

## Original Research Article

# Nocturnal pain in adhesive capsulitis and subacromial impingement syndrome

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## ABSTRACT

**Background:** Subacromial impingement syndrome (SIS) and adhesive capsulitis (AC) are the most common causes of shoulder pain. It is known that patients with both disorders have impaired sleep quality and increased levels of anxiety and depression. This study aimed to compare the sleep, disability, and affective states of patients with untreated AC and SIS.

**Method:** Patients with shoulder pain for more than three months and diagnoses of AC and SIS were included in the study. Pain was assessed by visual analog scale (VAS), disability by shoulder pain and disability index (SPADI), sleep quality by Pittsburgh sleep quality index (PSQI), and anxiety and depression by hospital anxiety and depression scale (HADS).

**Results:** The study included 65 patients (n=24 AC, n=41 SIS). Sleep was affected in both of the groups. The patients with AC had worse scores than patients with SIS including SPADI pain, SPADI-total, sleep latency, sleep duration, sleep disturbance, using sleep medication (p<0.05). Sleep problems were correlated to anxiety and depression.

**Conclusions:** Despite the patients with SIS had higher SPADI-pain levels, the patients with AC had higher scores of SPADI-disabilities. Both of the groups had nocturnal pain and sleep problems but patients with AC had higher amount of sleep problems and depression mood compared to patients with SIS.

**Keywords:** Sleep problems, Shoulder pain, SIS, AC

## INTRODUCTION

Shoulder pain is a condition that can be due to many causes, is quite common in society, and can cause serious disability. The most common causes of persistent shoulder pain include bursitis, tendinitis, rotator cuff problems, AC, SIS and glenohumeral osteoarthritis. It was found that 91% of patients with shoulder pain had nocturnal pain. Night pain leads to impaired sleep quality and frequent awakenings. Many clinical studies have shown that night pain, insomnia, and inability to sleep on the affected shoulder are typically associated with

pathologic processes of the shoulder. Pain and sleep disturbance are two important complaints that significantly affect the individual's biological and behavioral well-being and interact with each other.<sup>1</sup>

SIS is known as the most common cause of shoulder pain. As a result of pathologies in the anatomical structures located in or bordering the subacromial space, pain and functional limitation occur, especially with impingement of the supraspinatus muscle tendon. The pain is particularly prominent with overhead activities and nocturnal pain is typical.<sup>2</sup>

Another common cause of shoulder pain is AC. AC is a painful condition with spontaneous onset and progressive restriction of glenohumeral joint movements. Synovial inflammation at the onset of the disease progressively turns into capsular fibrosis. It is divided into three phases. The first phase is when the movements start to be restricted and inflammation is evident at this level. The second phase is the frozen shoulder period. Third phase is the resolution phase in which movements are regained.<sup>3</sup>

Although SIS and AC cause shoulder pain with different mechanisms, nocturnal pain, and sleep disturbance can be present at a significant rate. Treatment in each condition aims to stop the inflammatory process, reduce pain, gain a normal functioning and stable joint, maintain normal joint motion, and prevent progressive degenerative changes.<sup>4,5</sup> While pain and functionality are mostly used as outcome measures for the effectiveness of the treatments applied, the effects of the treatments on sleep have been little studied. Moreover, while there is more data in the literature for AC, the relationship of with SIS and sleep remains unclear.

The study aimed to determine the level of sleep disturbance in patients with shoulder pain due to AC, to compare patients with SIS and patients with AC in terms of sleep problems, and to investigate the effect of sleep quality on pain, disability, anxiety, and depression levels. It was hypothesized that SIS patients have as many sleep problems as AC patients.

## METHOD

This prospective, observational study was conducted on patients who applied to Marmara university and Medeniyet university department of physical medicine and rehabilitation with complaints of shoulder pain. Ethics approval was obtained from Marmara university clinical research ethics committee before the study (Protocol no: 09.2019.894). Verbal and written informed consent were obtained from all patients.

Clinical evaluations of the patients included in the study were performed by two experienced physiatrists. Patients who were diagnosed with SIS and AK as a result of history, physical examination, and magnetic resonance imaging in the first clinical evaluation and who met the inclusion and exclusion criteria were included in study.

