotator cuff tear or a partial-thickness tear that involved ≥50% of the tendon's thickness, as identified on preoperative ultrasound. The surgery was performed with the patient in the beach-chair position. All patients received anesthesia in the form of an interscalene block with sedation. Figure 1 depicts the surgical technique; see also the Supplementary Video.[21] Biceps tendon pathology was usually left alone with no surgical intervention. Initial shoulder arthroscopy was performed via a posterior portal to confirm the presence of a rotator cuff tear and to identify any other concomitant shoulder pathology (Figure 1A). Tears that required mobilization were not included. L- and V-shaped tears were directly repaired to the bone, and side-to-side repair techniques were rare (<1%). Following this evaluation, a lateral portal was created. The position of the lateral portal was determined by passing a spinal needle through the torn tendon under arthroscopic visualization. The position of the
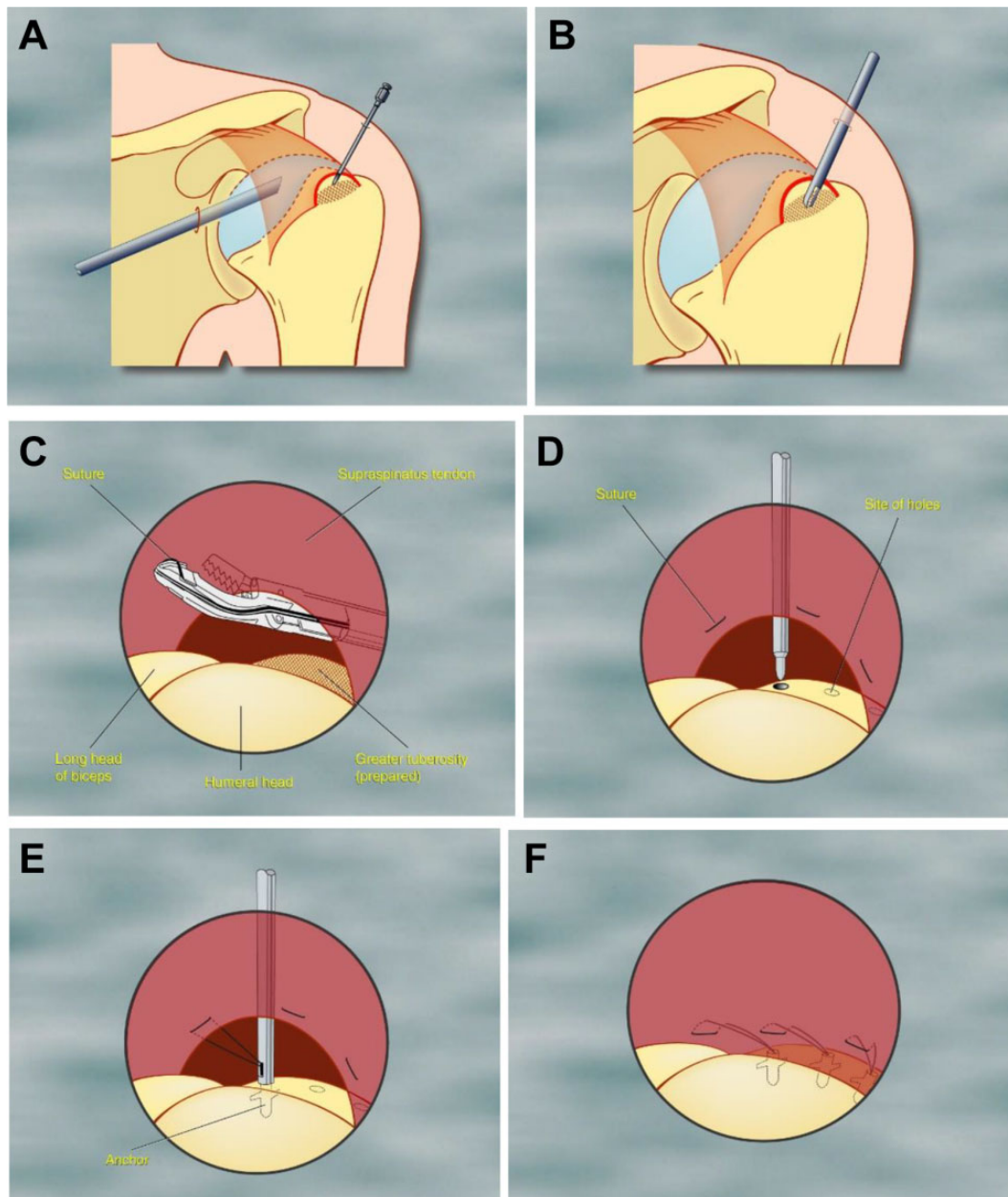
Figure 1. Illustration of the undersurface repair technique. (A) Insertion of the arthroscope. (B) Preparation of the greater tuberosity landing site with an arthroscopic shaver. (C) Passing sutures through the edge of the torn tendon. (D) Use of a T-handled punch to prepare holes for the suture anchors. (E) Deployment of anchors into the holes on the greater tuberosity. (F) Completed repair with the torn tendon reattached to the greater tuberosity.

