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The Effect of Body Mass Index to Functional Results After Arthroscopic Rotator Cuff Repair

Vücut Kitle İndeksinin Artroskopik Rotator Kılıf Cerrahisi Sonrası Fonksiyonel Sonuçlara Etkisi

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Abstract

INTRODUCTION: Rotator cuff tear is a common cause of shoulder pain and dysfunction. Many factors, including age, comorbidities, pre-operative muscle atrophy, and fatty degeneration, may affect functional outcomes after rotator cuff repair (RCR). The purpose of the study was to evaluate the effect of obesity on functional outcomes and complication rates after arthroscopic RCR.
METHODS: A total of 154 patients who underwent arthroscopic RCR between 2017 and 2019 were included in the study. Patients divided into two groups as non-obese (Group 1 [n=118], 76.6%, 56 females, 62 males) and obese (Group 2 [n=36], 23.4%, 25 females, 11 males). Constant-Murley Score (CS), American Shoulder and Elbow Surgeon's score (ASES), Visual analogue scale (VAS) score, and Short-Form 36 (SF-36) quality of life scale were used in the measurement of outcomes. Length of surgery, hospital stay, and complications were compared between the two groups (P=0.000).
RESULTS: Both pre-operative and postoperative CS, ASES, and SF-36 scores were significantly lower in the obese group (P=0.000). Also, the VAS score was higher in Group 2. The re-tear rate was significantly higher in obese group (27% vs. 4.2%, P=0.000). The duration of the surgery and hospital stay were significantly higher in the obese.
DISCUSSION AND CONCLUSION: Obese group have worse pre-operative and postoperative functional outcome scores and life quality measures when compared to non-obese patients. Also, re-tear rates are higher in obese patients.

Keywords: arthroscopic rotator cuff repair, obesity, BMI, outcomes

Öz

GİRİŞ ve AMAÇ: Rotator kılıf yırtığı omuz ağrısı ve kısıtlılığının sık görülen bir sebebidir. Yaş, ek hastalıklar, preoperatif kas atrofisi ve yağlı dejenerasyon gibi bir çok faktör rotator kılıf tamiri sonuçlarını etkileyebilmektedir. Çalışmanın amacı obezitenin artroskopik rotator kılıf tamiri yapılan hastalarda fonksiyonel sonuçlara ve komplikasyon sıklığına etkisini incelemektir.
YÖNTEM ve GEREÇLER: 217-2019 yılları arasında artroskopik rotator kılıf tamiri yapılan 154 hasta çalışmaya dahil edildi. Hastalar obez olmayan (Grup 1 [n=118], 76.6%, 56 kadın, 62 erkek) ve obez olan olarak iki gruba ayrıldı (Grup 2 [n=36], 23.4%, 25 kadın, 11 erkek). Sonuçları ölçmek için Constant Murley Skoru (CS), American Shoulder and Elbow Surgeon's (ASES) skoru, Visual analogue scale (VAS) skoru ve Short-Form 36 (SF-36) skoru kullanıldı. Cerrahi süresi, hastane yatış süresi ve komplikasyon sıklıkları her iki grup arasında karşılaştırıldı.
BULGULAR: Preoperatif ve postoperatif CS, ASES, SF-36 skorları obez grupta daha düşüktü ayrıca VAS skoru obez grupta anlamlı olarak daha yüksekti(P=0.000). Rerüptür oranı obez grupta daha yüksekti (27% vs. 4.2%, P=0.000). Cerrahi süre ve hastane yatışı obez grupta daha yüksekti (P=0.000).
TARTIŞMA ve SONUÇ: Obez gruptaki hastaların preoperatif ve postoperatif fonskiyonal sonuçları ve hayat kalitesi skorları obez olmayan hastalara göre anlamlı olarak düşük olarak görülmüştür. Ayrıca reruptur oranları obez grupta daha yüksektir.

Anahtar Kelimeler: artroskopik rotator kılıf tamiri, obezite, VKİ, sonuçlar

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INTRODUCTION

Rotator cuff tear (RCT) is a common cause of shoulder pain and loss of function (1). The prevalence of RCT increases with age (2). Surgical treatment is a well-accepted choice of treatment in full-thickness RCT when conservative treatment fails. The purpose of surgical treatment is re-insertion of the tendon over the footprint to allow the healing process and to reduce pain and improve the shoulder function. Among the surgical treatment options, arthroscopic rotator cuff repair (ARCR) has been accepted as the standard treatment method (3). However, functional results have been reported similar between arthroscopic and open RCR (4). The arthroscopic treatment provides less morbidity, less soft tissue damage, faster rehabilitation, and better cosmetic results.

