Arthroscopic repair of small and medium-sized rotator cuff tears. Technique and results

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RESUMEN

Introducción: este estudio describe la técnica y los resultados de la reparación artroscópica en desgarros del manguito rotador de pequeño y mediano tamaño en un hospital filantrópico vinculado a una institución educativa.

Materiales y métodos: evaluamos cincuenta y siete pacientes que fueron sometidos a cirugía artroscópica para tratar desgarros completos del manguito rotador (<3 cm) desde enero a diciembre de 2014 (edad media: 54.7), con seguimiento de al menos dos años (tiempo medio de seguimiento: 147 semanas).

Resultados: los casos evaluados con la UCLA *Shoulder Rating Scale* después de al menos dos años de seguimiento se clasificaron como deficientes en el 1.8% de los casos, como regular en el 15.8%, buenos en el 52.6% y excelentes en el 29.8%. Las puntuaciones promedio de UCLA preoperatorias y postoperatorias fueron de 12.4 y 31.7, respectivamente. Los valores medios de dolor evaluados por la escala visual analógica (EVA) también mejoraron significativamente, de 8.6 a 1.9.

Para los pacientes mayores de cincuenta y cinco años, la edad se asoció positivamente (r = 0.577) con una mayor diferencia en la puntuación EVA entre las evaluaciones preoperatorias y postoperatorias; en otras palabras, los pacientes mayores experimentaron menos dolor después de al menos dos años de seguimiento.

Conclusión: la reparación artroscópica arrojó buenos y excelentes resultados en el 82.4% de los casos con al menos dos años de seguimiento, especialmente en pacientes del grupo de cincuenta y cinco años o más. La técnica descripta demostró ser eficaz para tratar este tipo de desgarros, así como una buena opción de bajo costo.

Palabras Claves: Manguito Rotador; Hombro; Artroscopía

ABSTRACT

Introduction: *this study describes the technique and results of arthroscopic repair of small and medium-sized rotator cuff tears in a philanthropic hospital linked to an educational institution.*

Materials and methods: *we assessed fifty-seven patients who underwent arthroscopic surgery to treat complete rotator cuff tears (<3 cm) from January to December 2014 (mean age: 54.7) and were followed for at least two years (mean follow-up time: 147 weeks).*

Cases evaluated with the UCLA Shoulder Rating Scale after at least two years of follow-up were classified as poor in 1.8% of cases, 15.8% as fair, 52.6% as good, and 29.8% as excellent. Average preoperative and postoperative UCLA scores were 12.4 and 31.7, respectively. Mean values for pain assessed by the Visual Analog Scale (VAS) also improved significantly, from 8.6 to 1.9.

Results: *for patients over age fifty-five, age was positively associated (r = 0.577) with a greater difference in VAS score between preoperative and postoperative evaluations; in other words, older patients experienced less pain after at least two years of follow-up.*

Conclusion: *arthroscopic repair yielded good and excellent results in 82.4% of cases with at least two years of follow-up, especially for patients in the 55+ age group. The technique described proved effective for treating these types of tears, as well as a good low-cost option.*

Key words: *Rotator Cuff; Shoulder; Arthroscopy*

INTRODUCTION

Rotator cuff injuries are common in orthopedic practices, and frequently cause shoulder pain, morbidity, and lost workdays. The prevalence of this injury ranges from 5% to 33%, and tends to be higher in the elderly population, reaching around 45% in patients aged over age 65 and 80% in people over 80.[1-5]

The rotator cuff not only provides stability, but is also very important for the mobility of the glenohumeral joint. Treatment of injuries to this structure depends on several factors, ranging from alterations in activities to surgical treatment. Arthroscopic repair has been shown to be effective, providing high levels of satisfaction, pain relief, and improved function, with success rates that vary from 70 to 95%.[5-8]

The literature describes a wide variety of repair techniques and surgical outcomes for these injuries. Many of these techniques are very costly and can be difficult to reproduce and externally validate. This study describes the technique and reports results of arthroscopic repair of small and medium-sized rotator cuff tears in a philanthropic hospital linked to a teaching institution.