### *Inclusion criteria for SIS*

Patients aged 30-70 years with shoulder pain for more than 3 months were evaluated clinically. Magnetic resonance imaging (MRI) was ordered for patients with at least 3 of the following clinical findings: positive Neer impingement test, positive Hawkin's impingement test, positive painful arc sign, and pain increasing with isometric abduction. The diagnosis of subacromial impingement is based on the clinical findings, and MRI was used to rule out RC tears.

### *Inclusion criteria for AC*

Adults aged 30-70 years with shoulder pain and passive ROM restriction of more than 30° compared to normal values in at least two directions by goniometric measurement with restricted scapular rotation and symptoms for at least 3 months.

Exclusion criteria for both conditions were AC stage 4, previous trauma, previous history of physical therapy, injection/ surgery, evidence of complete rotator cuff tear, calcific tendinitis, biceps tendinitis, glenohumeral/acromioclavicular arthritis on magnetic resonance imaging, and uncontrolled diabetes mellitus (HbA1c>7%).

### *Outcome measures*

Pain levels of patients who had not received any previous treatment were questioned with VAS, and shoulder pain and disability were questioned with SPADI. The PSQI was used to assess sleep quality, and depression and anxiety levels were determined with the HADS.

VAS is a Likert scale that evaluates pain between 0 and 10. "0" means no pain and "10" means the most severe pain possible.

SPADI is self-administered questionnaire that consists of two dimensions, one for pain and the other for functional activities. Pain dimension consists of 5 questions regarding severity of individual's pain. Functional activities are assessed with eight questions designed to measure degree of difficulty individual has with various activities of daily living that require upper-extremity use. SPADI has Turkish reliability and validity.<sup>6,7</sup>

The PSQI is a Turkish validity and reliability scale consisting of seven subcategories and 19 questions. The seven subcategories are summed to obtain a global PSQI score ranging from 0 to 21; higher scores are indicative of poor sleep quality.<sup>8,9</sup>

HADS is a 14-question instrument that measures anxiety and depression. Each question is scored between 0 (no impairment) and 3 (severe impairment), with a maximum score of 21 for anxiety or depression. As a cut-off point, 0-7=normal, 8-10=mild, 11- 14=moderate, 15- 21=indicates severe mood disorder. Turkish validity and reliability of scale were performed by Aydemir et al.<sup>10</sup>

The sample size was estimated for primary outcome measures with the G Power V.3.1.7 program (University of Kiel, Kiel, Germany). According to the literature, initial PSQI values were 11.57±4.34.<sup>11</sup> The sample size was calculated for a significance level of 0.05 and 90% power. The resulting sample size was 16 per group. Assuming a dropout of 5%, the target sample size was 20 per group.

IBM SPSS Statistics for Windows, version 25.0. Armonk, NY: IBM Corp was used for statistical analysis in the evaluation of the data obtained from our study. Percentage, mean, median, and standard deviation values were obtained using descriptive statistical methods. The conformity of the data to the normal distribution was evaluated with the Shapiro-Wilk test. The Pearson chi-square test was used to compare categorical data. Mann-Whitney U test was used to compare the groups.

**RESULTS**

Twenty-four patients with AC and 41 patients with SIS included in study. Demographic data are summarized in Tables 1 and 2, and parameters such as age, body mass index, gender, dominant hand, and affected extremity

were equally distributed among groups. Symptom duration of SIS group was longer than AC group (p=0.01)

Patients with AC had worse scores than patients with SIS including SPADI-pain, SPADI-total, sleep latency, sleep duration, sleep disturbance and using sleep medication (p<0.05). Detailed statistics were summarized in Table 3.

PSQI total scores were in correlation to HADS- anxiety (rho=0,483 p=0,001), HADS-depression (rho=0,378 p=0,001), sleep latency (rho=0,879 p=0,001), sleep efficiency (rho=0,656 p=0,001), use of sleep medication (rho=0,797 p=0,001), day time dysfunction (rho=0,673 p=0,001), subjective sleep quality (rho=0,453 p=0,001), sleep duration (rho=0,886 p=0,001) and sleep disturbance (rho=0,886 p=0,001) parameters.

