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Are we getting any better? A study on repair integrity in 1600 consecutive arthroscopic rotator cuff repairs

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Background: Postoperative retear is the most common surgical complication after rotator cuff repair. This study aimed to determine whether there had been any improvements in rotator cuff repair integrity in our center and to identify any changes in the management of rotator cuff tears that may have impacted postoperative retear rate.

Methods: This retrospective observational single cohort study used running average analysis to examine 1600 consecutive patients over 8 years, who underwent primary arthroscopic rotator cuff repair by a single surgeon, and had cuff integrity assessed by ultrasound 6 months after operation.

Results: Retear rates ranged from 3% to 34%, with a mean of 15%. Over our study retear rates decreased from 18% to 5%. Reductions in retear rates were associated with less aggressive rehabilitation, postoperative abduction sling use, and increased surgical experience. Increases in retear rates were associated with increased false positives with a more sensitive ultrasound machine and learning curves with new equipment for a surgeon and sonographer.

Conclusion: A decrease in retear rate after arthroscopic rotator cuff repair occurred during our study. Although the study design prevents us from directly attributing changes in retear rate to changes in management, our results suggest that rehabilitation optimization and increased surgeon experience decrease postoperative retear.

Tears of the rotator cuff are a common cause of shoulder pain and dysfunction, and account for approximately 50% of all shoulder pathology.[24,28] Surgical repair is often recommended for the treatment of symptomatic patients, with the aim of being able to restore the normal structural anatomy of the shoulder.[35] Postoperative retear of the torn tendon is the most common complication of the surgery, and is associated with inferior functional status and increased pain, compared with patients with intact repairs in the longer term.[9,14] Reported rates of retear after arthroscopic repair have varied from 11% to 94%.[4,7,10,11,15,23,32,34,37,38]

There have been a number of advances in knowledge regarding the rotator cuff, the surgical visualization of rotator cuff tears, and the methods to repair them. These include advances in arthroscope technology and screen quality, repair constructs, and rehabilitation after operation. Furthermore, there has been an increased understanding of factors that contribute to poor repair integrity including patient age, tear size, and tear thickness.[25] However, there have been no studies evaluating the effects of these advancements on retear rate after arthroscopic rotator cuff repair, in large single surgeon cohorts.

The aim of this study, therefore, was to determine if there had been any improvements in rotator cuff repair integrity in a cohort of patients operated on by a single surgeon, and retrospectively to identify changes in the management of rotator cuff tears that may account for any changes in the retear rate.

Materials and methods

Study design

This observational single cohort study retrospectively analyzed consecutive primary rotator cuff repairs by a single surgeon using an arthroscopic knotless single-row inverted mattress technique over an 8-year period. The primary outcome analyzed was rotator cuff integrity at 6 months after surgery.

Inclusion and exclusion criteria

Patients were included if they (1) had undergone primary arthroscopic rotator cuff repair by the senior author (G.A.C.M.) between October 2005 and October 2013 and (2) had the integrity

This study received ethics approval from the South Eastern Sydney Local Health Network Human Research Ethics Committee-Southern Sector (HREC: 11/STG37).

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of the repair assessed via ultrasound 6 months after the operation by a sonographer.

Patients were excluded for (1) revision of rotator cuff repairs, (2) irreparable rotator cuff tears, (3) shoulder arthroplasty, (4) partially repaired rotator cuffs, (5) fractures associated with rotator cuff repairs, (6) patients who had expanded polytetrafluoroethylene patches used in the repair, (7) had missing operative data, and (8) isolated subscapularis repairs.

Surgical technique and postoperative management

The senior author performed all rotator cuff repairs in the study arthroscopically, using a single-row knotless inverted mattress technique.[26] The patient was positioned in a beach-chair position with anesthesia provided by an interscalene block and intravenous sedation. A posterior portal was created to assess the torn rotator cuff tendon and identify other glenohumeral pathologies including arthritis and long biceps tendon injuries. Mobility of the tendon was then assessed via a lateral portal. Partial thickness tears were converted into full thickness tears before reduction. Before repair debridement of the torn tendon and anatomical footprint was completed using an arthroscopic shaver. The tear was repaired using either a bursal or an undersurface approach as outlined by Rubenis et al.[31] Sutures were passed through the torn tendon using the Opus Smart Stitch device (ArthroCare Corp, Sydney, Australia). Either Opus Magnum 2—knotless implant set (ArthroCare Corp) or Piton—knotless fixation implant (Tornier, Sydney, Australia) suture anchors were used to reattach the torn tendon. Immediately after the procedure, the patient's arm was placed into a sling with a small abduction pillow (Ultrasling; DJO, Normanhurst, Australia).