Los autores declaran no tener conflictos de intereses.

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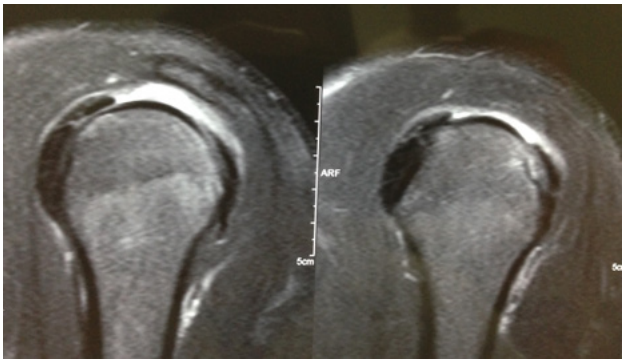


Figure 1: Magnetic resonance image (sagittal view) showing a tear in the supraspinatus tendon.

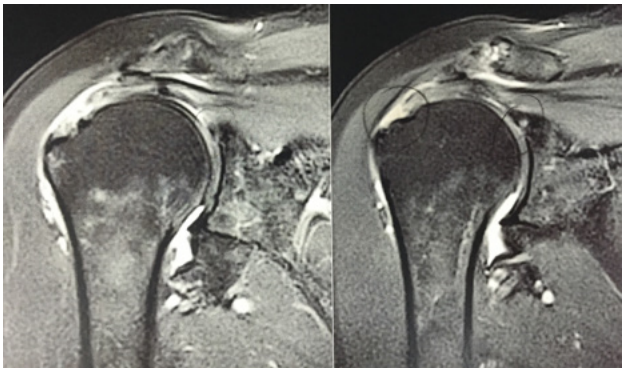


Figure 2: Magnetic resonance image (coronal view) showing a tear in the supraspinatus tendon.

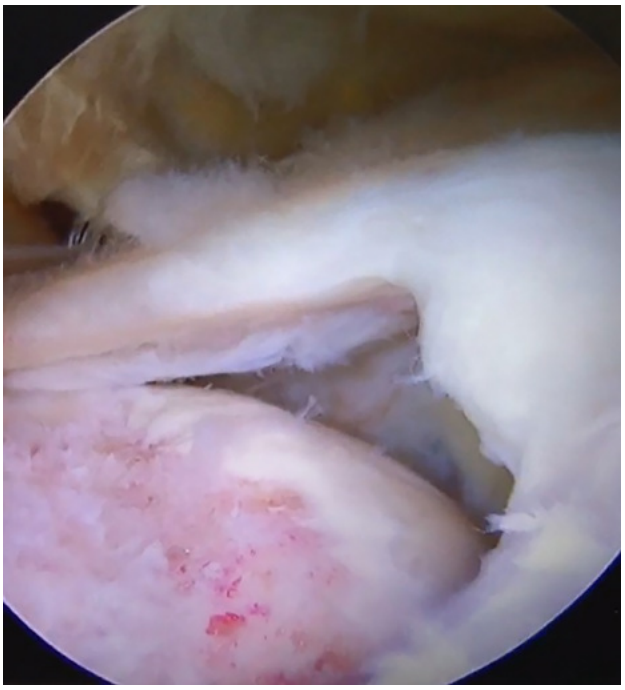


Figure 3: Intra-operative photo of a tear in the supraspinatus tendon and anterior portion of the infraspinatus tendon.

MATERIALS AND METHODS

After obtaining approval from the institutional review board (registered at Plataforma Brasil under process number 69485417.1.0000.5065), we searched the hospital's patient record system for cases in which patients underwent surgery to treat rotator cuff tears between January and December 2014 and identified a total of 340 patients.

After analyzing these cases and applying the inclusion and exclusion criteria, we evaluated fifty-seven cases in which patients underwent arthroscopic repair of small and medium-sized (<3 cm) complete rotator cuff tears and were followed for at least two years.

