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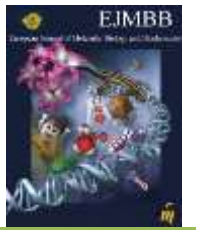

EXPLORING SLEEP QUALITY IN WELL-CONTROLLED ASTHMA: INSIGHTS FROM ACTIGRAPHY AND CLINICAL ASSESSMENTS

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ABSTRACT

The symptoms of asthma poorly controlled can adversely affect sleep quality, including nighttime coughing, wheezing, and chest tightness. Actigraphy, utilizing the Actiwatch 2 wristwatch, offers an objective means to assess sleep activity parameters like sleep onset latency (SOLT) and duration of awakening after sleep onset (WASO). In this study, 100 asthma patients were included, and their sleep quality was assessed through actigraphy. This study evaluated using the Asthma Control Questionnaire, whereas asthma-related quality of life was evaluated using the Asthma Quality of Life Questionnaire. The results, including ACQ, AQLQ, and lung function tests, were compared with sleep quality parameters. The findings revealed a total sleep time of 386.1mins, WASO of 54.71 mins, sleep efficiency of 86.01%, sleep onset latency of 7.06 mins, and an ACQ score of 0.36. Interestingly, no correlation was observed between sleep efficiency or WASO and respiratory functions, ACQ, or AQLQ. The study suggests that actigraphic measures of sleep are not associated with pulmonary function, asthma control levels, or the quality of daytime life in individuals with asthma. Importantly, it underscores the significance of achieving well-controlled asthma before evaluating sleep quality.

INTRODUCTION

It is estimated that there are sixty sleep disorders listed in the International Classification of Sleep Disorders. [1]. Adult asthmatics are reported to have 12.5%–19.7% sleep disturbances [2] whereas asthmatic children are reported to have 38.95% sleep disturbances [3]. It has been reported that effective treatment reduces the frequency and severity of episodes of asthma related to sleep disorders. [4, 5] Despite this, recent studies have shown that asthmatic children have sleep disorders. Self-reported sleep quality was not predicted by asthma symptoms. In order to improve asthmatic symptoms as well as quality of life, it is important to assess sleep disorders in patients with asthma. In clinical practice, questionnaires such as the AQLQ and ACQ are commonly used to assess quality of life and asthma control [6].

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Using the pediatric quality of life inventory, we assess health-related quality of life by separating asthma severity from health-related quality of life. [7] Neither AQLQ scores nor predicted forcing vital capacity correlate significantly with predicted forcing expiratory volume in 1 second. Poor asthma management and quality of life are associated with poor sleep quality

Several sleep disorders have been treated using actigraphy, including Alzheimer's disease [8], Parkinson's disease, tumour and Rheumatoid Arthritis. [9-12] Sleep disturbances in allergic rhinitis are also evaluated with actigraphy. [13, 14] ACQ and AQLQ are useful assessments of sleep quality relative to asthma control, [15]. Uncontrolled asthma patients had longer sleep cycles and a greater frequency of waking up during the night compared to those with controlled asthma. Respiratory functions were not assessed in their study. Using actigraphy, we measured pulmonary function, quality of life, and sleep quality in patients with adult asthma to assess the relationships between asthma control and sleep quality.

METHODOLOGY

Participants in this study were diagnosed as asthmatic by respiratory physicians according to ATS criteria21. Each patient signed an informed consent form. A study of participants with obstructive sleep apnea syndrome was excluded

Questionnaires

ACQ was used to assess disease control in asthma patients. Additionally, we assessed their quality of life using the AQLQ. Epworth Sleepiness Scale evaluated daytime sleepiness. A total of three questionnaire series were applied between the first and second assessment visits

Sleep quality assessment

An accelerometer on the wrist is called an actigraph, and it is light in weight. Using a digitally-integrated measure of gross motor activity and a light sensor, Actiwatch 2 allows you to visualize sleep and activity patterns and quality of physical activity. Actiware 5 software assessed the patient's sleep qualities by having them wear actigraphs for seven consecutive days. Actiwatch 2 was used to collect activity counts. Each epoch lasts 60 seconds.

Respiratory functions measurements and monitoring the peak flow

As a part of the procedure, all patients were asked to perform a Chestac 33 spirometer test in order to assess their pulmonary function. Three pulmonary function tests were performed to determine the highest FVC and FEV1. FEV1 % represents FEV1 as a percentage of FVC (FEV1/FVC×100). Using a Mini-WRIGHT Peak-flow Meter, all patients also measured their peak expiratory flow rate. During the same week, the patients wore an Actiwatch 2 to measure their sleep quality and recorded their PEFR twice a day, in the morning and in the evening.

