

The Relationship Between Fatigue and Functionality in Rotator Cuff Tears

Rotatör Manşet Yırtıklarında Yorgunluk ve Fonksiyonellik Arasındaki İlişki

 Onur Bilge¹,  Emine Cihan²,  Cansu Şahbaz Pirinççi³,  Muhammed Arca⁴,  Elif Dilara Durmaz⁵

¹Necmettin Erbakan University, Meram Faculty of Medicine, Department of Orthopaedics and Traumatology, Konya, Turkey

²Selcuk University, Vocational School of Health Sciences, Physiotherapy Program, Department of Therapy and Rehabilitation, Konya, Turkey

³Ankara City Hospital, Ankara, Turkey

⁴University of Health Sciences, Diyarbakır Gazi Yaşargil Training and Research Hospital, Diyarbakır, Turkey

⁵Karaman City Hospital, Karaman, Turkey

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Sorumlu Yazar/Corresponding Author:

Emine Cihan,

Selcuk University, Vocational School of Health Sciences, Physiotherapy Program, Department of Therapy and Rehabilitation, Konya, Turkey

e mail: pteminecihan@gmail.com

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ÖZET

Amaç: Rotatör manşet yırtığı, omuz ağrısına neden olan faktörlerin başında gelen en yaygın kas-iskelet sistemi bozukluklarından biridir. Bu çalışma rotatör manşet yırtıklarında yorgunluğun omuz fonksiyonelliği üzerine etkisini incelemek için yapılmıştır.

Gereçler ve Yöntem: Çalışmaya rotatör manşet yırtığı olan, 18-65 yaş aralığındaki 52 hasta dahil edildi. Omuza ait yorgunluğu Görsel Analog Skalası ile sorgulandı. Omuz fonksiyonelliği Basit Omuz Testi (BOT) ile değerlendirildi. Değişkenlerin normal dağılıma uygunluğu analitik (Kolmogorov-Smirnov testi) ve görsel (histogram ve olasılık grafikleri) yöntemlerle elde edildi.

Bulgular: Katılımcıların %31'i erkek % 69'u kadın olup yaş ortalaması 51,59±10,66 yıl olarak hesaplandı. Yorgunluk ile BOT'un ağrı (r:-0,413, p:0,002) ve kuvvet (r:-0,435, p:0,001) alt parametreleri arasında orta seviye negatif yönlü ilişki elde edilirken günlük yaşam aktivitesi (r:-0,352, p:0,010) ile toplam BOT skoru (r:-0,275, p:0,048) arasında zayıf ve negatif yönlü ilişki saptandı.

Sonuç: Rotatör manşet yırtığı olan hastalarda omuz yorgunluğu ve farklı omuz fonksiyonları arasında ilişki bulunmuştur

Anahtar Kelimeler: Rotatör manşet yırtığı, yorgunluk, fonksiyonellik, rehabilitasyon, omuz yaralanmaları

ABSTRACT

Aim: Rotator cuff tear is one of the most common musculoskeletal disorders leading to shoulder pain. This study was conducted to examine the effect of fatigue on shoulder functionality in rotator cuff tears.

Materials and Methods: Fifty-two patients, aged between 18-65 years, with rotator cuff tears were included in the study. Shoulder fatigue was questioned using the Visual Analog Scale. Shoulder functionality was assessed with the Simple Shoulder Test (SST). The conformity of the variables to the normal distribution was obtained by analytical (Kolmogorov Smirnov test) and visual (histogram and probability graphs) methods.

Results: 31% of the participants are men and 69% are women, and the average age was calculated as 51.59 ± 10.66 years. A moderate negative correlation was obtained between fatigue and SST's pain (r: -0.413, p: 0.002) and strength (r: -0.435, p: 0.001) sub-parameters, while a weak and negative correlation was found between daily living activities (r: -0.352, p: 0.010) and total SST score (r: -0.275, p: 0.048).

Conclusion: A relationship was found between shoulder fatigue seen in patients with rotator cuff tears and altered shoulder functions

Key words: Rotator cuff tear, fatigue, functionality, rehabilitation, shoulder injuries



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INTRODUCTION

Rotator cuff tear, which is one of the leading factors causing shoulder pain, is one of the most common musculoskeletal disorders (1). The prevalence of rotator cuff tears increases with age due to intrinsic and extrinsic reasons specific to the individual. Partial and full thickness ruptures, in particular, begin at the age of 40, and their incidence increases by 50% at the age of 60 (2). The rotator cuff consists of supraspinatus, infraspinatus, teres minor and subscapularis quadruple muscles and plays an active role in maintaining the functionality of the shoulder joint. Clinical findings of rotator cuff tears are shoulder pain, muscle weakness, severe fatigue, inability in overhead activities, loss of active movement and secondary symptoms related to these problems (3).