Inclusion criteria were patients with small and medium-sized (<3 cm) complete tears of the rotator cuff. Exclusion criteria were previous or subsequent labral lesions, moderate or advanced glenohumeral arthrosis, or refusal to participate in the study or sign an informed consent agreement. Injuries to the superior labrum or the long head of the biceps tendon (fibrillation, partial or longitudinal tears, strains, subluxations, positive semiological maneuvers for the biceps) were treated with tenotomy or tenodesis.

Tear size was defined via preoperative magnetic resonance imaging (MRI) and/or during surgery with a measuring probe; when both were available, surgical measurements took precedence over MRI data (figs. 1, 2, and 3). Tears were classified according to Cofield et al. as small (<1 cm), medium (1–3 cm), large (3–5 cm), or massive (>5 cm).[1, 9]

The evaluations were performed prior to surgery and during postoperative follow-up. We considered the last evaluation to be at least two years after the surgical procedure. The patients were assessed prior to surgery and again after at least two years (104 weeks) of follow-up. Evaluation included clinical examination of the shoulder with assessment of mobility, strength, and forward flexion of the shoulder.

Mean patient age was 54.7 years (range: 36–71). Twenty-one patients (36.84%) were male and thirty-six (63.16%) were female. The right shoulder was more frequently affected (n = 44, 77.19%). Mean follow-up time was 147 weeks (range: 124–172).

Three parameters were used for pre- and postoperative evaluation:

1. Forward flexion, namely the angle of active anterior elevation of the shoulder, in degrees.
2. The UCLA Shoulder Rating Scale.
3. The Visual Analog Scale for pain assessment (VAS).

The UCLA Shoulder Rating Scale was originally described by Amstutz et al. in 1981[10] and later modified in 1986 by Ellman et al.[11] The modified UCLA scale is comprised of five items that total 35 points: pain

TABLE 1. SCORES FOR PATIENTS

	Number of patients	Mean	Standard deviation	Minimum	Maximum
Forward flexion pre-op	57	118.6	35.7	60	180
Forward post-op	56	166.5	23.9	90	180
UCLA pre-op	57	12.4	4.3	6	30
UCLA post-op	57	31.6	3.3	21	35
VAS pre-op	56	8.6	1.8	2	10
VAS post-op	56	1.9	2.2	0	8

Scores for patients evaluated according to forward flexion, UCLA shoulder score, and vas pain scale before and after surgery.

(10 points), function (10 points), range of active forward flexion (5 points), manual force testing of forward flexion (5 points), and patient satisfaction (5 points); 34–35 points is considered excellent, 28–33 good, 21–27 fair, and 0–20 poor.

The Visual Analog Scale (VAS) was used as a subjective evaluation of pain. This scale consists of a straight line with points from 0 to 10 associated with colors for easy understanding; 0 expresses absence of pain and 10 the worst pain possible, and scores 0–2 indicate mild pain, 3–7 moderate pain, and 8–10 very severe pain.

Surgical technique

Our technique is similar to that described by Savoie.[3] Patients received general anesthesia and an interscalene brachial plexus block, and were positioned in lateral decubitus with the arm to be operated at 30° abduction, 15° elevation, and with longitudinal traction of 4–5 Kg (fig. 4).

First, the standard posterior portal was created (2 cm medial and inferior to the posterolateral edge of the acromion). Then a 14G Jelco catheter was used to create the anterior portal in the rotator interval (at the midpoint between the anterolateral edge of the acromion and the coracoid process). Lateral portals were also created (along with other accessory portals, if necessary) (fig. 5).

Next, the glenohumeral joint was assessed. Tenotomy of the long head of the biceps tendon was performed when this structure exhibited signs of degeneration. Subsequently, bursectomy was performed in the subacromial space to better visualize the tear through the lateral portal and repair the cuff. At this time, the tear was measured with an arthroscopic ruler (in millimeters) prior to debridement and preparation of the footprint. The tear was classified according to the Cofield et al. classification; tear pattern, mobility, and reducibility of the injury to the footprint were also assessed.

