



Effects of Sleeping Positions on the Rotator Cuff Pathology

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Abstract

The rotator cuff tear etiology is still unclear. Especially for atraumatic ruptures, degenerative processes come into prominence. This study aims to correlate between four most commonly-seen sleeping positions and patients with rotator cuff pathology. 87 patients who applied to the institute for suffering from shoulder pain for more than 6 months without a trauma and 93 voluntary people (as control group) above the age of 50 who applied to the institution for reasons other than shoulder pain included in the study. Rotator cuff ruptures and acromion types of the patients are diagnosed via magnetic resonance imaging. In face-to-face interviews, all the patients are asked to show their favorite sleeping positions on the visual cards and also questioned about their smoking habits and overhead activities. There are not any statistically substantive parameters between the patients and the control group in terms of age and sex. 83.9% of the patients with rotator cuff rupture have stated preferring lateral decubitus position while this rate is 61.3% among the control group ($p=0.003$). Atraumatic rotator cuff tears are increase with age. The increase pressure in the subacromial space can lead distribution in microvascular circulation of rotator cuff. Decrease in the microvascular circulation also affects the regeneration potential of rotator cuff. Laboratory studies demonstrated that lateral decubitus position has the most prominent increase in the subacromial pressure over all sleeping positions. We consider that sleeping in the lateral decubitus position causes long-term high subacromial pressure, leading to a microcirculatory disorder in the rotator cuff, which is a risk factor for the rotator cuff etiology.

Keywords: Rotator cuff, risk factors, tendinopathy, sleeping position, subacromial pressure, etiology

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Introduction

The rotator cuff pathology is the most substantial reason of shoulder pain. However, there is not any accurate consensus about its etiology. A lot of factors such as age, trauma, smoking, hypercholesterolemia, genetic characteristics, and morphological structure of the acromia, shoulder instabilities and degenerative tendinopathy play roles [1-8]. Especially for the atraumatic ruptures, degenerative processes related to age come into prominence [5]. The fact that incidence of rotator cuff rupture is to rise along with age makes the risk factors of ongoing degenerative processes essential [8].

Shoulder movements may alter the pressure on the rotator cuff, altering the subacromial volume [9]. The pressure on the subacromial area rises especially during the abduction, anterior flexion and internal rotation of the shoulder. In the event that high pressure is constant, a microcirculatory disorder in the rotator cuff is to be seen, forming a basis for degeneration.

Sleeping forms one quarter of the whole human lifespan. As it is observed, subacromial pressures are different from each other during the four most commonly-seen sleeping position [10]. Sleeping position may cause a long-term rise of subacromial pressure and cause degenerative changes on the rotator cuff. This study aims to correlate between four most commonly-seen sleeping positions and patients with rotator cuff pathology.

Material and Method

This study consists of 87 patients above the age of 50 who applied to the institute in 2014 for having been suffering from shoulder pain for more than 6 months without a trauma and 93 voluntary people (as control group) above the age of 50 who applied to the institution for reasons other than shoulder pain. Patients with neuromuscular and rheumatic diseases, diabetes, traumatic shoulder pain, healed proximal humerus fracture or past surgical history of the shoulder are excluded from the study. Rotator cuff ruptures of the patients are diagnosed via magnetic resonance imaging (MRI). The ruptures are categorized as partial rupture or total rupture regarding the images from MRI. Patient's acromion types are also recorded from MRI and classified according to Bigliani [1], type I is flat, type II is curved and type III is hooked. In control group Neer and Hawkins test are performed and if both are negative they accepted

in control group. In face-to-face interviews, all the patients are asked to show their favorite sleeping positions (before the shoulder pain has begun) on the visual cards (Figure 1).



Figure 1. Visual cards to show their favourite sleeping positions: a) supine position, arms at sides, b) supine position, arms at abduction under the head, c) lateral decubitus position, arms and elbows at 90 degree-flexion, d) prone position, arms at abduction.

Patients also asked for their smoking habits and overhead activity status.

For statistical evaluation, Mann-Whitney U Test to evaluate the quantitative data and chi-square test to determine the sleeping position variance are conducted via SPSS 21 program.

Results

Totally 87 patients and 93 voluntary people as a control group took part in our study. 60 patients (69%) of the study group were female and 27 (31%) were male; it was 64 (68.8%) female and 29 (31.2%) male for the control group. Average age was 63.99 (+/- 8.89) for the study group and 61.06 (+/- 8.89) for the control group. 40 (46%) of the patients had partial rupture and 47 (54%) had total rupture.