In the literature, many studies investigated the factors that affect functional outcomes after ARCR. Age, Diabetes Mellitus, smoking, torn subscapularis, retraction of the supraspinatus, fatty infiltration, and dyslipidemia are associated with poor outcomes and higher failure rates after ARCR. Most of these factors are non-modifiable (5).

Obesity is a growing public health problem and is related to high mortality and morbidity (6). Obesity is frequent between the fourth and seventh decades (7), like many other degenerative orthopedic pathologies. It was previously shown that obesity causes poorer clinical outcomes after many orthopedic procedures (8, 9). Obesity also increases the risk of rotator cuff tendinitis and RCT (10).

Most of the RCTs have degenerative etiology (11). To obtain proper tendon-bone healing, local and systemic factors should be controlled to achieve healing. Obesity can disturb tendon to bone healing with the following mechanisms: decreased vasculature due to atherosclerosis and chronic inflammation due to elevated pro-inflammatory cytokines (12). Also, osteoporosis may increase the failure rate (13), and a heavier arm may cause more mechanical stress to the affected shoulder(14).

The effect of body mass index (BMI) on functional results and complication rates after ARCR also have been evaluated before, but results are conflicting. In a recent study, no difference in functional results between obese and non-obese patients was found after ARCR (15). However, some researchers reported poor outcomes in obese patients (14, 16).

The present study aims to evaluate the effect of BMI on the functional outcomes, pain, quality of life, and complication rates after ARCR.

METHODS

This retrospective study evaluated the patients who received ARCR between 2017 and 2019. Inclusion criteria were (1) failed conservative treatment for minimum of 3 months, including analgesics and physiotherapy which were chronic tears (2) full-thickness RCT, (3) older than 18 years old with a (4) minimum 12 months follow-up period, (5) Goutallier grade 1 or 2 tears. Patients with (1) concomitant shoulder pathologies such as symptomatic acromioclavicular arthritis, frozen shoulder, degenerative glenohumeral arthritis, (2) irreparable tears (Goutallier grade 3-4), (3) partial tears, (4) insufficient preoperative and postoperative data were excluded from the study. Also, patients with ipsilateral neurological deficits, inflammatory arthritis, previous shoulder surgery on the affected side, and acute traumatic tears were excluded from the study.

After exclusions, a total of 154 patients were included. The size of the tear was classified, according to Patte et al. (17). The duration of surgery was also recorded. We used BMI to define obesity, which is calculated by weight in kilograms divided by height in meters square. The patients were divided into two groups according to their BMI. Group 1 included patients with normal BMI, which is under 30 kg/m^2. Patients with <30 kg/m^2 were defined as 'obese' and included in Group 2 (18). Preoperative BMI was used for analysis. The Constant Score (CS) (19) and American Shoulder and Elbow Surgeons (ASES) score (20) were used in the measurement of functional outcomes. The Visual Analogue Scale (VAS) (21) was used in the measurement of pain, and the Short Form-36 (SF-36) (22) was used in the evaluation of the quality of life. The patients who have pain and restriction in shoulder motions despite physiotherapy in the postoperative 6^{th} month were sent to MRI, patients who have retears were recorded. The frozen shoulder was defined as limitation of both active and passive shoulder range of motion in all directions. The development of frozen shoulder and symptomatic retears compared between groups.

All procedures were performed in the beach chair position under general anesthesia by two experienced orthopedic surgeons. Biceps tenotomy was routinely performed before the cuff repairs. Subscapularis tendon repair was performed when needed. Single row or transosseous equivalent techniques were performed according to the tear size. Acromioplasty was performed in patients with radiologic impingement. A shoulder sling was used for the postoperative first four weeks. Passive pendulum exercises were started immediately after the surgery. Active shoulder movements were allowed after the sixth postoperative week. Strengthening exercises were restricted in the first three months.

Mean, median, frequencies, minimum, maximum, and standard deviation (SD) measures were used for descriptive analyses.The Shapiro-Wilk test was used for the evaluation of the distribution of variables. One-way ANOVA and Kruskal-Wallis tests were used to compare parameters between three groups. Paired samples t-test was used to compare dependent variables. Spearman correlation analyses were performed to assess the relation between BMI and functional results. A P-value < 0.05 was considered statistically significant. Statistical analyses were performed using IBM SPSS for Windows, version 22 (IBM corp., Armonk, NY).