lateral portal is imperative for the undersurface technique, with the ideal position for the portal being midway between the anterior and posterior edges of the tear, parallel to or slightly above the rotator cuff landing site. This position provides optimal access to the torn tendon to enable landing site debridement and rotator cuff repair while facilitating optimal insertion of anchors into the greater tuberosity. A cannula in the lateral portal was not used.[20,29]

The arthroscope remained in the glenohumeral joint while the rotator cuff tendon edge was debrided lightly with a 4.0 or 5.5 mm–diameter arthroscopic shaver. The landing site on the greater tuberosity was also debrided with the 4.0- or 5.5-mm shaver to induce bleeding to enhance tendon-bone healing (Figure 1B). Prior to repair, partial-thickness tears were converted to full-thickness tears with a No. 11 blade under direct vision. The tendon was secured to the greater tuberosity with a knotless inverted mattress fixation technique. Sutures were passed through the edge of the torn tendon via the lateral portal with the Opus SmartStitch device (ArthroCare Corp) (Figure 1C). A

T-handled punch was used to create the landing sites for the suture anchors on the greater tuberosity (Figure 1D). The suture ends were passed through an Opus Magnum 2 suture anchor (ArthroCare Corp). The anchors were placed into their landing sites (Figure 1E) in the greater tuberosity, and the sutures were tightened with the tension-lock winding mechanism to reattach the tendon to the greater tuberosity (Figure 1F).[29] During the entire procedure, the arthroscope remained in the glenohumeral joint. Subacromial bursectomy and acromioplasty were not performed.

Intraoperative Data

The operative time was defined as the time taken from the first skin incision and visualization of the glenohumeral joint until the initiation of wound closure and was recorded for all cases. Intraoperatively, the tear dimensions and morphology were measured against the known diameter of the shaver head (either 4.0 mm or 5.5 mm) and recorded on a specifically designed template. The number of suture anchors used in the repair was also recorded.

Rehabilitation

One week prior to surgery, patients attended a group education session with a physical therapist. After surgery, all patients were instructed to wear a sling with a small abduction pillow (Ultrasling; DJO) for the first 6 weeks. All patients were provided with a rehabilitation protocol to follow for the first 6 months. In the first 6 weeks, rehabilitation comprised gentle passive range of motion exercises. Patients were reviewed by a physical therapist 6 weeks postsurgery, who initiated isometric strengthening exercises. They were reviewed again 3 months postsurgery by the same physical therapist, who then prescribed a program of active resistance exercises. Restrictions were imposed on overhead activities. For the first 3 months, overhead activities outside the prescribed exercises were not permitted. At 3 months postsurgery, patients were allowed to perform limited overhead activities of <15 minutes. Lifting restrictions were also imposed. No lifting was permitted in the first 6 weeks postsurgery. Between 6 weeks and 3 months, patients were permitted to lift up to 1 kg to chest height. After 3 months, patients were permitted to lift between 2 and 5 kg subject to individual progress. Unrestricted lifting and other activities were permitted after 6 months of rehabilitation.