Rehabilitation

After the operation, patients were instructed to follow a 6-month rehabilitation program. At the commencement of our study, a more aggressive approach to rehabilitation was used. This involved immediate passive range-of-motion exercises, followed by active range-of-motion exercises starting day 8 after operation. The intensity of active exercises was increased at 6 weeks after operation, and active resistance exercise was commenced at 3 months.[8] As the study progressed, a less aggressive approach to rehabilitation was introduced. This included more emphasis on the use of a sling with an abduction pillow to immobilize the arm for the first 6 weeks. Patients then began exercising the shoulder, incrementally increasing the difficulty of activities performed. Patients were asked to keep the arm immobilized for the first week and to only complete passive range-of-motion exercises in the first 6 weeks. Isometric strengthening exercises were started after this, and resistance exercises were started at 3 months.[23]

Data collection

Preoperative

Patients completed a questionnaire that asked them to classify whether there was an initiating injury, and the date of onset of symptoms and demographic data regarding age, gender, shoulder affected, and insurance type.[20,33]

Intraoperative

Tear dimensions were measured through intraoperative arthroscopic visualizations with a 5.5-mm or 4.0-mm shaver used as reference.[37] Tendon tear thickness was also evaluated intraoperatively. The operative time (time from initial skin incision to final wound closure), number of anchors used to restore tendon integrity, and in which hospital the surgery was performed were also recorded.

Postoperative

Rotator cuff integrity was assessed via ultrasound 6 months after operation using a standardized method previously outlined by a trained ultrasonographer.[5] This follow-up time was chosen as previous studies have shown that the overwhelming majority of repair failures occur within this period, with no significant number of retears occurring after 6 months.[14,26,27] Retear was defined as a full thickness defect in the rotator cuff tissue detected on ultrasound examination. The imaging was performed using either a GE Logiq Q9 or Logic E9 machine (General Electric, Sydney, Australia).[6]

Data analysis

The primary aim of this study was to calculate postoperative rotator cuff retear rates and how they changed over time. Changes in retear rate were calculated by plotting the moving average of repair integrity at 6 months after operation. Each graph had a sampling period one-tenth of the total cohort size (up to a maximum of 100). Each point on the graph is representative of the average retear rate of the sampling period before that point. Multiple logistic regression analysis was then used to identify factors that may contribute to retear at 6 months after surgery. Data were analyzed using SigmaStat version 3.5 and SigmaPlot version 10.0 (Systat Software Inc., Richmond, CA, USA). Stepwise backward regression analysis was used to assess the significance of our independent variables' (gender, case number, age, workers compensation status, health insurance status, tear thickness, and tear size) contribution to repair integrity at 6 months. Retear rate moving averages were then calculated for the following factors: tear size area, age, tear thickness, and private vs. public.

Results

Patient demographics

Between October 2005 and October 2013 there were 2191 rotator cuff repairs performed by the senior author (G.A.C.M.). Of these, 591 rotator cuff repairs were excluded as per our exclusion criteria; 290 patients failed to attend 6-month ultrasound examination, 155 operations were revision surgeries, 75 operations were repair via expanded polytetrafluoroethylene patches, 33 patients had missing operative information, 19 patients had partial repair, 11 patients had irreparable rotator cuff tears, 4 patients had isolated subscapularis repairs, and 4 patients had avulsion fractures associated with rotator cuff repair.

This left 1600 procedures that formed the study cohort, as summarized in Table I. Of these, 883 (55%) were males and 717 (45%) were females. There were 957 (60%) right shoulders and 643 (40%) left shoulders. The mean $\pm$ standard error of the mean age of the patients at the time of surgery was 59 years $\pm$ 0.3 years (range, 15-91 years).

A large proportion, 1418 (89%) of the patients, were operated in a private day surgery facility or in a private hospital, whereas 129 patients (8%) were operated on in a public hospital. The location of surgery was not recorded in 53 patients (3%).

Of 1600 patients, 375 patients (23%) had work-related injuries.

The preoperative duration of symptoms ranged from 0.3 months to 43 years. A total of 1153 patients (72%) had experienced their symptoms for less than or equal to 23 months, and 295 (18%) experienced their symptoms for greater than or equal to 24 months.[33] The duration of symptoms was not noted for the remaining 152 patients (10%).

Table I
Patient demographics and intraoperative data

Variable	
Sex	
Male	883 (55)
Female	717 (45)
Affected shoulder	
Right	957 (60)
Left	643 (40)
Age at surgery, yr	59 ± 0.3 (15-91)
Hospital	
Private	1418 (89)
Public	129 (8)
Not recorded	53 (3)
Work-related injuries	375
Preoperative symptom duration	
≤23, mo	1153 (72)
≥24, mo	295 (18)
Not recorded	152 (10)
Tear thickness	
Full	811 (51)
Partial	660 (41)
Not recorded	129 (8)
Tear size	
Anterior-posterior, cm	1.8 ± 0.03 (0.4-10)
Medial-lateral, cm	1.6 ± 0.02 (0.1-8)
Area, cm^2	3.5 ± 1.3 (0.08-64)
Surgical approach	
Undersurface	762 (48)
Bursal	285 (18)
Combined	318 (20)
Not recorded	235 (14)
Anchors used	2.1 ± 0 (1-6)
Operative time, min	24 ± 0.3 (4-120)

Data are presented as number (percentage) and mean ± standard error of the mean (range).

