

RESEARCH ARTICLE

Does Side Dominance Affect the Clinical and Functional Outcomes Following Arthroscopic Rotator Cuff Repair?

Erdal Uzun¹, Abdulhamit Mısır², Ahmet Güney¹

¹Department of Orthopedic and Traumatology, Erciyes University, Kayseri, Turkey

²Department of Orthopedic and Traumatology, Gaziosmanpasa Taksim Training and Research Hospital, Istanbul, Turkey.

Received: 23 March 2020, Accepted: 04 April 2020, Published online: 30 April 2020

© Ordu University Institute of Health Sciences, Turkey, 2020

Abstract

Objectives: The aims of this study were to evaluate the mid-term functional outcomes following arthroscopic rotator cuff repair (aRCR) and to define the effect of hand dominance on functional outcomes and re-tear rate.

Methods: Between 2009 and 2015, 160 patients with aRCR (100 females and 60 males) with a minimum 3-year follow-up duration were included in the study. Patients were divided into two main groups according to hand dominance of operated side: Dominant (Group 1) and nondominant (Group 2). Pre- and postoperative functional outcome scores and clinical status of patients were evaluated using the Visual Analog Scale (VAS), American Shoulder and Elbow Surgeons Standardized Shoulder Assessment Form (ASES), University at California at Los Angeles Shoulder Rating Scale (UCLA) and Constant-Murley score (CMS). Functional scores, and revision rate of patients were compared in terms of hand dominance, patient characteristics and operative features.

Results: The mean follow-up period was 45.5 ± 8.3 months (Range, 36 to 84 months). Mean age at the time of surgery was 59.0 ± 8.3 years in the dominant group and 58.3 ± 9.2 years in the nondominant group ($p=0.689$). Good to excellent postoperative functional outcomes were obtained regarding VAS, ASES, UCLA and CMS and scores in both groups compared with the baseline ($p=0.000$). Although dominant group had higher postoperative functional scores compared to nondominant group, improvement in functional scores were similar between groups ($p<0.05$). Retear was noted in 16 patients (7 patients, 7.2% in dominant group and 9 patients, 14.2% in nondominant group, $p=0.145$). Side dominance was not associated with re-tear development ($p=0.145$). However, tear size was found to be associated with re-tear development ($p=0.025$).

Conclusions: This study suggests that side dominance has no significant impact on improvement in clinical scores and re-tear development after aRCR in mid-term.

Key words: Rotator cuff, operation side, dominance, outcomes, functional, clinical

Suggested Citation: Uzun E, Misir A, Guney A. Does Side Dominance Affect the Clinical and Functional Outcomes Following Arthroscopic Rotator Cuff Repair?. Middle Black Sea Journal of Health Science, 2020; 6(1):106-114

Address for correspondence/reprints:

Erdal Uzun

E-mail: nuzuladre@gmail.com

Telephone number: +90 (507) 211 79 99

DOI: 10.19127/mbsjohs.708230

ORCID-ID 0000 0002 5456 3699

Introduction

Rotator cuff tears are among the most common pathologies of the shoulder with increasing incidence by age and require surgical intervention in the failure of conservative treatment (Marx et al. 2009). Arthroscopic rotator cuff repair (aRCR) has become widespread today with the development of arthroscopic techniques and equipments. Re-tear is the most common complication after aRCR with reported re-tear rates ranging from 5% to 94% (Ajrawat et al. 2019; Galatz et al. 2004; I.-B. Kim and Kim 2016; Lafosse et al. 2008; Le et al. 2014; Wang et al. 2010). There are many studies evaluating the risk factors that may affect outcomes after aRCR and re-tear rate in different patient groups (Y.-K. Kim et al. 2018; Park et al. 2015; Saccomanno et al. 2016; Shim et al. 2018). Side dominance is one of the factors that seems to play a role in the etiology of rotator cuff tears (Sayampanathan and Andrew 2017). Although side dominance is known to increase the risk up to 2 times in etiology, studies evaluating the effect of side dominance on clinical outcomes after aRCR are limited (Kelly et al. 2017; Oh et al. 2009, 2010; Woollard et al. 2017). Its effect on mid-term post-aRCR recovery and revision rate is not well known. In this study we aimed to investigate whether side dominance affected clinical and functional scores and retear rate after aRCR mid-term. The hypothesize was that dominant limb injuries tended to have higher revision rate and functional scores compared to non-dominant limb in the med-term.