**Table 1: Quantitative demographic and clinical characteristics and statistical analysis.**

Treatment	SIS, (n=41)		AC, (n=24)		P value*
	Mean	SD	Mean	SD	
Age (In year)	49.8	8.85	52.21	8.32	0.45
BMI (kg/m <sup>2</sup> )	27.64	4.58	31.82	5.93	0.08
Symptom duration (months)	8.06	6.3	5.17	2.98	0.01

\*Independent samples t-test

**Table 2: Qualitative demographic and clinical characteristics and statistical analysis.**

Variables	SIS, (n=41)		AC, (n=24)		P value*	
	N	%	N	%		
Gender	Female	27	65.9	18	75	X <sup>2</sup> =0.59, 0.31
	Male	14	34.1	6	25	
Dominant hand	Right	40	97.6	23	95.8	X <sup>2</sup> =0.152, 0.60
	Left	1	2.4	1	4.2	
Affected extremity	Right	27	65.9	11	45.8	X <sup>2</sup> =2.49, 0.09
	Left	14	34.1	13	54.2	

\*Chi-square test was used.

**Table 3: Comparison of VAS, SPADI, PSQI, and HADS scores between AC and SIS groups.**

Variables	Group	Mean ± SD	Median	Range	Z	P value*
Pain at night-VAS	AC	8.59±1.59	9	5	-0.62	0.53
	SIS	8.35±1.38	8	5		
SPADI-pain	AC	52.45±18.98	46.5	50	-2.68	0.007
	SIS	76.95±13.53	80	54		
SPADI-disability	AC	65.54±11.82	65.5	34	-2.57	0.03
	SIS	60.4±14.96	62	77.5		
SPADI-total	AC	79.47±13.08	80	44,6	-5.69	0.001
	SIS	52.95±10.45	55.5	46.6		
HADS-anxiety	AC	11.59±3.77	11.5	15	-0.78	0.43
	SIS	11.07±4.1	11	15		
HADS-depression	AC	10.54±2.28	12	7	-2.02	0.04
	SIS	9.05±2.89	9	10		
Subjective sleep quality	AC	2.04±0.78	2	2	-1.23	0.21
	SIS	2.22±0.83	2	2		
Sleep latency	AC	1.45±0.85	1	2	-2.54	0.01
	SIS	0.95±0.81	1	3		

Continued.

Variables	Group	Mean ± SD	Median	Range	Z	P value*
Sleep duration	AC	1.77±0.92	2	3	-3.28	0.001
	SIS	0.92±0.99	1	3		
Sleep efficiency	AC	2.22±0.42	2	1	-0.47	0.63
	SIS	2.17±0.84	2	3		
Sleep disturbance	AC	2.13±0.56	2	2	-3.08	0.002
	SIS	1.35±1.05	2	3		
Use of sleep medication	AC	1.45±0.85	1	2	-2.02	0.04
	SIS	1.02±0.83	1	3		
Day time dysfunction	AC	1.63±0.49	2	1	-1.13	0.25
	SIS	1.42±0.67	2	2		
PSQI-total	AC	12.72±4.25	12	11	-2.36	0.018
	SIS	10.07±4.34	9	16		

## DISCUSSION

In this study, sleep disturbance was found to be quite frequent for two conditions with shoulder pain, AC and SIS. AC patients had more sleep problems compared to SIS patients. Although SIS patients had higher scores in the SPADI-pain index subcategory, the AC group had more problems in SPADI-disability and SPADI-total scores. HADS-depression scores of AC patients were also significantly higher than the SIS group. PSQI-total score was found to be higher in AC patients. Subgroup analyses showed that this difference was due to sleep latency, sleep duration, sleep disturbance, and use of sleep medication parameters.

Mulligan et al. investigated sleep disturbance in patients with shoulder pain in their study. They showed that the condition that caused the most sleep disturbance in patients with shoulder pain was AC and the mean PSQI score was 12.07.<sup>1</sup> Similarly, the PSQI score was 12.7 in our study. While the mean PSQI score for SIS was 8.59 in the study by Mulligan et al. in our study, this score was found to be 10.07 in our study. However, Tekeoglu et al reported that the mean score in SIS patients was 11.6 in their study.<sup>11</sup> The current study demonstrated that SIS patients had more pain during the day than AC patients despite similar VAS-night pain scores. This is probably due to the fact that SIS patients perform more overhead activities during the day. There are several theories regarding the increased level of nocturnal pain in patients with shoulder disease. In daily practice, the causes of shoulder pain in patients are not isolated commonly there is more than one reason, particularly concomitant rotator cuff tears. Nocturnal pain is common in rotator cuff tears however, sleep quality does not differ among patients with varying rotator cuff disease severity.<sup>12</sup> In our study, we exclude the cases with rotator cuff tears, and a homogeneous study population was created in SIS and AC group. We believed that rotator cuff problems were not a confounding factor in our study.