There are not any statistically substantive parameters between the patients and the control group in terms of age and sex.

83.9% of the patients with rotator cuff rupture have stated preferring lateral decubitus position while this rate is 61.3% among the control group. Comparing the frequency and percentage of

the sleeping positions and the patients with rotator cuff rupture via chi-square test, it is seen that the differentiation observed is highly substantial ($p=0.003$) (Table 1).

Patients		Sleeping positions				Total
		1	2	3	4	
Control Group	Number	14	9	57	13	93
	% of patients	15.1%	9.7%	61.3%	14.0%	100.0%
	% of patients within sleeping position	60.9%	75.0%	43.8%	86.7%	51.7%
Patients with cuff tear	Number	9	3	73	2	87
	% of patients	10.3%	3.4%	83.9%	2.3%	100.0%
	% of patients within sleeping position	39.1%	25.0%	56.2%	13.3%	48.3%
Total	Number	23	12	130	15	180
	% of patients	12.8%	6.7%	72.2%	8.3%	100.0%
	% of patients within sleeping position	100.0%	100.0%	100.0%	100.0%	100.0%

Table 1. Distribution of sleeping positions within control and patient groups.

Smoking habits was positive in 31% in study group and 30.1% in control group ($p>0.05$). As two groups compared for overhead activity in study group 27.6% versus 17.2% in control group ($p=0.094$).

When study group is analyzed for acromion type, 49 (56.3%) is Type I, 21 (24.1%) is Type II, 17 (19.5%) is type III. When acromion types are distributed in patients with partial and total cuff tears any statistically substantive parameters is found between groups (Table 2).

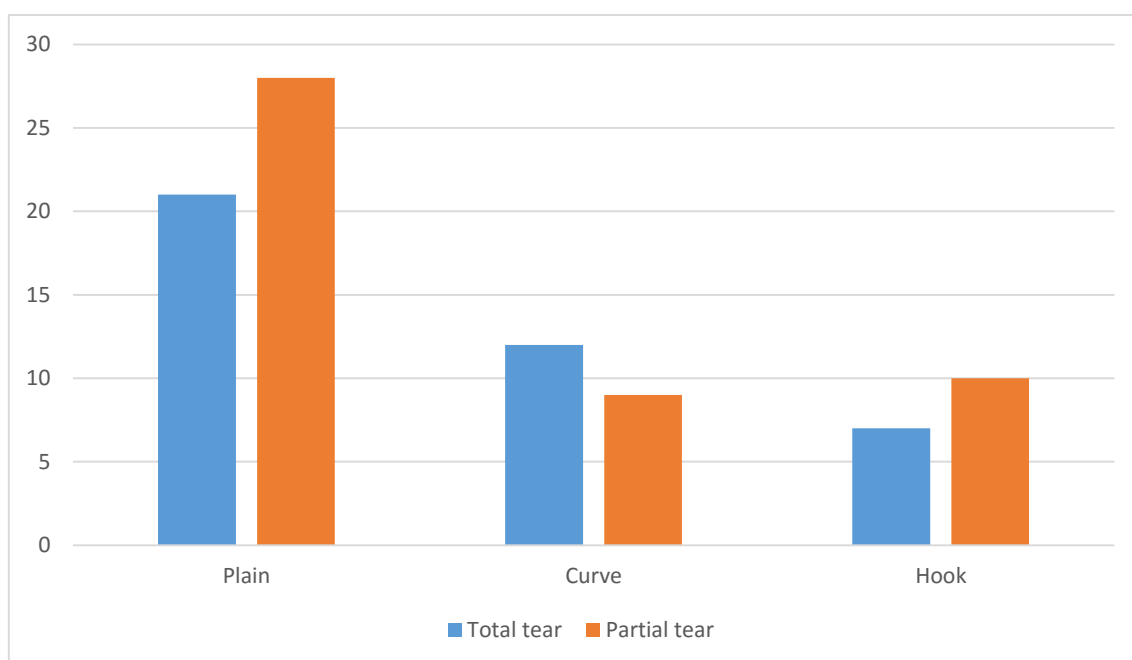


Table 2. Distribution of acromial morphology within partial and total cuff tear ($p>0.05$).

Discussion

Risk factors related to age and hypo vascularization play a key role in atraumatic rotator cuff ruptures. A study covering 1366 shoulders shows 20.7% rotator cuff ruptures while another study shows no rupture below the age of 50, 10.7% between the ages of 50-60, 26.5% between the ages of 60-70 and 36.6% above the age of 70 [8]. We have selected people above the age of 50 to form a gross sample.