Methods

Patients

The study protocol of this retrospective case-control study was approved by Erciyes University Faculty of Medicine clinical investigations research ethics board (Date: 24.07.2015, number: 2015/330). Between 2009 and 2015, a single surgeon (AG) with at least 5-year experience in arthroscopic shoulder surgery performed 275 RCRs. Of these, we retrospectively reviewed 160 consecutive RCRs with a minimum 3-year follow-up. Patients were divided into two main groups according to hand dominance: Dominant group (97 patients, 62 males and 35 females) and nondominant group (63 patients, 38 males and 25 females). Nonsurgical treatment options were applied to all patients including; Nonsteroidal anti-inflammatory drugs (NSAIDs), subacromial or glenohumeral steroid injections and physical therapy.

Patients without response to non-surgical treatment and who attended regular follow-up for at least 3 years with unilateral partial or total rotator cuff tear repair were included in this study. Patients; who have not attended regular follow-up for at least 3 years (72 patients), patients who had undergone previous surgery for the affected shoulder (subacromial pathologies – 18 patients; trauma – 2 patients; glenohumeral pathologies – 11 patients) and the patients who had not attended postoperative rehabilitation program regularly (12 patients) were excluded.

Surgical method

All surgical procedures were performed under interscalene block and general anesthesia combination. Patients were positioned in the beach-chair position. A diagnostic arthroscopy was performed prior to the repair process. Biceps tendon was tenotomized if the tendon was degenerated or inflamed. Then, the arthroscope was placed into the subacromial space, and bursectomy was performed to elucidate the tear pattern. A single or double row repair technique was used according to tear size and configuration. Repairs were performed using Smith & Nephew (London, UK) TWINFIX® suture anchor with ULTRABRAID® suture or FOOTPRINT PK® suture anchor. Subacromial decompression and release of anterior aspect of the coracoacromial ligament were performed following rotator cuff repair.

Postoperative rehabilitation

An immobilizer was used postoperatively for 6 weeks. Pendulum exercises were started immediately postoperatively. Twice a day, 10-min pendulum exercises with active elbow, wrist, and hand exercises were allowed for the first 6 weeks. Passive range of motion was allowed for 6-8 weeks, active-assisted range of motion between 8 and 10 weeks, and active range of motion between 10 and 12 weeks. Strengthening program was started at the 12th week.

Postoperative assessment

Patient characteristics and demographic data were recorded. Operative reports were evaluated, and pre- and postoperative clinical and functional examinations were performed. As the primary outcome measures, pre- and post-operative functional outcomes were measured using the Visual Analog Scale (VAS; ranging from 0 to 10; 0 = no pain to 10 = worst pain ever), American Shoulder and Elbow Surgeons Standardized Shoulder Assessment Form (ASES) (King et al. 1999), University at California

at Los Angeles Shoulder Rating Scale (UCLA) (Placzek et al. 2004) and Constant-Murley score (CMS) (Constant and Murley 1987). Also Minimal Clinically Important Difference (MCID) of VAS, UCLA, ASES and CMS values were evaluated for both groups as previously reported (Cvetanovich et al. 2019; Tashjian et al. 2020; Xu et al. 2020). Postoperative rotator cuff re-tear was evaluated by physical examination (persistent pain, loss of strength, pseudoparalysis) correlating with MRI (assessing the structural integrity of the repaired rotator cuff) (Flurin et al. 2005). An informed consent was obtained from all participating patients.

Data and Statistical Analysis

IBM SPSS Statistics version 22.0 (IBM Inc. Chicago, IL, USA) was used for statistical analysis. Descriptive data were presented as median (range), frequency and mean \pm standard deviation (SD). Distribution of the variables was tested by using the Shapiro–Wilk test. Nonparametric tests were used since the data were not normally distributed. The Mann–Whitney U test or Kruskal–Wallis test was used for intergroup comparisons of independent quantitative data, depending on the number of groups compared, and Wilcoxon test was used in the evaluation of dependent continuous variables (last follow-up vs. baseline). The chi-square test and Fischer exact test were used in the evaluation categorical data. A sample size of 56 participants per group was calculated as necessary to detect a significant difference in measurements, with a statistical power of 0.80. The type 1 error rate associated with the null hypothesis test was 0.05.

The level of statistical significance was set at p-value <0.05 .

