Knee Surg Sports Traumatol Arthrosc (2017) 25:2109–2113
DOI 10.1007/s00167-016-4228-5

SHOULDER

Preoperative and post-operative sleep quality evaluation in rotator cuff tear patients

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Received: 11 January 2016 / Accepted: 21 June 2016 / Published online: 11 July 2016

Abstract
Purpose The aim of this study was to examine the potential relationship between subjective sleep quality and degree of pain in patients with rotator cuff repair.
Methods Thirty-one patients who underwent rotator cuff repair prospectively completed the Pittsburgh Sleep Quality Index, the Western Ontario Rotator Cuff Index, and the Constant and Murley shoulder scores before surgery and at 6 months after surgery. Preoperative demographic, clinical, and radiologic parameters were also evaluated.
Results The study analysed 31 patients with a median age of 61 years. There was a significant difference preoperatively versus post-operatively in terms of all PSQI global scores and subdivisions ($p < 0.001$). A statistically significant improvement was determined by the Western Ontario Rotator Cuff Scale and the Constant and Murley shoulder scores ($p < 0.001$).
Conclusion Sleep disorders are commonly seen in patients with rotator cuff tear, and after repair, there is an increase in the quality of sleep with a parallel improvement in shoulder functions. However, no statistically significant correlation was determined between arthroscopic procedures and the size of the tear and sleep quality. It is suggested that rotator cuff tear repair improves the quality of sleep and the quality of life.

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Level of evidence IV.

Keywords Rotator cuff · Shoulder · Arthroscopy · Rotator cuff repair · Sleep quality

Introduction

Rotator cuff tear is a common condition causing pain and functional incapacity such as shoulder weakness and limited movement [6]. In some cases, rotator cuff tears become irreparable; however, both surgical and arthroscopic methods were reported to improve quality of life significantly [9]. Moreover, sonoelastography is a feasible method for application in the assessment of tendon quality in small supraspinatus tears [18].

The most important complaint of patients is increasing night-time pain and disrupted sleep. Painful conditions often disrupt sleep and, in advanced stages, may even have a negative effect on daily activities. Shoulder pathologies have been shown to be related to night pain, insomnia, and lack of sleep due to pain in the affected side [17, 19, 20, 21]. In most of these patients, the decision for surgery is made when sleep problems are added to complaints which started with the loss of joint function [15]. It has been well established that production of human growth hormone and sleep are closely associated; thus, healthy sleep also plays a critical role in the post-operative healing process [19]. Therefore, improvement of sleep quality in patients with rotator cuff tear may be regarded as a significant factor for healing along with surgical intervention.

There is limited information available on the relationship between rotator cuff repair and sleep disorder as there are few studies dedicated to the subject in the existing literature [1, 16]. Among these studies, Austin et al. investigated

sleep problems in patients with rotator cuff tear, screening patients with the Pittsburgh Sleep Quality Index (PSQI) at intervals of 2, 6, 12, and 24 weeks. Subjects reported that sleep disturbance was mitigated after rotator cuff repair via arthroscopic intervention. The researchers concluded that sleep problems were significantly alleviated by arthroscopic intervention. They also concluded that preoperative and post-operative narcotic pain medication application would disturb the sleep of patients with rotator cuff tear [1]. Austin et al.'s research is the only study that investigated the association between mitigation of sleep disturbance and rotator cuff repair.

As mentioned above, there has been only one study that investigated the effects of rotator cuff repair on sleep disturbance. For the purposes of the present study, we excluded patients who had been treated with sleep-affecting narcotics. Thus, it should be able to observe the direct effects of rotator cuff repair on sleep disturbance. It is firstly aimed to demonstrate the effects of cuff repair on sleep disturbance. Secondly, it is purposed to demonstrate the existence of any correlation between the size of rotator cuff tear and sleep disturbance.

Materials and methods

Rotator cuff repair was applied to 65 patients in the Orthopaedics and Traumatology Clinic between 2014 and 2015. The patient information was recorded prospectively. The inclusion criteria were (1) full layer cuff tear with arthroscopic repair and (2) having been treated with either nonsteroidal anti-inflammatory drugs or physiotherapy at least 3 months before surgical intervention. Patients were excluded if the tear could not be repaired, if revision surgery was applied, or if open rotator cuff repair was applied. Also excluded were those with severe glenohumeral arthritis, adhesive capsulitis, sleep apnoea disorder, neuropsychiatric disease, those taking medication because of a sleep disorder, and those with follow-up shorter than 6 months.