PEEK suture anchors were used (Sinfix, Sintegra Surgical, Brazil) and double-loaded with high resistance sutures. The suture configurations on the tendon were

Figure 4: Patient positioned in lateral decubitus, with the limb to be operated under traction.

placed according to the tear morphology. An average of 1.5 anchors (range: 1–3) were used to treat tears measuring 1.4 cm on average (range: 0.5–3 cm). We used the single-row positioning technique, with a minimum gap of 1 cm between and a 45–60° angle (the "deadman angle"). After placing the anchors, the camera was moved to the lateral portal, and through the standard posterior, posteromedial, or Neviaser portals a penetrator

Figure 5: Portals used during arthroscopy. Note the posteromedial portal (black), Neviaser portal (white), and standard posterior portal (gray).

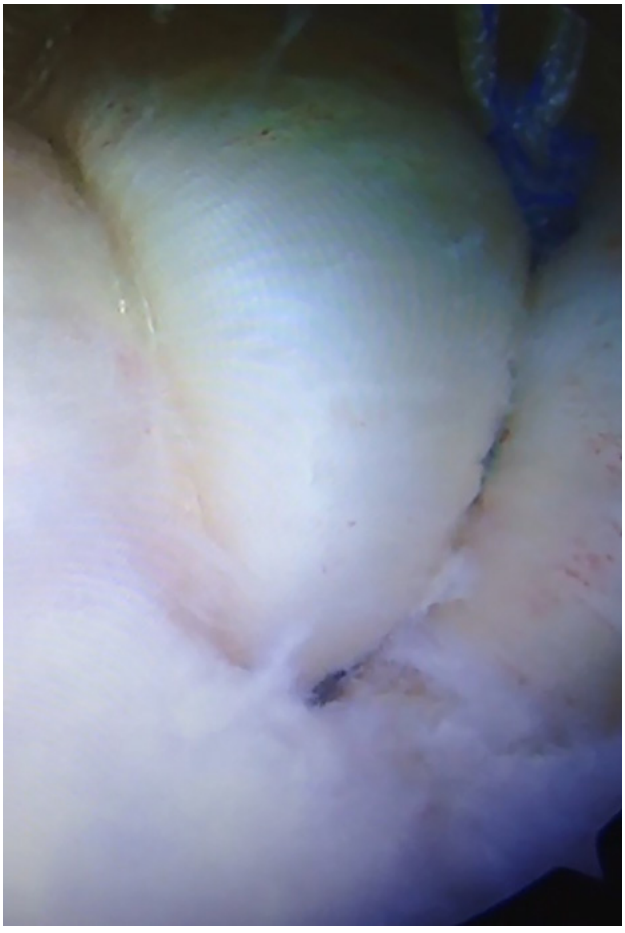
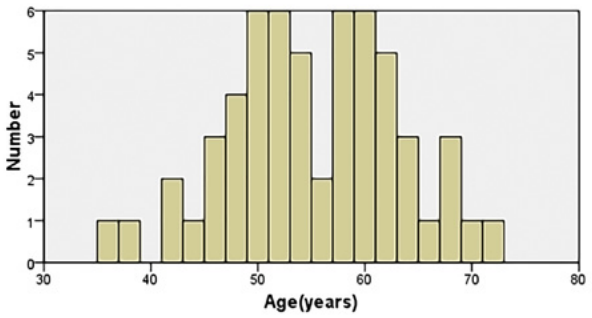


Figure 6: intraoperative image of the final aspect of the repair of the supraspinatus and infraspinatus tendon injury.

grabber was used to pass the sutures to the tear and sliding knots were placed (fig. 6).

We did not routinely perform acromioplasty or resection of the distal clavicula, except in cases with a large subacromial spur or problems involving the acromioclavicular joint. Injuries to the superior labrum or the long head of the biceps tendon (fibrillation, partial or longitudinal tears, strains, subluxations, positive semiological maneuvers for the biceps) were treated with tenotomy or tenodesis. Tenodesis was performed suprapectorally with arthroscopy using an anchor and the lasso-loop technique.



Graphic 1: Age distribution (frequency).

After the procedure, the operated shoulder was immobilized with a thoraco-brachial splint for six weeks, with active and passive mobilization of elbow, wrist, and hand joints followed by pendulum exercises of the shoulder starting in the third week post-surgery. After the sixth week, passive and active progressive movements of the shoulder began. Patients returned to strengthening exercises, stretching, and resumption of activities twelve to sixteen weeks after the procedure.