Results

The mean follow-up duration was 45.5 ± 8.3 months (range, 36 to 84 months). The mean age of patients was 58.8 ± 8.6 years (range, 36 to 77). There were 98 tears at the right side and 62 tears at the left side. Of the 160 patients, 97 (60.6%) had injuries on the dominant side, whereas 63 (39.4%) had injuries on the non-dominant side. There was no statistically significant difference between two groups regarding to preoperative patient and tear characteristics ($p>0.05$) (Table 1). Also, in our patient group, we found no significant difference between two groups regarding to pre- and intraoperative characteristics ($p>0.05$) (Table 2). Good to excellent outcomes with significant improvements in functional outcome scores were obtained at the last follow -up. Pre- and postoperative VAS, ASES, UCLA and CMS scores were improved significantly compared to the baseline ($p<0.000$ for all). Although dominant group had higher postoperative functional outcome scores compared to nondominant group; there was no statistically significant difference between two groups in terms of clinical and functional scores ($p>0.05$) (Table 3). A total of 16 patients (7 patients in dominant group and 9 patients in nondominant group) had re-tear and they underwent revision surgery during follow-up period. The mean re-tear time was 9.6 ± 5.9 months (range, 3 to 24 months). No parameters of patient demographics and operative features including leg dominance was found to be associated with re-tear except tear size (Table 4). In re-tear group; 2 patients (12.5%) were revised with reverse shoulder arthroplasty. Two patients (12,5%) were treated with latissimus dorsi tendon transfer and the others (12 patients, 75%) were treated with revision arthroscopic rotator cuff repair. No patients developed superficial or deep infection. No major complication was observed perioperatively or at the postoperative follow-up period.

Table 1. Patient and tear characteristics according to the study group. °

		Total (n=160)		Dominant (n=97)		Nondominant (n=63)		p value
Age		58.8 ± 8.6		59.1 ± 8.3		58.3 ± 9.2		0.575
Follow-up period (Month)		45,5 ± 8,3		45.3 ± 8.4		45.7 ± 8.2		0.689
BMI		26.3 ± 2.8		26.3 ± 2.7		26.3 ± 3.0		0.942
Sex	Female	100	62.5%	62	63.9%	38	60.3%	0.646
	Male	60	37.5%	35	36.1%	25	39.7%	
Tear type	Total	116	72.5%	71	73.2%	45	71.4%	0.807
	Partial	44	27.5%	26	26.8%	18	28.6%	
Tear pattern	Crescent	126	78.8%	75	77.3%	51	81.0%	0.573
	U type	22	13.8%	14	14.4%	8	12.7%	
	L type	12	7.4%	8	8.2%	4	6.3%	
Torn tendon	SS	120	75.0%	68	70.1%	52	82.5%	0.113
	SS+IS	36	22.5%	28	28.9%	8	12.7%	
	SS+IS+SSC	4	2.5%	1	1.0%	3	4.8%	
Side	Right	98	61.3 %	59	60.8%	39	61.9%	0.891
	Left	62	38.8 %	38	39.2%	24	38.1%	
Acromion type	1	44	27.5 %	27	27.8%	17	27.0%	0.866
	2	82	52.5 %	51	52.6%	33	52.4%	
	3	32	20.0%	19	19.6%	13	20.6%	
Smoking Habit	(-)	132	82.5 %	80	82.5%	52	82.5%	0.992
	(+)	28	17.5 %	17	17.5%	11	17.5%	
Comorbidity	(-)	86	53.8 %	52	53.6%	34	54.0%	0.964
	(+)	74	46.2 %	45	46.4%	29	46.0%	
Diabetes	(-)	134	83.8 %	79	81.4%	55	87.3%	0.326
	(+)	26	16.2 %	18	18.6%	8	12.7%	
Hypercholesterol emia	(-)	129	80.6 %	75	77.3%	54	85.7%	0.189
	(+)	31	19.4 %	22	22.7%	9	14.3%	
Thyroid disease	(-)	155	96.9 %	94	96.9%	61	96.8%	0.977
	(+)	5	3.1 %	3	3.1%	2	3.2%	

°Data are reported as mean ± SD or n (%). BMI, Body mass index.