Patients excluded from the study for the reasons mentioned above were as follows: the tear could not be repaired (five cases); revision surgery was applied (one case); open rotator cuff repair was applied (seven cases); severe glenohumeral arthritis (three cases); sleep apnoea disorder (five cases); neuropsychiatric disease (six cases); and sleep medication use (seven cases). Thirty-one patients met the inclusion criteria and were therefore included in the study (Fig. 1). All patients completed the Pittsburgh Sleep Quality Index (PSQI) preoperatively and at 6 months postoperatively. In addition, the patients were assessed preoperatively and post-operatively via the Western Ontario Rotator Cuff Index and the Constant and Murley shoulder scores. All patients were evaluated neuropsychiatrically by a neurology specialist, and any patients determined to have neurological or psychiatric pathology were excluded from the study. Demographic characteristics of age, gender, body mass index, affected side, duration of complaints, and nicotine use were recorded for each patient.

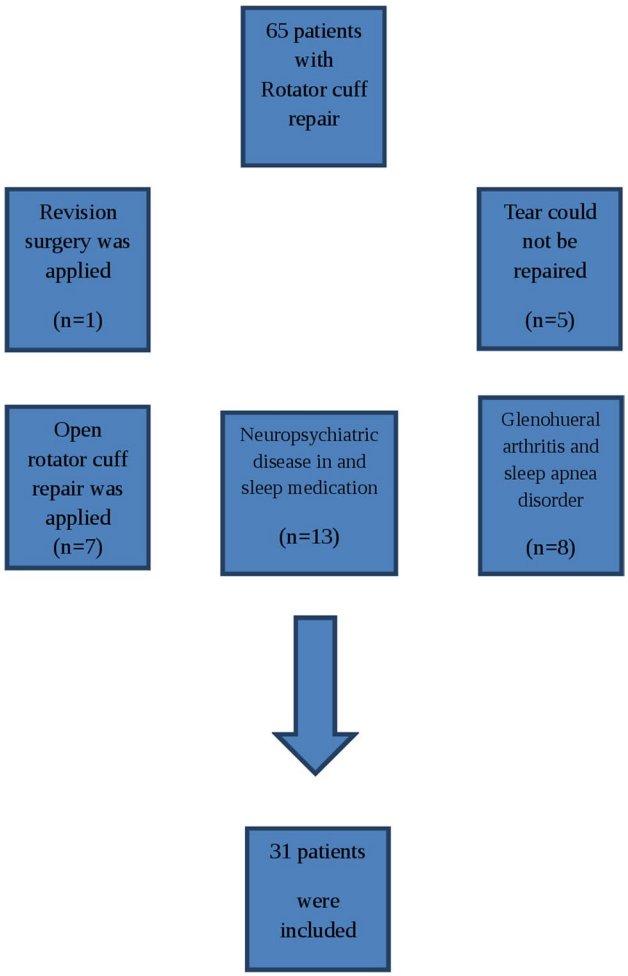

Fig. 1 Flow diagram of exclusion criteria

All the arthroscopic rotator cuff repairs were applied by the same orthopaedic surgeon, trained in shoulder surgery and with 8 years of experience, and the same surgical team. Post-operatively, the size of rotator cuff tear (small <1 cm, medium 1–3 cm, large 3–5 cm, massive >5 cm), the number of stabilizing sutures, biceps tenotomy, subacromial decompression, whether or not distal clavicular excision was applied, and intraoperative complications were recorded.

Interscalene block and post-operative pain control

Interscalene block was performed on all patients under ultrasound (Esaote, Mylab Five, Italy) guidance with a 5- to 10-MHz linear probe preoperatively. A total of 30 ml

local anaesthetic was administered as 20 ml 0.5 % bupivacaine and 10 ml 2 % lidocaine. In the first 2 days, additional analgesia was provided when required via dexketoprofen (50 mg at six-hour intervals). The same treatment protocol for pain control was applied to all patients. After discharge from the hospital, dexketoprofen 3 × 50 mg was administered. For patients who required further pain relief, etofenamate 2 × 500 mg was given. No patient required post-operative opioids .

Post-operative rehabilitation

In the early post-operative period, pendulum exercises were started as far as tolerable in all patients. The same post-operative rehabilitation protocol was followed for all patients, including a six-week period of immobilization with a shoulder sling. Passive limited movements were started in the 6th week and active movements in the 8th week. In the 3rd month, progressive resistance exercises limited to one kilogram were allowed. The weight restriction progressed to two kilograms in the 4th and 5th months. After 6 months, all the patients were permitted full free movement.