Of the shoulders operated on, 811 (51%) had full thickness tears and 660 (41%) had partial thickness tears. Tear thickness was not noted for 129 patients (8%). Fig. 1 graphs the proportion of partial thickness tears for each year of our study. The mean tear size in the anteroposterior and mediolateral dimensions were 1.8 ± 0.03 cm (range, 0.4-10 cm) and 1.6 ± 0.02 cm (range, 0.1-8 cm), respectively. The mean tear area was 3.5 ± 1.3 cm^2 (range, 0.08-64 cm^2). A total of 762 patients (48%) had their repairs completed using an undersurface approach, 285 (18%) using a bursal approach, and 318 (20%) using a combination of both. The surgical approach was not noted for 235 patients (14%). The mean number of suture anchors used in the repair was 2.1 ± 0 (range, 1-6), and the mean operating time was 24 ± 0.3 minutes (range, 4-120 minutes).

Retear rates for the whole cohort

Retear rates over the course of our study ranged from 3% to 34%, with the mean retear rate being 15%. The retear rate for the first 100 patients at the commencement of our study was 18%. The retear rate for the last 100 patients was 5%, an overall reduction in the retear rate of 13% (Fig. 2).

Moving average analysis of retear rate

Changes in retear rate were examined for subcohorts based on tear size area, patient age, tear thickness, and whether the operation was completed in the private or public hospital (Table II).

By tear size area

For tear sizes <200 mm^2, the mean retear incidence was 4% (22 of 660) (range, 0%-17%). Retear incidence was initially 8% and decreased by 7% over the course of our study, to reach 1%. Retear incidence for initial tear sizes 200 mm^2 to 600 mm^2 decreased from 13% to 5% with a mean incidence of 16% (87 of 548) (range, 4%-32%). Retear rates for tear sizes ≥600 mm^2 decreased from 33% to 16% with a mean incidence of 40% (98 of 247) (range, 16%-72%) (Fig. 3).

Similar to the global cohort, each tear size group experienced a peak in incidence occurring around September 2008.

By age

Only 1 patient aged ≤39 years had retorn at 6 months after operation. No overall change in postoperative retear incidence occurred during our study for patients 40 to 49 years old, with incidence of 5% at the beginning and end of our study. The mean incidence for this cohort was also 5% (10 of 207) (range, 0%-14%). Retear rates for patients aged 50 to 59 years decreased from 16% to 0% with a mean incidence of 10% (48 of 460) (range, 0%-26%). The retear incidence for patients aged 60 to 69 years decreased from 18% to 7% over our study with a mean incidence of 16% (69 of 427) (range, 3%-33%). Retear rates for patients aged 70 to 79 years decreased from 36% to 0% with a mean incidence of 28% (60 of 217) (range, 0%-64%). Initial retear rates for patients ≥80 years old were 0% and 40% at the end of this study. The mean incidence was 46% (24 of 52) (range, 0%-80%) (Fig. 4).

As previously observed, each age group with the exception of patients ≤39 years had a peak in incidence occurring around September 2008.

By tear thickness

The mean retear rate for patients with full thickness tears was 23% (189 of 811) (range, 45%-7%). Retear incidence at the beginning of our study was 14% and decreased to 7%. The mean retear rate for

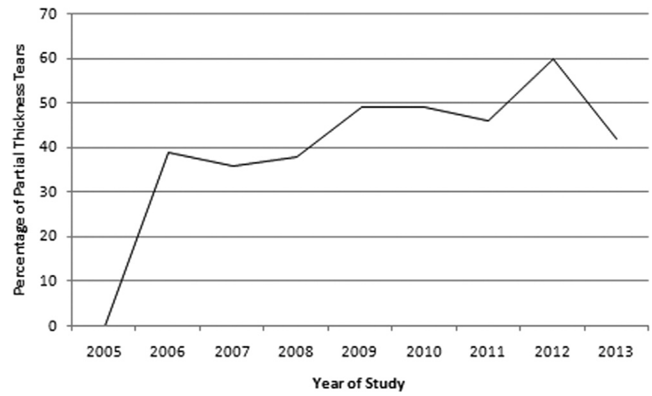

Figure 1 Proportion of partial thickness repairs by each year of our study.

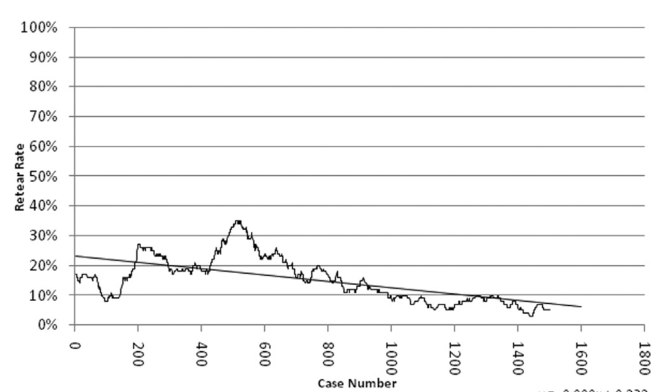

Figure 2 Overall retear rates moving average by case number (sampling period 100).