Outcome Measures

Rotator Cuff Integrity. At 6 months postsurgery, all patients returned for an assessment where an ultrasound was performed by a single experienced musculoskeletal sonographer to determine the integrity of the repair. The ultrasounds were performed with a General Electric Logiq E9 machine with a high-frequency (12 MHz) linear transducer. The ultrasounds were performed per a previously described technique.[3]

Complications. Any intraoperative complications were recorded on the operation report by the surgeon.

Postoperative complications, including retear, infection, and revision surgery, were recorded at routine postoperative appointments.

Data Analysis

Outcome measures recorded for the study were reported as mean ± SEM. Moving averages were used to examine the changes in retear rate and operative time as surgeon experience increased. These were calculated with Microsoft Excel. The data set was ordered chronologically in ascending order by the operation date, to allocate each patient a case number—with patient 1 the first patient in the cohort to have an undersurface rotator cuff repair and patient 1000 the last patient in the cohort to have surgery. Next, the mean operative time or mean retear rate for the first 100 patients in the cohort was calculated and plotted. Then, the mean operative time or retear rate was calculated for patients 2 to 101 and plotted. The process of moving along a single patient and plotting the mean value of 100 patients was repeated until the end of the data set had been reached.

The retear rate was further assessed in a subgroup analysis based on the tear thickness and the tear area. Patients with partial-thickness tears were placed into 1 group, and patients with full-thickness tears were placed into 3 subgroups based on the tear area: $<1 \, cm^2$, 1 to 4 cm^2, and $>4 \, cm^2$.

RESULTS

Demographics

Of the 1000 consecutive patients who underwent arthroscopic rotator cuff repair performed with the undersurface technique, there were 529 men and 471 women. The mean ± SEM age of the cohort was 58 ± 0.4 years. Patient ages ranged from 18 to 91 years. The mean tear area was 2.9 ± 0.14 cm^2, with tear areas ranging from 0.08 to 56 cm^2. The mean number of anchors used in the repairs was 1.8 (range, 1-6). Most patients in the cohort were privately insured (853 of 1000). There were 70 patients receiving workers' compensation, 64 patients with operations in a public hospital, and 13 patients receiving assistance from the Department of Veterans Affairs.

During the study period, 1199 patients met the inclusion criteria for the study. Of these patients, 199 did not return for their 6-month follow-up appointment and ultrasound. Therefore, the loss to follow-up for this study was 17%.

Retear Rates

The primary outcome of this study was to determine the retear rate at 6 months after surgery with the undersurface technique. Of the 1000 patients included in this study, 85 had a retear detected on ultrasound examination at 6-month follow-up, resulting in an overall retear rate of 8.5%.

The retear rates varied among the 4 groups. There were 478 patients with partial-thickness tears, of which 11 retore resulting in a retear rate for partial-thickness tears

TABLE 1
Retear Rates and Mean Number of Anchors
Used in the Repair for Each Tear Size Group

		Thickness		
	Partial	Full, <1 cm^2	Full, 1-4 cm^2	Full, >4 cm^2
Patients, n	478	21	367	134
Retears, n	11	0	34	40
Retear rate, %	2	0	9	30
Mean anchors, n	1.4	1.6	2.0	3.0