Rotator cuff muscles, which provide shoulder stability, may be particularly vulnerable to fatigue during repetitive shoulder movements. It is assumed that the upper extremity kinematics changes in individuals with shoulder fatigue and the risk of shoulder diseases related to this fatigue increases (4). Following rotator cuff fatigue, it has been observed that the humeral head continuously moves upwards and reduces the subacromial space (5). Subacromial space was narrowed in 50% of the participants who underwent a fatigue protocol consisting of 60° to 120° repeated shoulder abduction movement in the prone position with additional weight in their hands to fatigue the rotator cuff and scapular stabilizing muscles (6).

Muscle fatigue should not be ignored in terms of patient follow-up and knowledge of the healthcare team working with a multidisciplinary approach, deciding on the size of the surgery, reconstruction goals, and functional and clinical results to be achieved with physiotherapy (7). There are very few studies in the literature examining the effect of fatigue on shoulder functionality in rotator cuff tears, and no consensus has been reached on the time of inclusion in rehabilitation. Therefore, the aim of our study is to examine the fatigue after rotator cuff tear and the relationship between this fatigue and shoulder functionality.

MATERIALS AND METHODS

The study was carried out in the Necmettin Erbakan University, Meram Faculty of Medicine Hospital, Ankara City Hospital, University of Health Sciences Gazi Yaşargil Training and Research Hospital and Karaman City Hospital in the departments of Orthopaedics and Traumatology and Physiotherapy and Rehabilitation, between the dates 7th May to 31st May 2021, taking into account the Declaration of Helsinki. Ethical approval was obtained from Necmettin Erbakan University Meram Medical Faculty Medicine and Non-Medical Device Research Ethics Committee. Before starting the study, all participants were informed about the

study and their consents were obtained.

Participants

Volunteers with rotator cuff tears and without perception-response problems between the ages of 18-65 were included in the study. Patients who did not have a gross tear and did not undergo surgery and were referred to physical therapy were included. Those who did not want to volunteer, had mental retardation, had neuropathic pain, cancer pain, had other shoulder pathologies, rheumatic diseases, and had functional or neuromuscular deficits, and intractable pain irresponsive to previous conservative treatment modalities were excluded from the study. 60 people were interviewed for the study. 8 individuals were excluded from the study because 3 of them had other shoulder pathologies, 2 individuals had rheumatic disease, and 3 patients had neuropathic pain. The study was completed with 52 individuals, who were suitable with the aforementioned inclusion criteria. Post hoc power of this study was determined by G*Power (Version 3.0.10; Franz Foul, Universitat Kiel, Germany) and it calculated %94.30 with a $\alpha=0.05$ type I error and 0.413 effect size.

Evaluation Methods

The physical and sociodemographic characteristics (age, height, weight, BMI, gender) of the patients were recorded. Shoulder fatigue was questioned using the Visual Analogue Scale. This scale consists of a 10 cm line. "0" means not fatigue, "10" means extreme fatigue. The participant was asked to mark his level of fatigue on the line. Fatigue was determined with the help of a ruler with the "0" point as the beginning and the value obtained was recorded in cm (8).

The shoulder functionality was evaluated with the Simple Shoulder Test (SST), whose Turkish validity and reliability was conducted by Ayhan et al. This test consists of 12 questions and the answers are yes or no. The questionnaire includes pain, daily living activity, strength sub-parameters. The total score is between 0 and 12, and high scores indicate good functionality (9).

Statistical Analysis

IBM SPSS Statistics 20.0 (IBM Corp. Released 2012. IBM SPSS Statistics for Windows, Version 20.0. Armonk, NY: IBM Corp.) was used for statistical analysis and calculations. The conformity of the variables to normal distribution was examined using analytical (Kolmogorov-Smirnov test) and visual (histogram and probability graphics) methods. Descriptive analyzes were given using mean and standard deviation for normally distributed variables and number (%) values for ordinal variables. The relationship between fatigue and SST was evaluated using Spearman's correlation analysis. Correlation coefficients was classified as weak ($r = 0.20-0.39$), medium ($r = 0.40-0.69$), high ($r = 0.70-0.89$), very high ($r > 0.90$) (10). Significance level was accepted as $p < 0.05$.