Table II
Subcohort changes in retear incidence

Subcohort	Mean retear incidence (range) (%)	Initial retear incidence (%)	End retear incidence (%)
Tear size area, mm^2			
<200	4 (0-17)	8	1
200-600	16 (4-32)	13	5
≥600	40 (16-72)	33	16
Age, yr			
≤39	–	–	–
40-49	5 (0-14)	5	5
50-59	10 (0-26)	16	0
60-69	16 (3-33)	18	7
70-79	28 (0-64)	36	0
≥80	46 (0-80)	0	40
Tear thickness			
Full	23 (7-45)	14	7
Partial	3 (0-16)	3	2
Hospital			
Private	13 (3-34)	17	4
Public	30 (0-76)	39	7

patients with partial thickness tears was 3% (26 of 660) (range, 16%-0%). Initial retear rates were 3% and decreased to 2% (Fig. 5).

As mentioned above, the peak retear incidence occurred around September 2008.

Private vs. public

Retear rates for patients operated through the private health care system decreased from 17% to 4% over the study. The mean retear incidence was 13% (192 of 1418) (range, 3%-34%). Retear rates for patients whose operations were completed in the public hospital decreased from 39% to 7%. The mean retear incidence was 30% (38 of 129) (range, 0%-76%) (Fig. 6).

Both public and private patients experienced a peak retear incidence around September 2008.

Operative-time moving average analysis

Changes in average operative time over the duration of our study were examined similarly. The average operation time during our study decreased from 41 minutes to 20 minutes. The undersurface technique became the primary technique used around the 200-patient mark and was followed by a large decrease in operation time (Fig. 7).

Changes in management and retear rate

Between October 2005 and October 2013, there were several changes in the management and rehabilitation of rotator cuff tears by our service that may have affected retear rate (Fig. 8).

Ultrasonography

A new ultrasound machine was introduced to check postoperative repair integrity in September 2008.This coincided with the greatest peak in retear incidence that occurred during our study suggesting that this machine may have impacted the “nominal” incidence of rotator cuff retear.

In addition to a new ultrasound machine, 2 different sonographers were employed over the course of our study, with the first being hired before this study’s first patient. A large peak in retear incidence occurred around February 2007, the same time that the second sonographer began working at the practice.

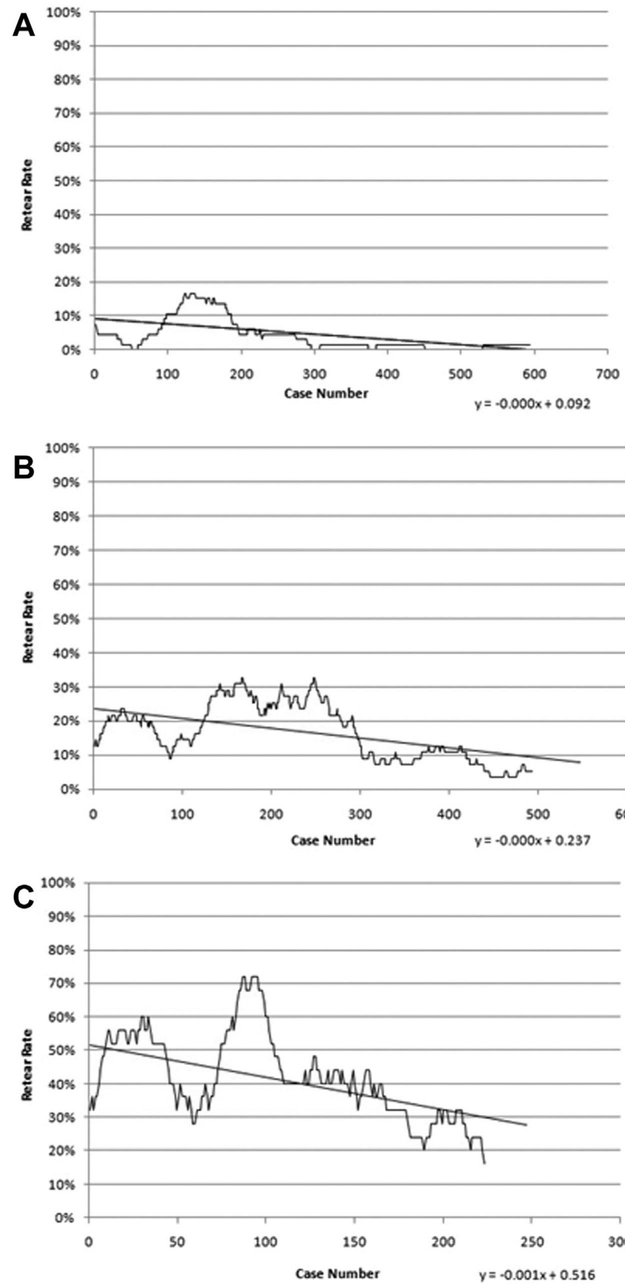

Figure 3 Retear rate moving average for tear size area by case number. (**A**) <200 mm^2 (sampling period: 66); (**B**) 200-600 mm^2 (sampling period: 55); (**C**) ≥600 mm^2 (sampling period: 25).