SPSS version 20 software was used for statistical analysis of the data, at a significance level of $p < 0.05$.

RESULTS

Fifty-seven patients who underwent arthroscopic repair of the rotator cuff were included in the study. Mean patient age was 54.7 years (36–71), with bimodal distribution of age frequency in two groups: one up to 55 years and another older than 55 years (graph. 1).

Thirty-one tenotomies and ten tenodesis were performed. In the tenotomy group, Popeye sign was observed in thirteen patients (42%), and only two cases (20%) in the tenodesis group.

The pre- and postoperative data were tabulated (Table 1) and distributions compared with the Wilcoxon test revealed a significant difference ($p \leq 0.05$) between the distributions of pre- and postoperative data for the three types of assessments used (forward flexion, UCLA, and VAS). These results remained when each age group was analyzed separately (graph. 2).

Data symmetry was assessed using the Kolmogorov-Smirnov test, which indicated normal distribution only for the variables "forward flexion," "UCLA pre-op,"

TABLE 2. CORRELATION BETWEEN AGE UP TO 55 YEARS AND CHANGE IN FORWARD FLEXION, UCLA SHOULDER SCALE SCORE, AND VAS PAIN SCALE

	Age (years)	Flexion score	UCLA score	VAS score
Age (years)	1	0.048	-0.156	-0.044
Flexion score		1	0.522**	0.174
UCLA score			1	0.623**
VAS score				1

***1% Significance.*

TABLE 3. CORRELATION BETWEEN OVER FIFTY-FIVE YEARS AGE GROUP AND CHANGE IN FORWARD FLEXION, UCLA, AND VAS SCORES

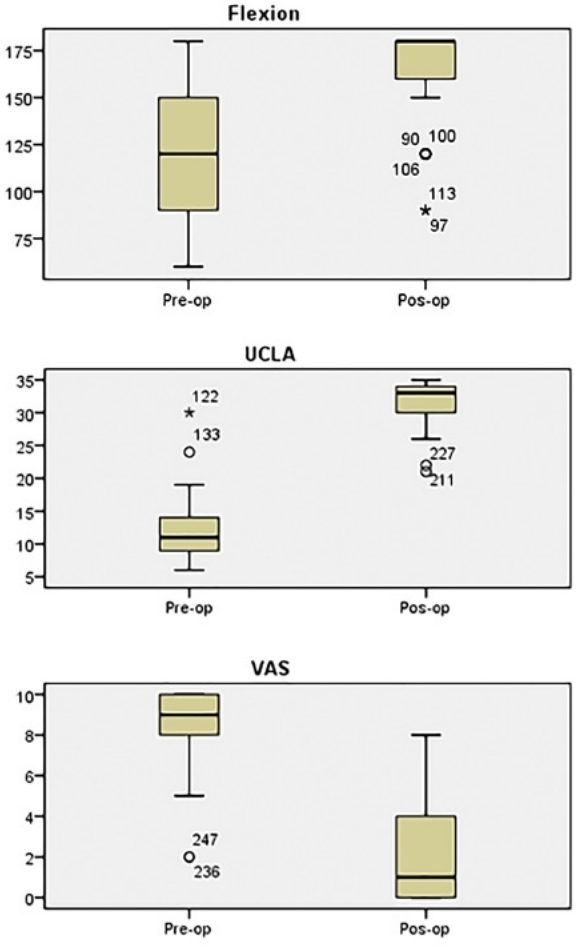
	Age (years)	Flexion score	UCLA score	VAS score
Age (years)	1	0.113	0.284	0.577**
Flexion score		1	0.605**	0.157
UCLA score			1	0.466**
VAS score				1

***1% Significance.*

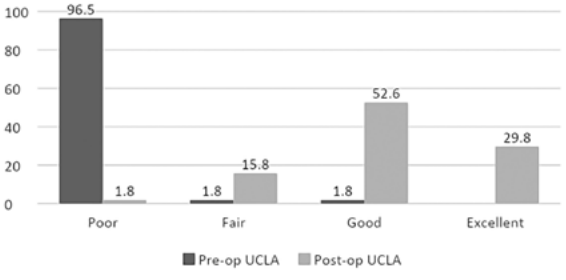
and "follow-up" (p >0.05). Consequently, the pre- and postoperative variables were compared using the non-parametric Wilcoxon test, which revealed a significant difference between the distributions of pre- and postoperative data (p≤0.05) for the three types of assessments (forward flexion, UCLA, and VAS).