We found in our study that the risk of getting a rotator cuff rupture is higher for the people sleeping in lateral decubitus position than people preferring other positions. Patients hold their arms at flexion, adduction and internal rotation in lateral decubitus position. That the subacromial space decreases especially with shoulder flexion and adduction during shoulder movement is presented via a 3-dimension computer modelling. A number of researchers have studied the subacromial pressure altering with shoulder movements [9,11,12]. Nordt et al. found in their study, which aims to evaluate the effectiveness of acromioplasty, that the pressure on the rotator cuff during oppose shoulder reaching position (flexion, adduction, internal rotation) was at the highest level in 56% of the patients before acromioplasty. They also found that this increased pressure had no relation with acromion morphology [9].

Rathban et al. suggests in a cadaveric study they conducted that there is a hypo vascular area in supraspinatus tendon that other rotator cuff tendons do not have, which may be related to leading the humeral head to cause a direct pressure on tendon in adduction position, which causes a microcirculatory disorder [13]. Sigtholm shows in his study that increased subacromial pressure is equal to the intramuscular pressure of rotator cuff and this pressure causes the microcirculatory disorder in the rotator cuff [12]. In another in vivo study measuring the subacromial pressure, it is seen that the pressure constantly rises at internal rotation, flexion and adduction [10]. It is also seen that subacromial adhesions increase the pressure on the rotator cuff especially at 100-degree flexion and the pressure substantially decreases after the adhesions are loosened [11].

The perfusion of bone tendon intersection is substantial for tendon regeneration. The persistence of this perfusion is especially substantial for the regeneration of hypo vascular rotator cuff after micro traumas. Hypoxia symptoms have priority for degenerative tendons [14]. Hypoxia induced factor (HIF) is seen at rotator cuff ruptures [15]. A study consisting of 586 patients emphasizes that hypoxia linked to the nicotine-related vasoconstriction effect is a determiner for the occurrence and size of the rupture [16]. In lateral decubitus position, humerus at flexion, internal rotation and adduction may increase the subacromial pressure and causes a microcirculatory disorder, and also may have a role in the atraumatic ruptures caused by tendon degeneration.

Werner et al. studied sleeping positions' effect on the rotator cuff with 20 voluntary participants. The lowest subacromial pressure is seen during supine position while the highest is seen in lateral decubitus position while arms are at flexion, adduction and internal rotation [17]. Whereas the former studies indicate that the pressure during external rotation increases; this study has found that the pressure during external rotation decreases and the patients are suggested to sleep in prone position [17]. Another study consisting of 111 patients found that patients with impingement syndrome who are between the ages of 30-60 mostly sleeps in lateral decubitus position [18]. However, both studies consists of people below the age of 60 and are not able to accurately evaluate the long-term effects of the sleeping positions. Our study has examined the patients above the age of 50 and has found that the pressure increased by lateral decubitus position can play role in rotator cuff rupture etiology. In a study examining 55 patients, whose one shoulder's rotator cuff rupture was repaired, it is seen that

67.3% of the patients' other shoulders also have ruptures [19]. As both arms are at flexion, adduction and internal rotation in lateral decubitus position, this finding supports our hypothesis.

There are other risk factors for rotator cuff tears like smoking, overhead activity and acromion type. In a recent study, Balke et al investigates acromial morphology and impingement syndrome and they emphasize that the acromial type according to Bigliani was not associated with any particular cuff lesion [20]. In our study we also find no correlation between acromion types and tear type, and only 19.5% of patients have type III acromion. Our findings about acromion type are compatible with literature [21]. A study over 111 rotator cuff tear patients found that smoking is an independent risk factor for cuff tear [18]. We found no difference between our groups. Baumgarten et al. find increased risk in smoker for rotator cuff tear but in this association is true when mean pack-years of smoking is over 30 [16].

Overhead activity is another risk factor for rotator cuff tear. It's important mainly in overhead athletes in young age population [22]. We also found increased risk for overhead activity in study group it was statistically insignificant. This may be due to average age our sample.

In the literature, ours is the first study indicating that sleeping positions play a role in rotator cuff etiology.

Conclusion

We consider that sleeping in the lateral decubitus position could cause long-term high subacromial pressure, leading to a microcirculatory disorder in the rotator cuff, which is a risk factor for the rotator cuff etiology.

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