Inflammation is the most commonly associated condition with nocturnal pain. For AC, the inflammation is mostly in the synovial joint, while for SIS it is in the subacromial

space. Increased cytokine levels have been suggested to be an important cause of nocturnal pain, especially in AC patients. Studies have shown that clinical symptoms and disease progression are associated with the IL-1a, IL-1b, TNF-a, IL-6, cyclooxygenase-1, and cyclooxygenase-2.<sup>13,14</sup> The role of inflammation in pathogenesis has implications for treatment. There are several studies demonstrated that glucocorticoid injections in the subacromial region for SIS and intra-articular injections for AC can reduce pain rapidly.<sup>14-18</sup> On the other hand, sleep disturbance at night disrupts the circadian rhythm of the patient. Circadian rhythm disturbance causes many adverse conditions. Circadian rhythm disturbance also triggers inflammation. Ha et al suggested melatonin levels that peak at night and early morning may activate the inflammatory response and act as a mediator to aggravate the pain complaint.<sup>19</sup>

Depression and anxiety were correlated with sleep disturbance. However, this finding should be interpreted with caution. Even if patients with uncontrolled diabetes mellitus were excluded from our study, the number of patients with AC was higher in patients with one or more underlying diseases. Endocrinologic problems such as diabetes and thyroid diseases may cause depression and anxiety independently of shoulder pain.<sup>20</sup> Nevertheless, the high number of confounding factors does not change the fact that patients with AC have more sleep problems.

The main goal in the treatment of both SIS and AC is to reduce shoulder pain, provide functional shoulder movements and prevent re-development of the diseases. Conservative treatments are used primarily to achieve this goal. Among conservative treatments, physical therapy, methods, mobilization, and exercise programs are prominent. However, it is necessary to relieve the pain as soon as possible and to provide movement of the joint to prevent secondary complications. In the treatment, it would be rational to focus on the factors affecting night pain as well as reducing the pain as soon as possible

Our study has some limitations and some strengths. Among the limitations, the centers where the patients

were seen were tertiary centers. This suggests more problematic patients and makes it difficult to generalize the results to the population. Secondly, the patients included in the study did not receive physical therapy, injection, and surgical treatment. However, almost all patients had used non-steroidal anti-inflammatory drugs in the previous three months. The strengths are that the patients were evaluated by two different experienced physiatrists with strong exclusion criteria. Patients with rotator cuff injuries were excluded.

## CONCLUSION

To conclude, this study shows that sleep disturbance is frequent in SIS patients, but not as intense as in AC patients. Sleep problems are correlated with depression and anxiety.