According to the modified UCLA Shoulder Rating Scale, 34–35 points is considered excellent, 28–33 good, 21–27 fair, and 0–20 poor. Of the fifty-seven patients in our sample, 96% had a preoperative UCLA score below 20. When evaluated again using the same scale after surgery and recovery (during follow-up of at least two years), 1.8% of cases were classified as poor, 15.8% as fair, 52.6% as good, and 29.8% as excellent (graph. 3). The groups were not statistically compared before and after surgery because of the low occurrences in some of the groups, but the differences are shown in graphic 3. Similarly, patients assessed with the VAS pain scale showed an improvement before and after the procedure, from 8.6 to 1.9, respectively.

Since age distribution was bimodal (see graphic 1), comparisons were made between the two age groups (<55 years and 55+). When the age groups versus follow-up were compared using Student's parametric t-test, the data was found to be distributed normally; in

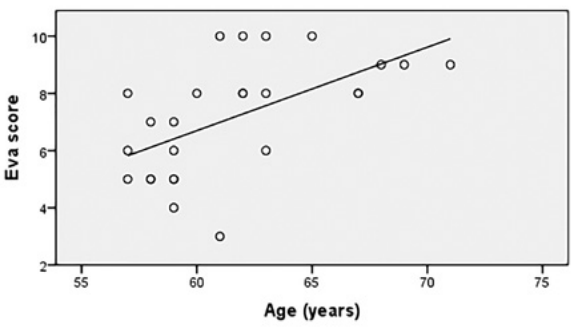


Graphic 2: Boxplot representing cases assessed using forward flexion, the UCLA Shoulder Scale, and the VAS scale: the black line in each box represents the median, outer bars represent minimum and maximum values, and points beyond the line represent outliers.



Graphic 3: Frequency distribution for UCLA Shoulder Rating Scale functional assessment scores before and at least two years after surgery.

other words, there was no significant difference between the age groups and follow-up and the various evaluations can be compared with the age groups, without the follow-up variable skewing the study. To study possible associations between age and the various assessments, the variations between pre- and postoperative values for



Graphic 4: Correlation between change in EVA pain score and patient age (in years) for the 55+ age group.

each group were calculated and correlation determined using Pearson's correlation coefficient.

For the <55 age group, no significant association was found between age and the various evaluations, whether flexion, UCLA, or VAS. A significant association was found between flexion and UCLA (positive) and UCLA and VAS (Table 2).

On the other hand, for the 55+ age group, a moderately positive association (r = 0.577) was found between age and change in VAS score, indicating that greater age was associated with the difference between pre- and post-surgery scores (in other words, greater age indicated less pain during the postoperative period). Associations were also identified between flexion and UCLA and between UCLA and VAS (Table 3).

When change in VAS score was compared with the 55+ age group, a linear equation for adjustment of change in VAS score as a function of age (in years) was found: Y = -10.8 + 0.29.X, where Y represents the change in VAS score and X age in years. The equation states that for this age group (55+), for each difference in years of age, the pain score varies 0.29 on a scale of 0 to 10. Since VAS variation increases with age (i.e., the difference between pre- and postoperative is greater), for each additional year of age the patient feels less pain after the procedure, at a rate of 0.29 points for each year (graph. 4). The coefficient of explanation for this equation is R2 = 33.3% (in other words, the decrease in pain at this rate of 0.29 per year occurs in 33.3% of patients).