Table 2. Pre- and intraoperative characteristics of patients according to the study group. °

		Total (n=160)		Dominant (n=97)		Nondominant (n=63)		p value
Number of anchors used		2,3 ± 0.7 / 2.0 (1-5)		2,3 ± 0.6 / 2.0 (1-4)		2,3 ± 0.8 / 2.0 (1-5)		0.862
Time to surgery (months)		8.9 ± 8.5 / 6.0 (0-48)		8.9 ± 9.4 / 6.0 (1-48)		7.2 ± 6.7 / 6.0 (1-36)		0.161
Tear size (mm)		25.8 ± 10.9 / 20 (10-55)		26.0 ± 10.4 / 25 (10-55)		25.4 ± 11.6 / 20 (10-55)		0.466
Operative time (minutes)		82.2 ± 17.4 / 75 (60-120)		80.6 ± 17.0 / 75 (60-120)		84.6 ± 17.9 / 75 (65-120)		0.071
Repair type	Single row	90	56.3 %	56	57.7%	34	54%	0.639
	Double row	70	43.7 %	41	42.3 %	29	46%	
Biceps tenotomy	(-)	112	70.0 %	67	69.1%	45	71.6%	0.751
	(+)	48	30.0 %	30	30.9%	18	28.4%	
Acromioplasty	(-)	25	15.6 %	16	16.5%	9	14.3%	0.707
	(+)	135	84.4 %	81	83.5 %	54	85.7%	

° Data are reported as mean ± SD / median (min-max) or n (%).

Affect of Side Dominance on Arthroscopic Rotator Cuff Repair

Table 3. Comparative clinical outcome scores of all patients and Dominance (+) and Dominance (-) groups.^o

	Total (n=160)		<i>p</i>	Dominant (n=97)		Nondominant (n=63)		<i>p</i>
	Mean ± SD	Median (min-max)		Mean ± SD	Median (min-max)	Mean ± SD	Median (min-max)	
Time to failure (months)	9.6 ± 5.9	8.0(3-24)		7.5 ± 5.7	6.0(3-20)	11.3 ± 5.9	8.0 (6-24)	0.071
Re-tear (n/%)	16 (10)			7 (43.8)		9 (56.3)		0.145
<u>VAS score</u>								
Preop	5.1 ± 2.6	4.0(2-10)	0.00	4.8 ± 2.6	4.0(2-10)	5.6 ± 2.6	5.0(2- 10)	0.051
Postop				2.4 ± 1.8	2.0(1-9)	3.0 ± 1.9	2.0(1- 9)	0.004
Pre-post difference	2.7 ± 1.9	2.0(1-9)		-2.3 ± 2.2	-2.0((-8)-4)	-2.5 ± 2.3	-2.0((-8)- 2)	0.797
Pre-post difference <i>p</i>				0.000		0.000		
<u>ASES score</u>								
Preop	41.8 ± 17.3	45.0(10-72)	0.00	43.8 ± 17.3	50.0(10-72)	38.7 ± 17.1	43.0(10-66)	0.043
Postop				87.7 ± 15.2	90.0(23-100)	80.9 ± 19.2	90.0(27-100)	0.005
Pre-post difference	85.0 ± 17.1	85.0(23-100)		43.8 ± 15.9	44.0(8-80)	42.1 ± 19.5	42.0(5-85)	0.677
Pre-post difference <i>p</i>				0.000		0.000		
<u>UCLA score</u>								
Preop	17.2 ± 4.4	18.0(6-26)	0.00	17.8 ± 4.4	19.0(6-26)	16.3 ± 4.3	17.0(6-25)	0.033
Postop				31.7 ± 4.2	33.0(14-35)	30.4 ± 4.6	32.0(16-35)	0.023
Pre-post difference	31.2 ± 4.4	31.2(14-35)		13.8 ± 4.4	14.0((-2)-24)	14.1 ± 5.1	14.0(2-24)	0.869
Pre-post difference <i>p</i>				0.000		0.000		
<u>CM score</u>								
Preop	42.4 ± 12.3	44.0(11-70)	0.00	43.6 ± 12.1	45.0(11-70)	40.6 ± 12.6	42.0(13-68)	0.122
Postop				83.0 ± 14.6	87.0(36-100)	78.8 ± 15.2	82.0(32-100)	0.042
Pre-post difference	81.4 ± 14.9	81.4(32-100)		39.3 ± 13.0	40.0((-5)-72)	38.2 ± 16.3	39.0((-4)-72)	0.697
Pre-post difference <i>p</i>				0.000		0.000		

^o Data are reported as mean ± SD / median(min-max) or n (%). VAS: Visual Analog Scale; ASES: American Shoulder and Elbow Surgeons Standardized Shoulder Assessment Form; UCLA: University at California at Los Angeles Shoulder Rating Scale; CM: Constant-Murley. Bolded *p* indicates a statistically significant difference between groups (*p* < 0.05).