New operating facility

In May 2006, a new surgical facility opened with higher quality arthroscopes and screens. The surgeon performed the majority of rotator cuff repair cases at this facility. A temporary increase in retear rate, followed by a decrease in retear rate occurred at the time that the theatre opened.

Physical therapy

Furthermore, a less aggressive rehabilitation protocol was gradually introduced over the course of the study, as outlined earlier. The overall decrease in retear rate that occurred over the course of our study suggests that these changes to rehabilitation may have impacted the retear rate. In addition, the temporary

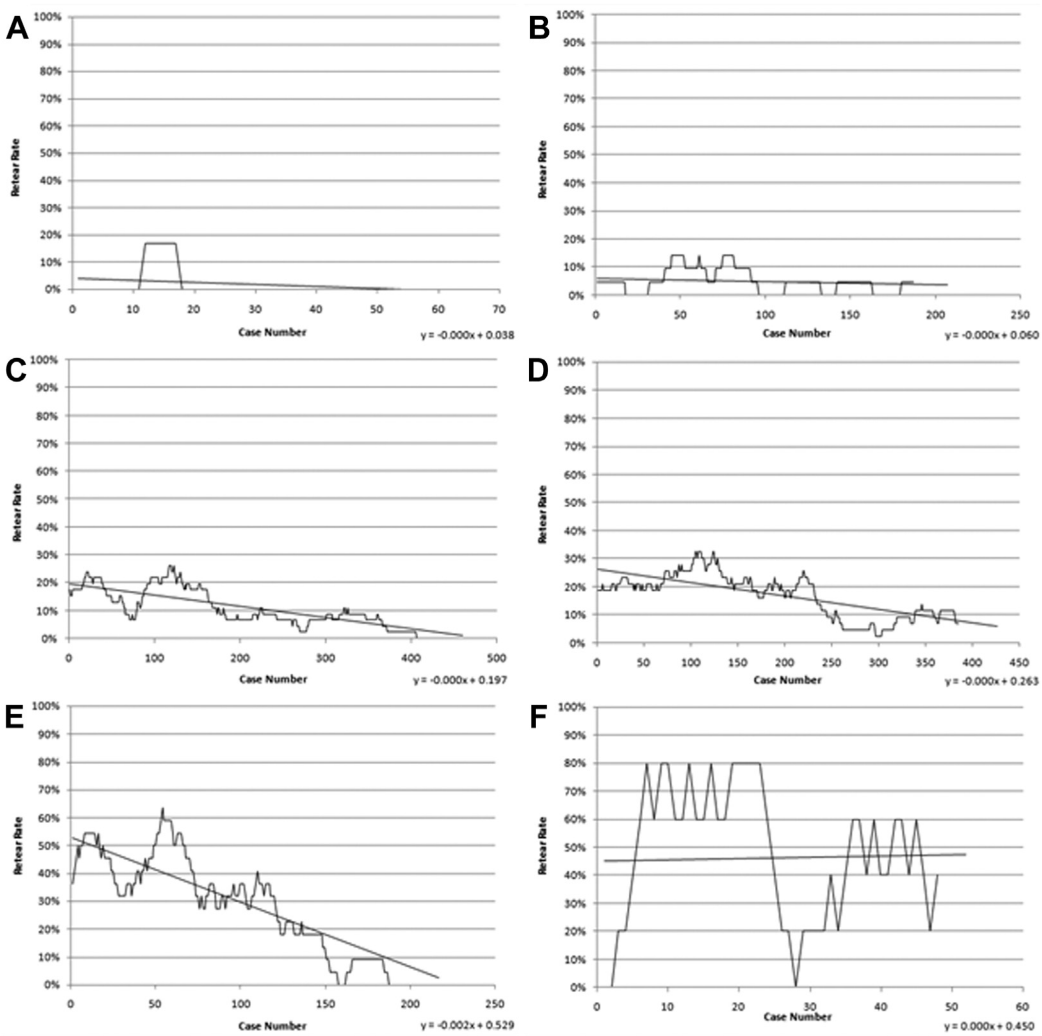

Figure 4 Retear rate moving average for age by case number. (**A**) Age ≤39 years; (**B**) age 40-49 years (sampling period: 20); (**C**) age 50-59 years (sampling period: 46); (**D**) age 60-69 years (sampling period: 43); (**E**) age 70-79 years (sampling period: 22); (**F**) age ≥80 years (sampling period: 5).

decline in retear incidence coincided with a randomized control trial examining rehabilitation methods suggests that attention to detail with respect to postoperative management may have impacted the changes in repair integrity.

Surgical technique

Bursal and undersurface surgical approaches were used over the duration of our study, with the undersurface technique being increasingly used as the study progressed. The undersurface technique became the primary means of repairing rotator cuff tears around June 2007. No noticeable changes in retear rate were noted at this time suggesting that this did not have an immediate impact on retear. Furthermore, regression analysis showed that the technique did not affect retear rate. However, the introduction of the undersurface technique was associated with a significant decrease in operative time (see below).