DISCUSSION

The literature corroborates our good results in the short and medium term for patients who undergo arthroscopic repair of rotator cuff tears.[8] Tauro reported good and excellent results (by UCLA score) in 92% of fifty-three patients operated.[5, 12] Gartsman reported good and excellent outcomes in 84% of 50 patients operated and followed for at least thirteen months, with mean UCLA Shoulder Rating score rising from 12.8 to 31.7 in the postoperative period.[2, 13, 14] Burkhart et al., in an arthroscopic repair series, found good and excellent results in 95% of cases (based on UCLA score) with follow-up of 3.5 years.[7]

Several factors can affect healing of the repair and subsequent surgical outcome. For example, bone quality decreases with age and may compromise fixation of the anchor and, in turn, the tendon suture. In the literature, tear size has been described as affecting healing of the repaired rotator cuff tendon, with poorer results for larger injuries. Fatty infiltration, muscle atrophy, and retraction of the muscle-tendon unit are also associated with poorer results. In our sample (median age: 55) anchors did not come loose in any patient.

The literature emphasizes that good results are still possible even in cases where the tendon ruptures again. In patients with confirmed rerupture, Dodson et al. found no changes in the arc of movement or in scores on the ASES, Simple Shoulder Test, or VAS in 7.9 years compared with a follow-up of 3.2 years; they found a statistically significant decrease in forward flexion strength and lateral rotation of 45% and 42%, respectively, in 7.9 years.[15] These authors demonstrated that ultrasound in follow-up found a statistically significant increase in tear size in all patients. They concluded that patients with these defects can remain asymptomatic for a long period, but muscle strength is lost in elevation and external rotation movements.[15] They attributed this low symptomatology to several factors including subacromial decompression during the surgical procedure, physical therapy rehabilitation protocol, and the balanced forces of the intact subscapular and infraspinatus tendons, described by Burkhart as a suspension bridge.[6, 16, 17] In our sample we did not use imaging of the tear as a control due to limited resources; we do not believe that this imaging would have changed our procedure, except in cases of suspected rerupture with poor results.

In our sample we found good and excellent results in 82.4% of the patients operated with at least two years of follow-up, with mean UCLA score of 31.7. These findings are comparable with results from other studies on arthroscopic repair of rotator cuff injuries with short and intermediate follow-up. Although we did not assess the integrity of the repair using imaging, functional level and postoperative pain were significantly better after surgery.

We believe that the better outcomes in the population over age fifty-five result from lower demand on the arms, and perhaps fewer work-related injuries.

According to Boileau, approximately 90% of rotator cuff injuries are associated with injuries to the long head of the biceps tendon, including histological changes.[18-21] We believe that the biceps is a considerable source of pain and its function is not fully understood in shoulder biomechanics. In our study we conducted thirty-one tenotomies and ten tenodesis, with only 42% and 10% of these patients expressing associated complaints or showing Popeye sign.

Miyazaki et al. evaluated arthroscopic rotator cuff repairs in patients up to fifty years of age with at least twenty-four months of follow-up, and found excellent and good results in 92% of this sample.[4] In another study with patients over sixty-five years of age, these same authors found good and excellent results in 96% of cases, showing that advanced age did not affect postoperative clinical outcome.[4, 22, 23] Veado et al. studied patients in the same age group and found good and excellent results in 89% of cases.[24] In our sample, we observed a significant association between age and better scores, which translated into better results in the 55+ age group.

Many techniques are described in the literature for rotator cuff repair, including the double row, transosseous-equivalent, and suture bridge techniques. Because of financial limitations, in our institution we use a single-row technique which is simple, reproducible, and economical and has proven effective for treating small and medium-sized rotator cuff tears.

Our study has limitations, such as short follow-up time (two years), retrospective nature, and use of scores that cannot correlate factors associated with poor results.[25-28] As for follow-up, we intend to continue this research to observe outcomes over a longer period and perhaps use imaging of the tear as a control. Strong points of the study are a relatively large sample compared with other similar studies, and use of a low-cost technique, primarily for institutions with limited resources.

CONCLUSION

Arthroscopic repair yielded good and excellent results in 82.4% of cases with a minimum follow-up time of two years, mainly in the 55+ age group.

This technique proved effective in treating these types of tears and is a good low-cost option for these injuries.

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