Sleep quality evaluation

Sleep quality was evaluated with the PSQI, which has been tested for reliability and validity. The PSQI consists of 19 questions to be answered by the patient, with each one scored from 0 to 3, with 0 representing absolutely no problem and 3 the worst sleep quality. These 19 questions are separated into seven sub-categories: sleep quality, sleep latency, duration of sleep, habitual sleep efficiency, sleep disorder, use of medication for sleep, and daytime functional disorder. The total of these seven sub-categories provides the global PSQI score. As the score increases from 0 to 21, it indicates a worsening in the quality of sleep. A total score of >5 indicates poor sleep [4].

Western Ontario Rotator Cuff Index (WORC)

The WORC is a 21-item scale which evaluates the impact of rotator cuff pathology on "quality of life". Subjects answer each question on a 100-mm visual analog scale, and the higher numbers demonstrate a higher degree of pain or difficulty. The questions in each of the theoretical domains are presented together. The WORC total is obtained by adding the scores on all the items [12].

Constant and Murley Shoulder Score (CSS)

Constant and Murley created the CSS in 1987. It is a 100-point scoring system in which 35 points are reported directly from the patient's declaration of pain and function. The remaining 65 points are allocated from measurement of range of motion and strength. The patient can complete the self-report section of the CSS in approximately 5 min, and the clinician can complete the range of motion and strength portion in approximately 10 min. This scale has been used internationally for reporting outcomes for various shoulder conditions [7].

The Local Ethics Committee of the University of Kırıkkale approved this study (IRB Number: 18/07), and written informed consent was obtained from all the patients. This study conforms to the Declaration of Helsinki and subsequent modifications.

Statistical analysis

Statistical analysis was applied using SPSS v.15.0 software (SPSS Inc., Chicago, USA). A confidence interval (CI) of 95 % and a two-tailed $p < 0.05$ were determined to be statistically significant for all of the analyses. The numerical data were analysed with the Shapiro–Wilk test in terms of assessing whether data were parametric. Because the numeric data were not parametric, the Mann–Whitney U test was used for comparison. The comparisons of PSQI before and after surgery were analysed with the Wilcoxon test. The numerical data were expressed with medians, minimum and maximum values, and numbers, while categorical data were expressed as numbers and percentages. In Austin et al.'s study, the median PSQI score was 11.58, and 56 patients were included. Referencing from this study, the median value of PSQI was found to be 15.00 in the present study, and including 31 patients gave a result of 81 % power ($\alpha = 0.05$).

Results

The study included a total of 31 patients comprising 22 females and 9 males with a median age of 61 (26–75) years. Demographic data are shown in Table 1. The mean PSQI score was determined as 15 (7–17) preoperatively and 6 (3–10) post-operatively ($p < 0.001$) (Table 2). Sleep quality was determined not to have recovered to a sufficient

Table 1 Demographic data (*n*:31)

Gender: male/female	9/22
Age mean (range) (years)	61 (26–75)
Body mass index median (range) (kg/m^2)	28 (22–35)
Smoker	4
Operated side: right/left	18/13
Mean duration of complaints (months)	6.7

Table 2 Preoperative and post-operative PSQI scores

	Preop	Postop	*P* value
PSQI	15 (7–17)	6 (3–10)	$P < 0.0001$
Sleep quality	2 (1–3)	1 (0–2)	$P < 0.0001$
Sleep latency	3 (1–3)	1.57 ± 0.5	$P < 0.0001$
Sleep duration	2 (0–3)	0 (0–2)	$P < 0.0001$
Habitual sleep efficiency	2 (1–3)	1 (0–2)	$P < 0.0001$
Sleep disturbance	2 (1–3)	1 (1–2)	$P < 0.0001$
Daytime dysfunction	2 (1–3)	1 (0–2)	$P < 0.0001$

Table 3 Shoulder scores

	Preop	Postop	*P* value
Western Ontario Rotator Cuff Scale	80 (54–98)	36 (24–49)	$P < 0.0001$
Constant and Murley shoulder score	46 (36–74)	78 (62–90)	$P < 0.0001$

level by the 6th month in 18 (58 %) patients. A statistically significant improvement was determined in the sleep quality sub-categories of sleep quality, sleep latency, duration of sleep, habitual sleep efficiency, sleep disorder, and daytime functional disorder (Table 2).

The mean score of the Western Ontario Rotator Cuff Scale [9] was determined as 80 (54–98) preoperatively and 36 (24–49) post-operatively ($p < 0.001$). The mean Constant and Murley shoulder score [10] was determined as 46 (36–74) preoperatively and 78 (62–90) post-operatively ($p < 0.001$). A statistically significant improvement was determined in the shoulder scores (Table 3).