TABLE 2
Mean Operative Times for Each Tear Size Group

		Thickness		
	Partial	Full, <1 cm^2	Full, 1-4 cm^2	Full, >4 cm^2
Operative time, min				
Mean ± SEM	15 ± 0.4	14 ± 1.8	17 ± 0.5	22 ± 0.9
Range	5-60	5-33	4-75	5-60
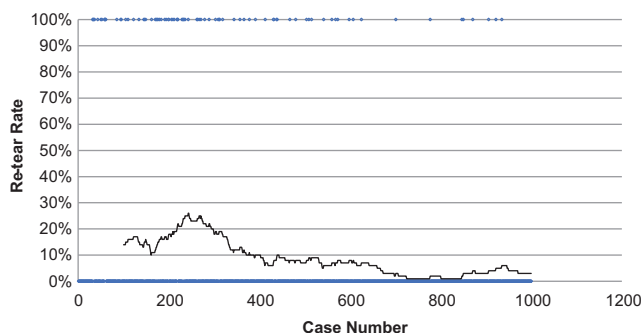
Figure 2. Moving average graph demonstrating the relationship between case number and retear rate.
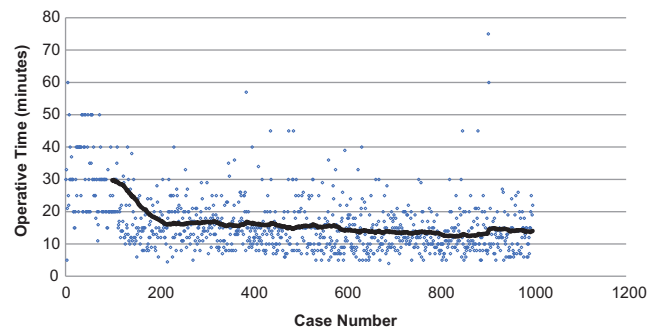
Figure 3. Moving average graph depicting the relationship between operative time and case number.

of 2%. There were 21 patients with full-thickness tears <1 cm^2. All patients in this group had an intact repair at 6 months postsurgery (0% retear rate). Of the 367 patients with full-thickness tears between 1 and 4 cm^2, 34 were retorn at 6 months (9% retear rate). There were 134 patients with full-thickness tears >4 cm^2, of which 40 had a retear detected on ultrasound (30% retear rate) (Table 1). The patients with full-thickness tears >4 cm^2 had a significantly higher retear rate than those with full-thickness tears of 1 to 4 cm^2 ($P < .0001$) and <1 cm^2 ($P < .0001$) as well as those with partial-thickness tears ($P < .0001$), per chi-square analysis. The patients with full-thickness tears of 1 to 4 cm^2 had a significantly higher retear rate than those with full-thickness tears <1 cm^2 ($P < .0001$) and those with partial-thickness tears ($P < .0001$), per chi-square analysis.

There were significantly more anchors used in the repair of large tears (>4 cm^2) than medium-size tears (1-4 cm^2) ($P = .0001$), small tears (<1 cm^2) ($P = .0001$), and partial-thickness tears ($P = .0001$). There were significantly more anchors used in the repair of medium-size tears (1-4 cm^2) than small tears (<1 cm^2) ($P = .0001$) and partial-thickness tears ($P = .0001$), and there were significantly more anchors used in the repair of small tears (<1 cm^2) versus partial-thickness tears ($P = .03$).

A moving average analysis was performed to determine the effect of surgeon experience on the retear rate. As demonstrated in Figure 2, the retear rate improved with increasing surgeon experience. The retear rate peaked at 25% after approximately 250 cases but declined with more experience and approached zero at the 800-case mark.

Operative Time

The mean (±SEM) operative time for the cohort was 16 ± 0.3 minutes. The operative times ranged between 4 and 75 minutes. The mean operative times were also assessed for each tear size subgroup and are listed in Table 2.

Operative times were significantly longer in the repair of large tears (>4 cm^2) than medium-size tears (1-4 cm^2) ($P = .0001$), small tears (<1 cm^2) ($P = .0001$), and partial-thickness tears ($P = .0001$). Operative time was significantly longer in the repair of medium-size tears (1-4 cm^2) than partial-thickness tears ($P = .0001$).

A moving average analysis was also performed to determine the impact of increasing surgeon experience with the undersurface technique on the operative time. Figure 3 shows that the mean operative time was initially around 30 minutes, and a steep learning curve occurred in the first 200 cases, by which the mean operative time had halved to approximately 15 minutes and plateaued thereafter with minimal variation.

Surgical Complications

The only recorded complication of the undersurface repair was retear, occurring in 85 out of 1000 patients. Of the 85 patients with retears, 24 underwent subsequent revision surgery, resulting in a reoperation rate of 28% among those

who retore but an overall cohort reoperation rate of 2.4%. Those who did not undergo reoperation (1) were asymptomatic, (2) had good shoulder function despite retearing, (3) had smaller tears that were managed by a "watch and wait" approach, or (4) did not wish to undergo revision surgery. There were no other indications for reoperation besides retear. There were no documented postoperative infections or thromboembolic complications. Postoperative stiffness was not an uncommon problem postoperatively, but there were no patients in the cohort who underwent reoperation for stiffness.