Table 4: Patient demographics and operative features according to the retear status. °

		Total (n=160)	Retear (-) (n=144)	Retear (+) (n=16)	p
Age (year)		58.8 ± 8.6	58.9 ± 8.6	58.1 ± 8.8	0.728
BMI (kg/m²)		26.3 ± 8.0	26.3 ± 2.8	26.6 ± 3.1	0.655
Sex (n/%)	Female	100 (62.5)	91 (63.2)	9 (56.3)	0.586
	Male	60 (27.5)	53 (36.8)	7 (43.8)	
Side dominancy (n/%)	(+)	97 (60.6)	90 (62.5)	7 (43.8)	0.145
	(-)	63 (39.4)	54 (37.5)	9 (56.2)	
Affected side (n/%)	Right	98 (61.3)	89 (61.8)	9 (56.3)	0.665
	Left	62 (38.8)	55 (38.2)	7 (43.7)	
Dominant side(n/%)	Right	84 (60.9)	74 (51.4)	6 (37.5)	0.398
	Left	76 (39.1)	70 (48.6)	10 (62.5)	
Smoking habits (n/%)	Nonsmokers	132 (82.5)	117 (81.2)	15 (93.8)	0.212
	Smokers	28 (17.5)	27 (18.8)	1 (6.3)	
Comorbidity	(+)	74 (46.2)	64 (44.4)	10 (62.5)	0.169
	(-)	86 (53.8)	80 (55.6)	6 (37.5)	
Tear type	Total	116 (72.5)	103 (71.5)	13 (81.3)	0.409
	Partial	44 (27.5)	41 (28.5)	3 (18.7)	
Repair type	Single row	90 (56.3)	82 (56.9)	8 (50.0)	0.595
	Double row	70 (43.7)	62 (43.1)	8 (50.0)	
Biceps tenotomy	(+)	112 (70)	99 (68.8)	13 (81.3)	0.301
	(-)	48 (30)	45 (31.3)	3 (18.8)	
Acromioplasty	(+)	135 (84.4)	120 (83.3)	15 (93.8)	0.276
	(-)	25 (15.6)	24 (16.7)	1 (6.3)	
Time injury to surgery (months)		6 (1-48)	6 (1-48)	6 (1-24)	0.615
Operative time (minutes)		75 (60-120)	75 (60-120)	82.5 (65-120)	0.134
Number of anchors used		2 (1-5)	2 (1-5)	2 (1-5)	0.892
Tear size (mm)		20 (10-55)	20 (10-55)	25 (15-50)	0.025

° Data are reported as mean ± SD or median (min-max) or n (%). Bolded *p* indicates a statistically significant difference between groups (*p* < 0.05). BMI, Body mass index.

Discussion

The most important finding of this current study was that side dominancy was found not to affect improvement in clinical scores and re-tear development after aRCR in mid-term. Besides, aRCR is an effective method with low re-tear rate and high clinical scores regardless of side dominancy, repair method (single or double row) and patient characteristics in mid-term. However larger tear size was found to negatively affect re-tear development.

In our study, postoperative VAS, ASES, UCLA and CMS scores were significantly improved compared to the baseline in both groups. In Dominant group, 87.4 % of VAS, 85.6 % of UCLA, 89.1% of ASES and 87% of CMS MCID values were achieved respectively whereas 85.2 % of VAS; 84.0 % of UCLA, 87.7% of ASES and 85.6% of CMS MCID values achieved in nondominant group. However, we found no difference between clinical improvement values of two groups according to the MCID scores.

In the other words, although there were significant score differences between the dominant and nondominant shoulders, that difference was not clinically significant.

There are many studies evaluating the risk factors that may affect outcomes after aRCR or re-tear in different patient groups (Berglund et al. 2018; Charousset et al. 2006; Chung et al. 2016; Gasbarro et al. 2016; Y.-K. Kim et al. 2018; Park et al. 2015; Saccomanno et al. 2016; Sahni and Narang 2016; Savoie et al. 2016; Shim et al. 2018; Tashjian et al. 2010). Some patient and tear characteristics such as larger tear size, older age, higher interval from tear to surgery, diabetes, obesity were reported to be associated with poorer outcomes after aRCR (Berglund et al. 2018; Park et al. 2015; Saccomanno et al. 2016; Sahni and Narang 2016; Tashjian et al. 2010). However, studies evaluating the effect of side dominance on clinical outcomes after aRCR are limited (Oh et al. 2009, 2010) (Kelly et al. 2017;

Woollard et al. 2017). Recently Kelly et al. (Kelly et al. 2017) evaluated the possible effect of hand dominance on functional outcome following single row rotator cuff repair and found no difference between dominant and non-dominant side surgery. Also, they reported higher overall outcome score in the dominant surgery group with at least 3 years follow up. In line with this study Woollard et al. (Woollard et al. 2017) revealed that surgery on the dominant arm resulted in greater improvement in patient-reported disability thereby increasing the odds of a successful surgery. However, some other studies examining whether or not rotator cuff repair on the dominant arm predicts clinical outcome reported no effect of hand dominance on impairment-based outcome scores (Oh et al. 2009, 2010). In concordance with Kelly et al. (2017) and Woollard et al. (2017) we found that side dominance had a significant impact on postoperative functional and clinical scores in the mid-term. However, there was no statistically significant difference between two groups in terms of improvement in clinical and functional scores.