The difference in patient gender, the severity of the rotator cuff tear, use of tobacco and alcohol, acromioclavicular osteoarthritis, the operated side, the size of rotator cuff tear, the number of stabilizing sutures, biceps tenotomy, subacromial decompression, and the application of distal clavicular excision were determined not to have had any statistically significant effect on the PSQI sleep evaluation or the shoulder scores (n.s.).

Discussion

The most important result of the present study was demonstrating the mitigation of sleep disturbance in patients with rotator cuff tear who were not exposed to narcotics after rotator cuff repair. Although patients with rotator cuff tear often have complaints of sleep disorders, to the best of our knowledge, there are few studies on this subject in the existing literature [1, 16]. The reasons for an increasing PSQI score and increasing nocturnal pain in shoulder diseases are not yet known [10]. However, synovial inflammation in the subacromial area and glenohumeral joint is a common histological feature of shoulder disorders [11]. Rotator cuff repair provides a significant reduction in pain and an increase in functional capacity [2, 9, 15]. In epidemiological studies, there has been shown to be a wide range of sleep disorders in 15–35 % of the general population, while sleep disorders in the patient population with symptomatic rotator cuff tear are seen more widely than in the general population [3, 4, 14]. In the current study, all the patients had sleep disorders. Despite a general improvement in sleep quality following rotator cuff repair, sleep disorders were seen to continue in the post-operative 6th month in 58 % of the patients (PSQI > 5).

In a study of sleep quality by Austin et al. [1], preoperative narcotic use and prolonged post-operative narcotic use were reported to be factors worsening the quality of sleep. Cronin et al. [8] evaluated the effects of morphine use on sleep patterns and reported that morphine use increased wakefulness and inhibited REM sleep. Mahfoud et al. [13] conducted an evaluation of sleep disorders in those with substance abuse, including narcotic addiction. Sleep disorders were reported in 96 % of those with substance abuse. As narcotic (opioids) use, insomnia, and neuropsychiatric diseases are known to cause sleep disorders, patients with these problems were excluded from the study. Thus, the effects of these were removed from the study as reasons for sleep disorder potentially related to rotator cuff tear, thereby increasing the power of the study.

In a study by Cho et al. [5], the PSQI score was determined as 6.6 ± 3.6 preoperatively and 4.2 ± 3.3 at the 6th month post-operatively. It was reported that successful rotator cuff repair could improve psychological status, health-related quality of life, and sleep disorders. Austin et al. [1] determined sleep disorders in 89 % of patients and found a statistically significant improvement in the PSQI value from preoperative 11.70 ± 4.61 to 6th month post-operative 4.61 ± 0.66. The conclusion was also reached that surgical factors such as acromioplasty, distal clavicular excision, biceps tenotomy, the number of sutures used, and the size of the tear did not affect sleep disorders. The findings of the current study were determined to be in parallel with those of Austin et al. No significant relationship was determined in the current study between surgical procedures and PSQI. However, in contrast to that previous study, by excluding patients receiving treatment for insomnia, neuropsychiatric patients, and those using narcotics, a more specific study group was formed of patients with rotator cuff tear only. Therefore, the current study was able to show more clearly whether rotator cuff tear affected sleep.

One of the limitations of the current study was the lack of a control group who had not undergone surgery. Furthermore, the decision for rotator cuff tear surgery is a complex

one, including factors such as patient age, size of the tear, chronicity of the tear, and muscle quality. The majority of the patients had been unresponsive to non-operative treatment for several months, and surgical treatment was applied at the end of unsuccessful conservative treatment. Therefore, the patient selection of this study could have been biased. That there was no control group has the potential to produce prejudiced outcomes. Another limitation of this study is that no imaging of the improvement at the end of the study was documented.

The results of the present study indicate that rotator cuff repair mitigates sleep disturbance as well as improves quality of life. Rotator cuff repair also may enhance the healing of the tear indirectly by alleviating sleep disturbance.

Conclusion

Sleep disorders are commonly seen in patients with rotator cuff tear, and after repair, there is an increase in the quality of sleep with a parallel improvement in shoulder functions. However, no statistically significant correlation was determined between arthroscopic procedures and the size of the tear and sleep quality.

Our results indicate that rotator cuff repair mitigates sleep disturbance and improves quality of life. Rotator cuff repair also may enhance the healing of the tear indirectly by alleviating sleep disturbance.

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