Factors associated with retear

We were interested to see if any demographic or intraoperative factors correlated with retear and how these factors affected retear rates over time. Larger anteroposterior tear size, tear size area, and mediolateral tear size were found to be independent predictors of rotator cuff retear. Only anteroposterior tear size was used in our final regression analysis as it was the strongest predictor. Larger anteroposterior tear size was the strongest predictor of retear at 6-month ultrasound (Wald statistic = 45, $P \leq .001$), followed by advanced age (Wald statistic = 40, $P \leq .001$), lower surgeon case number (Wald statistic = 35, $P \leq .001$), and patients whose operations were performed in the public hospital (Wald statistic = 29, $P \leq .001$). Full thickness tears (Wald statistic = 9, $P = .003$), the male gender (Wald statistic = 7, $P = .009$), and workers' compensation patients (Wald statistic = 6, $P = .015$) were found to be less significant predictors of rotator cuff retear (Table III).

Decreased operation time had a strong correlation with increased surgeon case number ($r = 0.40$, $P = .0001$) and with operating through the private system ($r = 0.16$, $P = .0001$).

Discussion

The primary aim of this study was to determine whether the advancements to the management of rotator cuff repair had resulted in an improvement in retear rate. Over the course of our study, we found there to be a substantial reduction in retear rates, which decreased from 18% to 5%. Furthermore, our results suggested that variations in our retear rate could be associated with

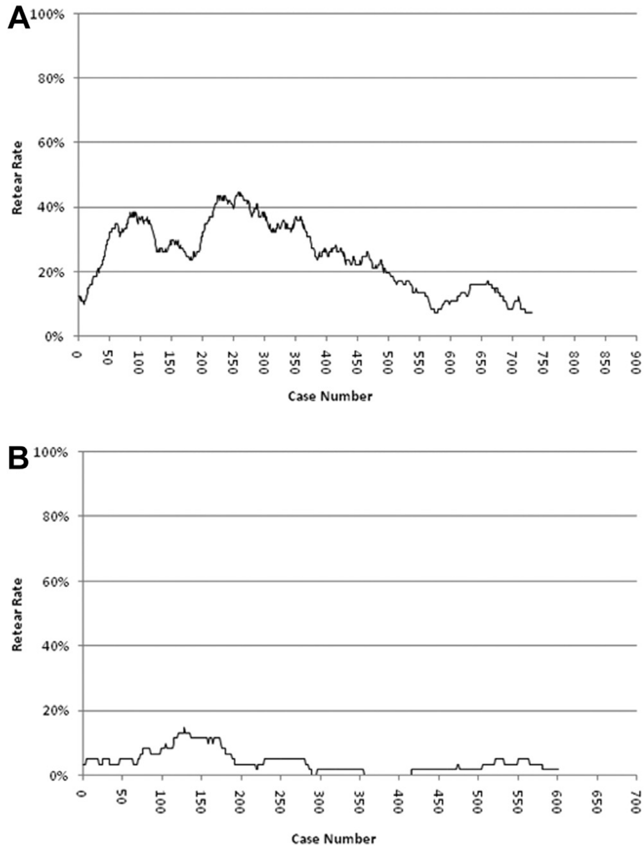

Figure 5 Retear rates moving average for tear thickness by case number. (**A**) Full-thickness tears (sampling period: 81); (**B**) partial-thickness tears (sampling period: 66).

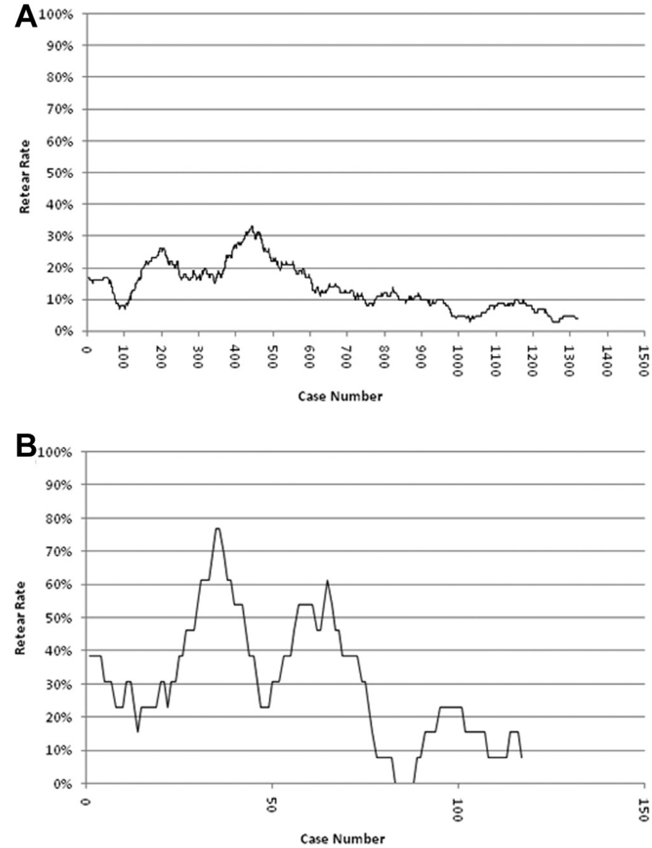

Figure 6 Retear rates moving average for hospital operation was completed by case number. (**A**) Private hospital (sampling period: 100); (**B**) public hospital (sampling period: 13).

changes in ultrasound equipment and technicians, changes in the operation facility (and upgraded imaging equipment/monitors), and changes in postoperative rehabilitation.