Table 1. Patient Demographics (n=154)

Variable*	Mean ± SD-N (%)
Female/Male	81/73 (52.5% / 47.5%)
Age at the surgery (Year±SD)	62.68 ± 6.29
Follow-up (Months±SD)	15.6 ± 4.8
BMI (kg/m^2±SD)	27.58 ± 2.55
Obesity (Yes/No)	36/118 (23.4% / 76.6%)
Tear Size	
Large	40 (25.9%)
Medium	82 (53.2%)
Small	32 (20.7%)

*BMI, body mass index; SD, standard deviation. * Continuous data are presented as mean ±SD; categoric data as the number and percentages.*

RESULTS

Group 1 included 118 patients (76.6%, 56 female and 62 male patients) and Group 2 included 36 patients (23.4%, 25 female and 11 male patients). Patient demographics were shown in Table 1. The duration of the surgery was higher in group 2 than group 1 (71.69 ± 12.93 min. and 83.59±15.55 min. respectively, P=0.000). In group 2, the frequency of large-size cuff tear was significantly higher than in group 1 (38.8%, 15.2%, respectively, P=0.000). Preoperative outcome scores were significantly improved (p=0.000). Both preoperative and postoperative shoulder scores were better in group 1. A comparison between preoperative and postoperative functional results and life quality measures are shown in Table 2. Postoperative complication rates, length of surgery, and hospital stay are shown in Table 3. The was a significant negative correlation between BMI and functional results and a positive correlation between BMI and pain scores, as shown in Table 4.

DISCUSSION

The primary findings of this study were that obese patients had significantly worse preoperative and postoperative functional results and higher retear rates compared to non-obese patients. The duration of surgery and length of hospital stay were significantly higher in obese patients.

Kessler et al. analyzed 213 patients who received ARCR, and they found no difference in functional shoulder scores and complication rates between obese and non-obese patients after three years of follow-up (15). Ateschrang et al. analyzed

Table 2. Comparison of functional scores and life quality measures between two groups

	Group 1 (Mean ± SD)	Group 2 (Mean ± SD)	P
ASES (Preoperative)	43.89 ± 6.03	37.28 ± 7.42	<0.001
ASES (Postoperative)	81.94 ± 5.51	64.11 ± 15.11	<0.001
CS (Preoperative)	42.14 ± 5.38	39.30 ± 5.23	0.020
CS (Postoperative)	81.54 ± 5.97	63.50 ± 13.85	<0.001
VAS (Preoperative)	6.06 ± 0.81	6.63 ± 0.82	<0.001
VAS (Postoperative)	1.58 ± 0.87	3.54 ± 1.69	<0.001
Short-form 36			
Physical function (Preoperative)	60.45 ± 7.94	56.74 ± 9.50	0.090
Physical function (Postoperative)	87.86 ± 7.55	74.78 ± 12.77	<0.001
Physical role(Preoperative)	18.51 ± 16.61	20.76 ± 17.91	0.420
Physical role(Postoperative)	77.44 ± 13.02	65.76 ± 18.52	<0.001
Pain (Preoperative)	24.95 ± 7.88	18.15 ± 13.07	<0.001
Pain (Postoperative)	80.81 ± 13.09	56.46 ± 26.98	<0.001
General health (Preoperative)	30.49 ± 11.98	23.04 ± 14.85	<0.001
General health (Postoperative)	80.91 ± 9.92	61.30 ± 20.42	<0.001
Vitality (Preoperative)	29.55 ± 11.45	32.39 ± 9.17	0.120
Vitality (Postoperative)	78.96 ± 9.86	63.48 ± 18.16	<0.001
Social function (Preoperative)	29.30 ± 9.84	25.57 ± 10.97	0.020
Social function (Postoperative)	75.81 ± 9.97	63.59 ± 16.80	<0.001
Emotional role (Preoperative)	35.79 ± 10.76	27.04 ± 12.54	<0.001
Emotional role (Postoperative)	72.44 ± 11.66	52.78 ± 22.54	<0.001
Mental health (Preoperative)	45.10 ± 27.09	24.39 ± 20.20	<0.001
Mental health (Postoperative	90.29 ± 15.41	74.28 ± 22.62	<0.001

ASES: American Shoulder and Elbow Surgeon's Score, CS: Constant Score, VAS: Visual Analogue Scale Score

Table 3. Comparison of complication rates, length of the surgery and hospital stay between two groups