Re-tear is the most common complication after RCR with reported re-tear rates ranging from 5% to 94% (Ajrawat et al. 2019; Galatz et al. 2004; I.-B. Kim and Kim 2016; Lafosse et al. 2008; Le et al. 2014; Wang et al. 2010). Overall re-tear rate was 10% (16 patients) in our study population, that rate, which is slightly lower than the rates reported in the literature can be attributed to the relatively shorter follow-up period. This study suggest that side dominance has no significant impact on re-tear after aRCR in the mid-term.

Larger tear size, older age, higher time interval from tear to surgery, diabetes, obesity were reported to be associated with poorer outcomes after aRCR (Berglund et al. 2018; Park et al. 2015; Saccomanno et al. 2016; Sahni and Narang 2016; Tashjian et al. 2010)(I.-B. Kim and Kim 2016). In our study, we found no effect of patient and tear characteristics such as age, BMI, sex, tear type, tear pattern, torn tendon, tear side, acromion type, smoking habits and comorbidities on re-tear development. However larger tear size was found to negatively affected re-tear development as many studies in the literature (Park et al. 2015; Saccomanno et al. 2016) (Gasbarro et al. 2016). In the literature there are conflicting results about the outcomes of single- or double-row rotator cuff aRCR (Hurley, Maye, and Mullett 2019; Y.-K. Kim et al. 2018; Sugaya et al. 2007). We found no differences with either single- or double-row rotator cuff repairs in terms of re-tear rate.

The strength of this study was that all the procedures were performed in a single center by a single surgeon with at least 5-year experience on arthroscopic shoulder surgery. Besides, we evaluated a large variety of factors; patients' characteristics and demographic data, pre- and postoperative scores and intraoperative factors in terms of side dominance. There are several limitations of this current study. First, this study was retrospective in nature but we used the prospectively collected data of patients without loss of follow-up to reach more accurate results. Second, although at least 3-year follow-up may be sufficient to evaluate the re-tear rate, long-term functional outcomes and re-tear rate may differ and more accurate results may be obtained with longer follow-up. Third, patients daily work has not been evaluated, this may affect homogeneity, clinical outcomes and re-tear rate. Further randomized prospective studies with more homogeneous patient groups are needed to evaluate the effects of side dominance on aRCR.

Conclusion

This study suggests that side dominance has no significant impact on improvement in clinical scores and re-tear development after aRCR in mid-term. Besides, aRCR is an effective method with high clinical scores and low re-tear rate regardless of side dominance, surgical features and patient characteristics in mid-term. However larger tear size was found to negatively affect re-tear development.

Ethics Committee Approval: Ethics committee approval was received for this study from School of Medicine Clinical Research Ethics Committee of Erciyes University (2015/330)

Peer-review: Externally peer-reviewed.

Author Contributions: Concept – EU,AM,AG; Design EU,AM; Supervision AG; Materials - EU,AG; Data Collection and/or Processing – EU,AM,AG.; Analysis and/or Interpretation – EU,AM,AG; Literature Review - EU,AM; Writing - EU,AM; Critical Review – AG,AM.

Conflict of Interest: No conflict of interest was declared by the authors.

Financial Disclosure: The authors declared that this study hasn't received no financial support.