DISCUSSION

The results of this study demonstrate that the undersurface rotator cuff repair technique is a fast, safe, and effective method of repairing the torn rotator cuff. It was fast, with a mean operative time of 16 minutes. It was also safe, demonstrated by a 2.4% reoperation rate, and effective, with a retear rate of 8.5%. Furthermore, the retear rate and operative time improved with increasing experience of the surgeon and surgical team. The retear rate, after 1000 consecutive surgeries, was <5%. Retear rates varied according to the size of the tear, with better rates of healing observed in patients with partial-thickness tears and small full-thickness tears than in those with large full-thickness tears. Operative times were also longer for patients with larger tears.

The main advantage of the undersurface technique as compared with other techniques that approach the torn tendon from the bursal side is its fast operative time. Previous studies have shown that undersurface repairs were, on average, between 12 and 32 minutes faster to perform than bursal-sided repairs when the same suture anchors were used.[23,29] The difference in operative time is most likely because there is no need to perform a bursectomy or acromioplasty. Furthermore, performing an acromioplasty and/or bursectomy may induce bleeding, which can impair visualization of the torn tendon and other structures within the glenohumeral joint.[23,29]

Other advantages of a shorter operative time are lower operating room costs[6] and a low incidence of surgical complications (infection, thromboembolism) similar to other large series.[13,29] In this study, there were no infective or thromboembolic complications.

The first 200 cases were a steep learning curve, where the mean surgical duration decreased from 30 to 15 minutes, after which the operative time plateaued at 15 minutes. A study on the learning curve was performed by Guttmann et al,[11] who focused on the first 100 cases of arthroscopic rotator cuff repair. Specifically, they assessed the learning curve using blocks of 10 cases. They found that the most significant learning occurred in the first 10 cases. It is difficult to make a valid comparison with our technique given the difference in the numbers of cases assessed in the different studies.

The other key advantage of the undersurface technique was its low retear rate of 8.5%. This is favorable given that retear rates quoted in the literature range between 15% and 90%.[7] Our retear rate of 8.5% is, to our knowledge, one of the lowest reported in a large cohort of patients. It is lower than that for the bursal-sided technique noted by Rubenis et al,[23] which was 21%. Initially we had concerns about the level of footprint contact achieved with the undersurface technique, especially with the arm in the abducted position. A biomechanical study of this technique showed good contact pressure at the footprint and good repair strength.[2]

Possible reasons for the low retear rate achieved in this study include the high numbers of smaller tears included, the fact that significantly retracted tears were repaired with synthetic patches, the use of a knotless fixation technique, a high-volume surgeon, and a conservative rehabilitation program. It is also our practice to avoid making the tear larger to repair it, as the natural tendon is stronger than the repaired tendon. We also regularly follow up our patients in the first 6 months postsurgery, so any potential problems are identified early and followed up.

Healing rates were better for patients with partial-thickness tears and small full-thickness tears as compared with patients with large full-thickness tears. This is likely the result of a combination of factors, including (1) better footprint coverage and lower tension on the repair of smaller tears, which enhances healing from both a biological and a mechanical perspective[2,5]; (2) less tendon retraction and fatty infiltration of smaller tears[5]; and (3) favorable biological characteristics of smaller tears, including better fibroblast cellularity, higher blood vessel proliferation, and greater inflammatory response than that seen in larger tears.[16]

Visualization of the torn tendon is optimized by the undersurface repair technique. Approaching the tendon from within the glenohumeral joint allows for greater visualization of the torn tendon and other shoulder structures, such as the long head of biceps, the labrum, and the capsule, because the view is not obstructed by the subacromial bursa. It is relatively easy to debride the tendon edge and the landing site with the arthroscope remaining in the glenohumeral joint and by passing the arthroscopic shaver through a lateral portal.[20]