	Group 1 Mean ± SD- n (%)	Group 2 Mean ± SD- n (%)	P
Frozen shoulder	3 (2.5%)	9 (25%)	<0.001
Symptomatic re-rupture	5 (4.2%)	10 (27%)	<0.001
Lenght of the surgery (min)	71.69 ± 12.93	83.59 ± 15.55	<0.001
Lenght of hospiral stay (day)	1.09 ± 0.28	1.30 ± 0.46	<0.001

Table 4. Correlation between BMI and functional results

	BMI r	P value
Preoperative ASES	-0.406	<0.001
Postoperative ASES	-0.715	<0.001
Preoperative CS	-0.224	0.010
Postoperative CS	-0.686	<0.001
Preoperative VAS	0.236	0.010
Postoperative VAS	0.586	<0.001

r: Spearman Correlation efficient, ASES: American Shoulder and Elbow Surgeon's Score, CS: Constant Score, VAS: Visual Analogue Scale Score

146 patients with a minimum of two years follow-up after either arthroscopic or mini-open RCR. In their study, patients were divided into three groups according to their BMI. There was no difference between average and pre-obese patients (25<BMI<30), although functional results were worse, and retear rates were higher in obese patients (14). Our findings were consistent with the literature, the retear rate in the obese group was found to be 27% which was significantly higher than the non-obese group.

Berglund et al. analyzed the factors affecting the speed of recovery (SOR) after ARCR (23). In their population, preoperative Simple Shoulder Test and Vas scores were worse in obese patients. Also, external rotation was more limited in the obese group. This finding was consistent with our study. Preoperative CS and ASES scores were found significantly lower in obese patients. Also, VAS and SF-36 scores were worse in the obese group compared to non-obese patients. Besides, the 'large size' tear rate was high in obese patients. This can explain the preoperative difference between the two groups. Berglund et al. also found a higher ASES score at the 12-month follow-up in non-obese patients, and ROM measures plateaued earlier (sixth postoperative month) in the obese population (23).

In their prospective study, Fermont et al. evaluated obesity, fatty infiltration, cuff retraction, and preoperative ROM factors as possible prognostic factors affecting recovery after ARCR. They found no relationship between these factors and functional outcomes, and they concluded that patient selection is more critical to obtain successful results (24).

Previous studies showed that obesity increases the rate of rotator cuff pathologies (25). In a recent systematic review, Macchi et al. concluded that obesity increases the risk of rotator cuff tendinopathy and RCT. Also, they reported that the risk of complications after RCR was higher in obese patients (26).

For the rotator cuff tears, the purpose of the surgical treatment is to re-attach the torn tendon over the footprint. The inflammatory phase takes place in the early stages of the healing after re-insertion of the tendon. Obesity may alter the physiologic inflammatory phase by increasing pro-inflammatory cytokines and oxidative stress (25, 27). Obesity and type 2 diabetes impairs neo-angiogenesis, which is crucial in the healing process (28). At the cellular level, these mechanisms may cause less favorable results in obese patients after RCR, but clinical results are found similar (15, 24). Significantly higher retear rates in obese patients may be attributed to the negative effects on the healing process. Further prospective studies are needed to evaluate the relation between BMI and long-term functional results after RCR.

William et al. found longer operative time and hospital stay in obese patients after RCR compared to non-obese patients (16). Our findings support William et al.; we found longer operation time and hospital stay in the obese group. Longer operation time may increase the risk of anesthetics-related complications, and more extended hospital stay may cause hospital infection and increase the cost of treatment.

This study has some limitations. Retrospective design and relatively short follow-up periods decrease the quality of evidence. Also, obese patients consisted of 23.4% of the population, which was less than similar studies (15). Also, we did not stratify the obese patients because of the small sample size, and overweight patients were considered as normal. Postoperative magnetic resonance imaging was performed only in patients without expected clinical improvement so that we may have missed some asymptomatic retears. Large tears were more frequent in obese patients, which may have caused lower outcomes, but we did not consider that finding a bias because it was previously shown that large tears are more frequent in obese patients (25).

In conclusion, obese patients have worse preoperative and postoperative functional scores, and life quality measures compared to non-obese patients. Also, retear rates are higher in obese patients. Since obesity is a modifiable risk factor, it should be controlled preoperatively.

Ethics Committee Approval: Ethical approval was obtained before starting the study (2020-06/32)
Conflict of Interest: All authors declare that, they have nı conflict of interest
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