References

- Ajrawat P, Dwyer T, Almasri M, Veillette C, Romeo A, Leroux T, et al. Bone Marrow Stimulation Decreases Retear Rates after Primary Arthroscopic Rotator Cuff Repair: A Systematic Review and Meta-Analysis. *Journal of shoulder and elbow surgery* 2019; 28(4): 782–91.
- Berglund DD, Kurowicki J, Giveans MR, Horn B, Levy JC. Comorbidity Effect on Speed of Recovery after Arthroscopic Rotator Cuff Repair. *JSES open access* 2018; 2(1): 60–68.
- Charouset C, Duranthon LD, Grimberg J, Bellaiche L. Arthro-C-scan analysis of rotator cuff tears healing after arthroscopic repair: analysis of predictive factors in a consecutive series of 167 arthroscopic repairs. *Revue de chirurgie orthopedique et reparatrice de l'appareil moteur* 2006; 92(3): 223–33.
- Chung SW, Park H, Kwon J, Choe GY, Kim SH, Oh JH. Effect of Hypercholesterolemia on Fatty Infiltration and Quality of Tendon-to-Bone Healing in a Rabbit Model of a Chronic Rotator Cuff Tear: Electrophysiological, Biomechanical, and Histological Analyses. *The American journal of sports medicine* 2016; 44(5): 1153–64.
- Constant CR, Murley AH. A Clinical Method of Functional Assessment of the Shoulder. *Clinical orthopaedics and related research* 1987; (214): 160–64.
- Cvetanovich GL, Gowd AK, Liu JN, Nwachukwu BU, Cabarcas BC, Cole BJ, et al. Establishing Clinically Significant Outcome after Arthroscopic Rotator Cuff Repair. *Journal of shoulder and elbow surgery* 2019; 28(5): 939–48.
- Flurin P-H, Landreau P, Gregory T, Boileau P, Brassart N, Courage O, et al. Arthroscopic repair of full-thickness cuff tears: a multicentric retrospective study of 576 cases with anatomical assessment. *Revue de chirurgie orthopedique et reparatrice de l'appareil moteur* 2005;91(S8): 31–42.
- Galatz LM, Ball CM, Teefey SA, Middleton WD, Yamaguchi K. The Outcome and Repair Integrity of Completely Arthroscopically Repaired Large and Massive Rotator Cuff Tears. *The Journal of bone and joint surgery. American volume* 2004; 86(2): 219–24.
- Gasbarro G, Ye J, Newsome H, Jiang K, Wright V, Vyas D, et al. Morphologic Risk Factors in Predicting Symptomatic Structural Failure of Arthroscopic Rotator Cuff Repairs: Tear Size, Location, and Atrophy Matter. *Arthroscopy: the journal of arthroscopic & related surgery: official publication of the Arthroscopy Association of North America and the International Arthroscopy Association* 2016; 32(10): 1947–52.
- Hurley ET, Maye AB, Mullett H. Arthroscopic Rotator Cuff Repair: A Systematic Review of Overlapping Meta-Analyses. *JBJS reviews* 2019; 7(4): e1.
- Kelly MA, Mc Donald CK, Boland A, Groarke PJ, Kaar K. The Effect of Hand Dominance on Functional Outcome Following Single Row Rotator Cuff Repair. *The open orthopaedics journal* 2017; 11: 562–66.
- Kim I-B, Kim M-W. Risk Factors for Retear After Arthroscopic Repair of Full-Thickness Rotator Cuff Tears Using the Suture Bridge Technique: Classification System. *Arthroscopy: the journal of arthroscopic & related surgery: official publication of the Arthroscopy Association of North America and the International Arthroscopy Association* 2016. : 32(11): 2191–2200.
- Kim Y-K, Jung K-H, Kim J-W, Kim U-S, Hwang D-H. Factors Affecting Rotator Cuff Integrity after Arthroscopic Repair for Medium-Sized or Larger Cuff Tears: A Retrospective Cohort Study. *Journal of shoulder and elbow surgery* 2018; 27(6): 1012–20.
- King GJ, Richards RR, Zuckerman JD, Blasler R, Dillman C, Friedman RJ, et al. A Standardized Method for Assessment of Elbow Function. Research Committee, American Shoulder and Elbow Surgeons.” *Journal of shoulder and elbow surgery* 1999 ;8(4): 351–54.
- Lafosse L, Brzoska R, Toussaint B, Gobezie R. The Outcome and Structural Integrity of Arthroscopic Rotator Cuff Repair with Use of the Double-Row Suture Anchor Technique. *Surgical Technique. The Journal of bone and joint surgery. American volume* 90 Suppl 2008; 2: 275–86.
- Le BTN, Wu XL, Lam PH, Murrell GAC. Factors Predicting Rotator Cuff Retears: An Analysis of 1000 Consecutive Rotator Cuff Repairs. *The American journal of sports medicine* 2014; 42(5): 1134–42.
- Marx RG, Koulouvaris P, Chu SK, Levy BA. Indications for Surgery in Clinical Outcome Studies of Rotator Cuff Repair. *Clinical orthopaedics and related research* 2009; 467(2): 450–56.