The retear rate of 5% at the end of our study period compares favorably with published figures, with the current literature reporting rates in the range of 11% to 49 %.[4,7,10,15,23,32,34,37]

One factor that may contribute to our low retear rate is the high number of patients with partial thickness tears in our study (660 of 1600 cases), and a reasonably higher proportion of patients with small tears, compared with patients with large tears.[23]

To the best of our knowledge, no study has examined how changes in the management of rotator cuff repair have affected the incidence of postoperative retear. With our study design, it was not possible to definitively identify the factors that may have resulted in changes in retear incidence. We examined the timing of all changes in the management of rotator cuff tears during our study to try to offer some possible explanations for the changes seen in our retear rate.

Changes that may have attributed to a decrease in rotator cuff retear include (1) the introduction of a less aggressive rehabilitation program over the study's duration and (2) a randomized control trial focusing on postoperative vibration therapy.[21]

The introduction of the less aggressive rehabilitation program occurred gradually over the course of the study, making it difficult to implicate in the reduction of retear rates. The link between aggressive rehabilitation and increased rates of retear has been suggested by Lee et al,[22] but this was not proven to be statistically significant. The decrease in retear incidence occurring during and immediately after the randomized control trial suggests that enrolling patients in a clinical trial is likely to enhance patient compliance, especially with respect to wearing of a sling and adherence to the rehabilitation protocol.[21]

In addition, a learning curve for the surgeon (and surgical team) in our study may have contributed to the reduction in retear rates. There has been limited data evaluating learning curves for rotator cuff repair, with no studies examining changes in retear rate. Guttmann et al[13] examined changes in operative time for rotator cuff repair and noted a significant decrease in time as the surgeon's case number increased. This was consistent with our results that showed a 21-minute decrease in operative time over our study. Other studies have examined the effects of a learning curve

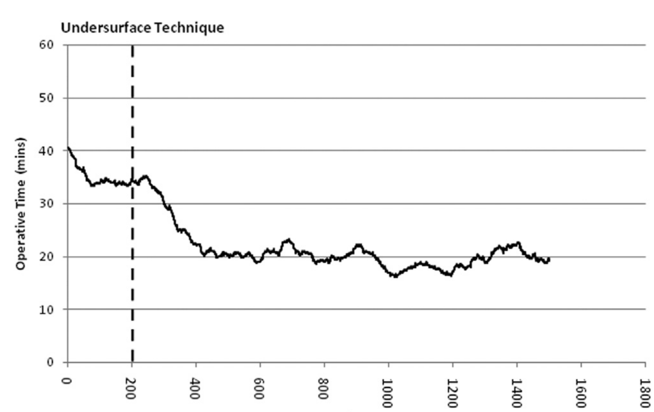

Figure 7 Operation time moving average by case number (sampling period: 100).

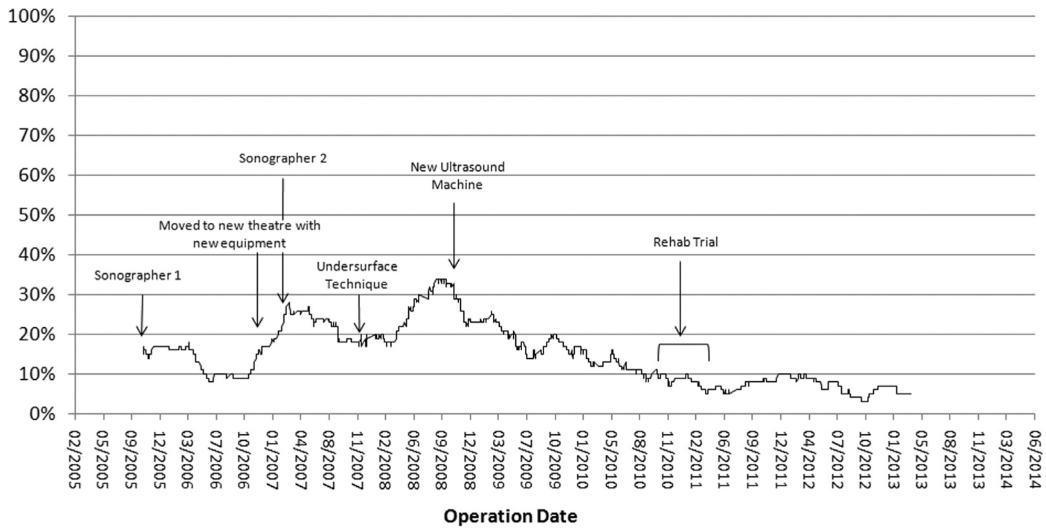

Figure 8 Overall retear rates moving average by operation date and changes in management of rotator cuff repairs (dates of changes marked on the graph have been adjusted to reflect the sampling period) (sampling period: 100).

for other operations and suggest that an increase in surgeon experience correlates to decreased levels of postoperative complications.[18,36]

Several factors were also identified that may explain any increase in retear rate, which were (1) a higher resolution ultrasound machine and (2) a learning curve for new equipment.