With the development of advanced suture-passing devices, such as the Opus Magnum SmartStitch Device and the Perfect Passer System, it is also relatively straightforward to pass sutures through the end of the torn tendon in an inverted mattress configuration. This suture configuration compresses the tendon onto the landing site in a tension band configuration and has greater time zero strength as compared with simple sutures.[20]

There is no need to perform an acromioplasty or subacromial decompression when the undersurface technique is performed. Although traditionally performed concomitantly with rotator cuff repair, recent evidence suggests that acromioplasty confers no clinical benefit in the management of rotator cuff disease.[1,10,14,17,24,25] Acromioplasty may still be indicated in the treatment of patients with a type 3 acromion, however.[9]

Gartsman and O'Connor[10] performed a randomized controlled trial comparing outcomes of 2 groups of patients: one group that underwent only rotator cuff repair and a second group that underwent rotator cuff repair and subacromial decompression. At 1-year follow-up, there was no difference

in the American Shoulder and Elbow Surgeons score between the groups, indicating that there is no functional benefit to performing concomitant subacromial decompression. A meta-analysis of the utility of subacromial decompression in rotator cuff repair found no statistically significant difference in terms of functional outcomes and reoperation rates between patients undergoing isolated rotator cuff repair and those undergoing concomitant rotator cuff repair and subacromial decompression.[4] However, acromioplasty may still be indicated in the treatment of patients with a type 3 acromion.[9]

The main disadvantage of the undersurface rotator cuff repair technique is that it is occasionally necessary to complete the repair from the bursal side of the tendon. The reason is that it can be difficult to visualize the tendon landing site during placement of the final suture anchors toward the end of the repair. This is particularly a problem for larger tears requiring more suture anchors. With increasing experience with the technique, we have developed a method to avoid conversion to a bursal-sided repair. For larger tears, we often do not completely tighten the first anchor prior to deployment of the second anchor. The first anchor is subsequently tightened at the end of the repair. Subjectively, this has reduced the number of cases in which conversion to a bursal-sided repair is necessary. The main disadvantage of conversion to a bursal-sided repair is inconvenience. A further disadvantage of this technique is that it does not allow for double-row fixation.

There are a few limitations of this study. Given that this was a single-surgeon and single-center study, the results obtained may not be applicable to other surgeons and other centers. The surgeon has significant experience with arthroscopic rotator cuff techniques, and the learning curves may differ for surgeons without as much experience with arthroscopy. The study was also retrospective in design. Some patients were lost to follow-up and did not attend their 6-month ultrasound appointment to determine the integrity of the repair. It was not possible to determine if some patients with retears underwent revision surgery at other centers, which may have falsely lowered our reoperation and complication rates. Furthermore, outcomes were assessed at a relatively short 6-month follow-up. However, there is evidence to suggest that the retear rate does not change significantly between 6-month and 2-year follow-up.[18,19]

Other limitations of this study include an element of selection bias in that the mean tear size in our study was smaller than that of most other large rotator cuff series. Specifically, >50% of participants had a partial-thickness tear or a full-thickness tear <1 cm^2. We also had a single sonographer assessing the tears, and there was no direct comparison with other arthroscopic or open techniques.

This study also has several strengths. First, this was a large cohort study that addressed outcomes of a single arthroscopic rotator cuff repair technique in a cohort of 1000 patients. To our knowledge, this is the largest study assessing patient outcomes of a single rotator cuff repair technique. Second, it was a single-center, single-surgeon study, minimizing many potential confounding factors and improving the internal validity of the study. Finally, data were collected prospectively in a systematic fashion.

CONCLUSION

The all-inside undersurface arthroscopic rotator cuff repair method is a novel, fast, safe, and effective surgical technique. In a cohort of 1000 consecutive patients, the mean operative time was 16 minutes, and the retear rate was 8.5%, which is, to our knowledge, the lowest recorded from a single technique in a large cohort. There were no recorded infections or other surgical complications besides retear. The overall reoperation rate was low at 2.4%. Retear was the only indication for reoperation.

A Video Supplement for this article is available at http://journals.sagepub.com/doi/suppl/10.1177/23 25967119864088.

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