- Oh JH, Kim SH, Ji HM, Jo KH, Bin SW, Gong HS. Prognostic Factors Affecting Anatomic Outcome of Rotator Cuff Repair and Correlation with Functional Outcome. *Arthroscopy: the journal of arthroscopic & related surgery: official publication of the Arthroscopy Association of North America and the International Arthroscopy Association* 2009; 25(1): 30–39.
- Oh JH, Kim SH, Kang JY, Oh CH, Gong HS. Effect of Age on Functional and Structural Outcome after Rotator Cuff Repair. *The American journal of sports medicine* 2010; 38(4): 672–78.
- Park JS, Park HJ, Kim SH, Oh JH. Prognostic Factors Affecting Rotator Cuff Healing After Arthroscopic Repair in Small to Medium-Sized Tears. *The American journal of sports medicine* 2015; 43(10): 2386–92.
- Placzek JD, Lukens SC, Badalanmenti S, Roubal PJ, Freeman DC, Walleman KM, et al. Shoulder Outcome Measures: A Comparison of 6 Functional Tests. *The American journal of sports medicine* 2004; 32(5): 1270–77.
- Saccomanno MF, Sircana G, Cazzato G, Donati F, Randelli P, Milano G. Prognostic Factors Influencing the Outcome of Rotator Cuff Repair: A Systematic Review. *Knee surgery, sports traumatology, arthroscopy: official journal of the ESSKA* 2016; 24(12): 3809–19.
- Sahni V, Narang AM. Review Article: Risk Factors for Poor Outcome Following Surgical Treatment for Rotator Cuff Tear. *Journal of orthopaedic surgery (Hong Kong)* 2016; 24(2): 265–68.
- Savoie FH 3rd, Zunkiewicz M, Field LD, Replogle WH, O'Brien MJ. A Comparison of Functional Outcomes in Patients Undergoing Revision Arthroscopic Repair of Massive Rotator Cuff Tears with and without Arthroscopic Suprascapular Nerve Release. *Open access journal of sports medicine* 2016; 7: 129–34.
- Sayampanathan AA, Andrew THC. Systematic Review on Risk Factors of Rotator Cuff Tears. *Journal of orthopaedic surgery (Hong Kong)* 2017; 25(1): 2309499016684318.
- Shim SB, Jeong JY, Yum TH, Yoo JC. A Comparative Study to Evaluate the Risk Factors for Medium-Sized Rotator Cuff Tear in Patients Younger Than 50 Years of Age. *Arthroscopy: the journal of arthroscopic & related surgery: official publication of the Arthroscopy Association of North America and the International Arthroscopy Association* 2018; 34(11): 2971–79.
- Sugaya H, Maeda K, Matsuki K, Moriishi J. Repair Integrity and Functional Outcome after Arthroscopic Double-Row Rotator Cuff Repair. A Prospective Outcome Study. *The Journal of bone and joint surgery. American volume* 2007; 89(5): 953–60.
- Tashjian RZ, Hollins AM, Kim H-M, Teefey SA, Middleton WD, Steger-May K, et al. Factors Affecting Healing Rates after Arthroscopic Double-Row Rotator Cuff Repair. *The American journal of sports medicine* 2010; 38(12): 2435–42.
- Tashjian RZ, Shin J, Broschinsky K, Yeh C-C, Martin B, Chalmers PN, et al. Minimal Clinically Important Differences in the American Shoulder and Elbow Surgeons, Simple Shoulder Test, and Visual Analog Scale Pain Scores after Arthroscopic Rotator Cuff Repair. *Journal of shoulder and elbow surgery.* 2020; 1058-2746(19):30797-9.
- Wang VM, Wang FC, McNickle AG, Friel NA, Yanke AB, Chubinskaya S, et al. Medial versus Lateral Supraspinatus Tendon Properties: Implications for Double-Row Rotator Cuff Repair. *The American journal of sports medicine* 2010; 38(12): 2456–63.
- Woollard JD, Bost JE, Piva SR, Kelley Fitzgerald G, Rodosky MW, Irrgang JJ. The Ability of Preoperative Factors to Predict Patient-Reported Disability Following Surgery for Rotator Cuff Pathology. *Disability and rehabilitation* 2017; 39(20): 2087–96.
- Xu S, Chen JY, Lie HME, Hao Y, Lie DTT. Minimal Clinically Important Difference of Oxford, Constant, and UCLA Shoulder Score for Arthroscopic Rotator Cuff Repair. *Journal of orthopaedics* 2020; 19: 21–27.