Surprisingly, the highest peak in retear incidence coincided with the introduction of a more sensitive ultrasound machine. We hypothesized that this may not represent a true indication of our retear rate at the time, rather an increase in the rate of false positives. When we examined repairs reported at ultrasound as retorn, we noted a number of "thinned but intact" tendons at revision surgery. As sonographer experience increased with the machine and surgical team, diagnostic accuracy increased.[19]

Our results showed a correlation between increased initial tear size area and retear at 6 months after operation. This is similar to other studies that suggest that tear size is predictive of postoperative retear.[2,3,12,26,29] Although higher rates of retear were seen for patients with larger initial tears, improvement in cuff integrity was seen in small, medium, and large tears over the course of our study.

We also noted that advanced age correlated with increased rates of postoperative retear. This finding is consistent with other studies suggesting a link between age at the time of surgery and retear.[2,34] However, all age cohorts with the exception of patients aged 40 to 49 years (only 1 retear) and patients aged ≥80 years (who saw an increase) had a reduction in retear rates during our study.

Similar to research by Peters et al[30] and Kamath et al,[17] patients in our study with full thickness tears had higher rates of retear, compared with patients with partial thickness tears, suggesting a correlation between tear thickness and postoperative cuff integrity.[17,30]

Table III
Independent predictors of rotator cuff retear at 6 months ranked by Wald statistic

Independent variable	Wald statistic	*P* value
AP tear size	45	<.001
Age	40	<.001
Case number	35	<.001
Public hospital patients vs. private hospital	29	<.001
Full- vs. partial-thickness tears	9	.003
Sex (male)	7	.009
Workers compensation patients vs. not	6	.015

AP, Anteroposterior.

Interestingly, our studies showed that patients operated through the public system had significantly higher retear rates than patients operated through the private system, 30% compared with 13%, respectively. Patients who had operations completed in the public hospital had higher overall retear rates as well as higher rates at the beginning and end of our study. Although patients in both cohorts were operated on by the same surgeon and received the same rehabilitation and imaging, a few differences were identified in the treatment they received that may have contributed to this difference. These were (1) different arthroscope and screens used in theatre, (2) different theatre staff, (3) no preoperative education session for public patients, and (4) different patient socioeconomics. Inferior scope and screen quality and possible lack of theatre staff experience (due to the lower number of public operations) may have affected the repair quality.[16] Furthermore, probable lower socioeconomic status of public patients has been linked to increased rates of surgical complications.[1] However, both public and private hospital patients had a decline in retear incidence, suggesting that changes in postoperative management that were common in both cohorts may have been most responsible for the decrease in incidence.

To help understand the changes in retear rates, we attempted to determine variables that may have correlation with increased retear rates, building on the previous research conducted by Le et al[23] and Wu et al.[37] Common variables identified with respect to increased retear rates in both our study and previous work were anteroposterior tear length, tear size area, mediolateral tear length, tear thickness, age at surgery, and operative time. Unique factors identified in our study that correlated with increased retear rates were number of anchors, workcover status, anchors per cm^2, patients operated through the public system, case number, gender, and bursal operation technique. Similar to our previous studies, no single variable had exceptionally strong correlation with retear, with all correlation coefficients (r) being <0.35. This suggests that a number of factors are responsible for postoperative retear rather than a single factor.

One of the primary strengths of our study was our large 1600-patient sample size. To the best of our knowledge, this is the largest study examining postoperative repair integrity of rotator cuff repairs to date. Other strengths were that all operations were completed by the same surgeon, and that all data were collected using a standardized method for the duration of the study.

A limitation of the study was its observational nature, and as such we were not able to directly compare each of the changes in management based on their resulting retear rate. As a result of this, we were only able to suggest which changes in management may have contributed to changes in retear incidence. A short follow-up time may be a limitation of our study, but several studies have shown that no significant change in rotator cuff retear rates occurs between 6 months and 2 years.[26,27] In addition, the differing proportions of partial- to full-thickness repairs over our study may have affected our retear rate at a given time. Another limitation of our results may be the large range of ages included (15 to 91 years). The likely differences in bone and tendon quality may limit the applicability of our findings to other cohorts. Finally, although the use of a single surgeon is beneficial to the reliability of our results, our findings may not be applicable to other surgeons and institutions.

Conclusion

In conclusion, significant decreases in postoperative rotator cuff retear rates were seen over the duration of our study, with the most recent retear rate of 5% being extremely low. Improvements in cuff integrity were seen in nearly all subcohorts, including groups traditionally having higher rates of retear, namely those of advanced age, larger tear size, and full-thickness tears. Furthermore, our data suggest that increased focus on postoperative immobilization of the arm and a more passive approach to rehabilitation may result in improved surgical outcomes. It is also worth noting that although improvements in both surgical and imaging equipment may result in long-term improvements in patient outcomes, the learning curve for new equipment may result in transiently higher complication rates.

Disclaimer

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