Table 1. Physical and demographic characteristics of the participants

| Parameters | Participants | |
|--------------------------------|--------------|----------|
| Age (year, X±SD) | 51,59±10,66 | |
| Height (cm) | 163,78±7,85 | |
| Weight (kg) | 71,63±12,37 | |
| BMI (kg/m ² , X±SD) | 26,71±4,44 | |
| Gender | n | % |
| Female | 36 | 69,2 |
| Male | 16 | 30,8 |

X:Average, SD:Standard Deviation, cm:centimeter, kg: kilogram, n: Number of participants,%:Percent

Table 2. Averages of the parameters evaluated.

| Parameters | X±SD |
|-------------------------|-----------|
| Fatigue | 7,03±2,89 |
| Simple Shoulder Test | |
| Pain | 0,88±0,67 |
| Daily Living Activities | 2,26±2,89 |
| Strength | 0,96±1,13 |
| Total Score | 4,11±4,30 |

X: Average, SD:Standard Deviation, p<0.05

Table 3. Relationship between fatigue and shoulder functionality

| Fatigue | r | p |
|-----------------------|--------|-------|
| Simple Shoulder Test | | |
| Pain | -0,413 | 0,002 |
| Daily Living Activity | -0,352 | 0,010 |
| Strength | -0,435 | 0,001 |
| Total Score | -0,275 | 0,048 |

r: Correlation coefficient, p<0.05

RESULTS

The study was completed with 52 participants (age: 51.59 ± 10.66 years, BMI: 26.71 ± 4.44). 31% of the participants were men and 69% were women. Physical and sociodemographic characteristics are shown in Table 1.

The fatigue level of the participants was found to be 7.03 ± 2.89. It was found that pain was 0.88 ± 0.67, daily living activity was 2.26 ± 2.89, strength 0.96 ± 1.13, and total score was 4.11 ± 4.30 in Simple Shoulder Test. Fatigue and SST scores are shown in Table 2.

A moderate negative correlation was obtained between fatigue and SST's pain (r: -0.413, p: 0.002) and strength (r: -0.435, p: 0.001) sub-parameters, while a weak and negative correlation was found between daily living activity (r: -0.352, p: 0.010) and the total SST score (r: -0.275, p: 0.048). The relationship between fatigue and SST is shown in Table 3.

DISCUSSION

As the most important result of the study, a relationship was found between shoulder fatigue and shoulder functions in individuals with rotator cuff tears. The prevalence was higher in women. When shoulder injuries were investigated by including gender factor, repetitive injuries, prevalence and frequency of surgery were higher in women (11). The rate of women applying to our clinic is higher than the rate of men.

Adaptive changes in vascular endothelial growth factor and dystrophy, along with rotator cuff tears, decreased vascular circulation accompanied by atrophy after tendon rupture are seen as the cause of fatigue. Fatigue seen for these reasons can also affect muscle strength (12). In a study by Chopp et al., a decrease in the strength of each rotator cuff muscle was observed due to fatigue (10). Our results are similar to the literature, and it was concluded that fatigue is related to muscle strength. Rotator cuff muscles are dynamic shoulder stabilizers that show varying degrees of activity. In their injuries, shoulder and upper extremity kinematics are negatively affected and their functions are impaired (13). In the EMG study by Mulla et al., it was shown that the fatigue created in the shoulder plays a predisposing role in injury and affects function. The muscle that was tired in the study had difficulty working at full angle and completing the activity (14). In our study, it was observed that fatigue negatively affected daily living activities. Rotator cuff muscles are insufficient to provide shoulder stability due to fatigue and the continuity of activities cannot be ensured.

The pain that occurs in shoulder activities, regardless of the localization of the injury, negatively affects the patient and causes the activity level to decrease to a minimum by causing muscle weakness (15). The resulting pain is related not only to inadequate movements but also to fatigue. Cuff muscles with increased fatigue become more sensitive. There are studies arguing that this situation increases the effects of perceived pathology by lowering the pain threshold (16). In our study, we found that fatigue is inversely related to pain. The reason for this situation may be decreased afferent transmission due to fatigue. This clinical finding was concordant with the finding in the study of Mastaglia L. as the nerve cell suppressed due to fatigue may have decreased the perception of pain (17).

As a result, a relationship was found between shoulder fatigue seen in patients with rotator cuff tears and altered shoulder functions. In addition, the prevalence of rotator cuff tears is higher in women. Fatigue management should be taught to patients in rehabilitation of this injury, which will not go to surgery after the initial diagnosis, and it should be noted that it may affect shoulder functions.

Our study has some limitations. Firstly, this is a correlation study and only the relationship was examined. Another limitation of our study is that fatigue cannot be evaluated

objectively. Lastly, the sample size is relatively low. Studies with larger sample sizes are needed.

In conclusion, in future studies, we recommend adding parameters such as muscle strength and shortness, muscle endurance, which are thought to affect fatigue and shoulder functionality. Considering the fatigue in the rotator cuff muscles provides a deeper look in the assessment, which can be applied to improvements in shoulder injury prevention and rehabilitation programs.

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Sorumlu Yazar: Emine Cihan, Selcuk University, Vocational School of Health Sciences, Physiotherapy Program, Department of Therapy and Rehabilitation, Konya, Turkey
e-mail: pteminecihan@gmail.com

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