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## REFERENCES

- Mulligan EP, Brunette M, Shirley Z, Khazzam M. Sleep quality and nocturnal pain in patients with shoulder disorders. *J Shoulder Elbow Surg.* 2015;24(9):1452-7.
- Singh H, Thind A, Mohamed NS. Subacromial Impingement Syndrome: A Systematic Review of Existing Treatment Modalities to Newer Proprioceptive-Based Strategies. *Cureus.* 2022;14(8):e28405.
- Cho CH, Bae KC, Kim DH. Treatment Strategy for Frozen Shoulder. *Clin Orthop Surg.* 2019;11(3):249-57.
- Michener LA, Walsworth MK, Burnet EN. Effectiveness of rehabilitation for patients with subacromial impingement syndrome: a systematic review. *J Hand Ther.* 2004;17(2):152-64.
- Redler LH, Dennis ER. Treatment of Adhesive Capsulitis of the Shoulder. *J Am Acad Orthop Surg.* 2019;27(12):e544-54.
- Angst F, Schwyzer HK, Aeschlimann A, Simmen BR, Goldhahn J. Measures of adult shoulder function: Disabilities of the Arm, Shoulder, and Hand Questionnaire (DASH) and its short version (QuickDASH), Shoulder Pain and Disability Index (SPADI), American Shoulder and Elbow Surgeons (ASES) Society standardized shoulder assessment form, Constant (Murley) Score (CS), Simple Shoulder Test (SST), Oxford Shoulder Score (OSS), Shoulder Disability Questionnaire (SDQ), and Western Ontario Shoulder Instability Index (WOSI). *Arthritis Care Res (Hoboken).* 2011;63(11):S174-88.
- Bumin G, Tüzün EH, Tonga E. The Shoulder Pain and Disability Index (SPADI): Cross-cultural adaptation, reliability, and validity of the Turkish version. *J Back Musculoskeletal Rehabilitation.* 2008;21(1):57-62.
- Mollayeva T, Thurairajah P, Burton K, Mollayeva S, Shapiro CM, Colantonio A. The Pittsburgh sleep quality index as a screening tool for sleep dysfunction in clinical and non-clinical samples: A systematic review and meta-analysis. *Sleep Med Rev.* 2016;25:52-73.
- Agargun MY. Pittsburgh uyku kalitesi indeksinin gecerligi ve guvenirligi. *Turk Psikiyatrl Derg.* 1996;7:107-15.
- Aydemir Ö, Guvenir T, Kuey L, Kultur S. Validity and reliability of Turkish version of hospital anxiety and depression scale. *Turk Psikiyatri Derg.* 1997;8(4):280-7.
- Tekeoglu I, Ediz L, Hiz O, Toprak M, Yazmalar L, Karaaslan G. The relationship between shoulder impingement syndrome and sleep quality. *Eur Rev Med Pharmacol Sci.* 2013;17(3):370-4.
- Khazzam MS, Mulligan EP, Brunette-Christiansen M, Shirley Z. Sleep Quality in Patients With Rotator Cuff Disease. *J Am Acad Orthop Surg.* 2018;26(6):215-22.
- Bunker TD, Reilly J, Baird KS, Hamblen DL. Expression of growth factors, cytokines and matrix metalloproteinases in frozen shoulder. *J Bone Joint Surg Br.* 2000;82(5):768-73.
- Voloshin I, Gelinis J, Maloney MD, O'Keefe RJ, Bigliani LU, Blaine TA. Proinflammatory cytokines and metalloproteases are expressed in the subacromial bursa in patients with rotator cuff disease. *Arthroscopy.* 2005;21(9):1076.e1-6.
- Roddy E, Ogollah RO, Oppong R, Zwierska I, Datta P, Hall A et al. Optimising outcomes of exercise and corticosteroid injection in patients with subacromial pain (impingement) syndrome: a factorial randomised trial. *Br J Sports Med.* 2021;55(5):262-71.
- Cole BF, Peters KS, Hackett L, Murrell GA. Ultrasound-Guided Versus Blind Subacromial Corticosteroid Injections for Subacromial Impingement Syndrome: A Randomized, Double-Blind Clinical Trial. *Am J Sports Med.* 2016;44(3):702-7.
- Cho CH, Min BW, Bae KC, Lee KJ, Kim DH. A prospective double-blind randomized trial on ultrasound-guided versus blind intra-articular corticosteroid injections for primary frozen shoulder. *Bone Joint J.* 2021;103-B(2):353-9.
- Gencer Atalay K, Kurt S, Kaplan E, Yağcı İ. Clinical effects of suprascapular nerve block in addition to intra-articular corticosteroid injection in the early stages of adhesive capsulitis: A single blind, randomized controlled trial. *Acta Orthop Traumatol Turc.* 2021;55(6):459-65.
- Ha E, Lho YM, Seo HJ, Cho CH. Melatonin Plays a Role as a Mediator of Nocturnal Pain in Patients with Shoulder Disorders. *J Bone Joint Surg Am.* 2014;96(13):e108.

20. Sultan S, Luminet O, Hartemann A. Cognitive and anxiety symptoms in screening for clinical depression in diabetes: a systematic examination of diagnostic performances of the HADS and BDI-SF. *J Affect Disord.* 2010;123(1-3):332-6.

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