Statistics

StatPrism 5 was used for all statistical analyses. Values are presented as means + standard errors. Correlations were examined by Spearman's coefficients.

RESULTS

Patient's characteristics

The study included a total of 100 participants. However, data on both actigraphic and peak expiratory flow rate (PEFR) were unavailable for eleven subjects, resulting in the utilization of data from 78 patients. Table 1 displays the mean age, gender distribution, height, weight, and percentage of PEFR, as well as other pulmonary function parameters such as %FVC, FEV1, and %FEV1 for the patients.

Actigraphy

The analysis included the assessment of sleep onset latency (in minutes), total sleep time (in minutes), wake after sleep onset (WASO) duration (in minutes), and sleep efficiency (in percentage). The results indicated an average of 386.1minutes of sleep per night, 54.71 minutes of WASO, a sleep efficiency of 86.01%, and a sleep onset latency of 7.06 minutes (refer to Table 2).

Sleep efficiency and pulmonary function test relation

Pneumonia function tests and sleep efficiency were examined. It was evident that good FEV1% or %PEFR was associated with good sleep efficiency, but these associations were not statistically significant.

WASO and pulmonary function test relation

The subsequent analysis aimed to investigate potential correlations between wake after sleep onset (WASO) and lung function tests. Results revealed that none of these variables exhibited a correlation with %FVC, %FEV1, %FEV1%, or %PEFR.

Correlation among ACQ score, WASO, Efficiency on sleep and respiratory functions

Sleep efficiency, WASO, and respiratory functions were evaluated in relation to the ACQ score. Sleep efficiency and WASO were not correlated with ACQ scores. Compared with PEFR, %FVC, %FEV1, and FEV1%, the ACQ score showed negative correlations (table: 3)

Table 1: Characteristics of patients

Characteristics	Number (n=78)
Age in yrs	56.5±15.2
Gender Male Female	 28 50
Height in cm	159.9±5.8
Weight in kg	56.5±8.7
Body mass index	21.8±2.1
PER average in %	85.8±18.5

%FVC	106±18.2
%FEV	72.2±9.9
%FEV(FEV1/FEV1 pred)	97.8±19.5

Table 2: Actigraphy data

Characteristics	Number (n=78)
Sleep time in mins	386.1±97.1
WASO in min	54.71±21.57
% of efficiency in sleep	86.01±4.41
Latency on sleep onset	7.06±6.15

Table 3: Correlation study

	ACQ	AQLQ
% efficiency of sleep	0.1279	-0.0248
WASO	0.1928	0.1170
%PEFR Mean	-0.4768*	0.3633**
%FVC	-0.5044*	0.4182**
$\%FEV_1$	-0.6670**	0.3338**
$FEV_1\%$	-0.4565*	0.1480

DISCUSSION

In our evaluation of asthma patients, we explored the interplay between sleep quality, pulmonary function, and quality of life. Surprisingly, there was no discernible association between respiratory functions, quality of life, and sleep quality among asthma patients. Furthermore, even in the presence of severe airflow limitation, sleep quality remained unaffected, with the exception of an impact on wake after sleep onset (WASO) in individuals with severe asthma control.

It found a robust correlation between the level of asthma control and sleep quality in their study involving ten asthmatic patients and utilizing wrist actigraphy. Their findings indicate a positive association between Asthma Control Questionnaire (ACQ) scores and sleep onset latency, implying that individuals with poorly controlled asthma experience an extended period before falling asleep.

Additionally, ACQ and AQLQ scores were correlated with sleep efficiency, sleep episodes, and wakefulness. We found no significant correlation between ACQ scores and AQLQ scores with any of the several parameters relating to sleep quality in our study. Furthermore, there were negative correlations observed between Asthma Control Questionnaire and Asthma Quality of Life Questionnaire. Although the significant correlation between ACQ and AQLQ is not explicitly presented here, it is worth noting that a high average ACQ score in our study indicated excellent asthma control.

Consequently, a study showed poorer asthma control in their study, with an ACQ of 2.20 at the first visit and 1.93 at the second visit. The variations in asthma control levels between the two study groups can account for this disparity. Asthmatics often report feeling sleepy during the day.

Based on studies, four of ten of their patients (40% of whom had scores over 10.20) had scores over 9.20; but in our study, only three of the 39 patients (7.6%) had scores over 10 [16]. Sleep efficiency or WASO scores did not significantly correlate with ESS scores. Despite the high prevalence of obstructive sleep apnea in asthma28, subjects with nocturnal symptoms were apparently excluded from our study, suggesting that our study subjects had well controlled nocturnal symptoms.

Study participants reported self-reported sleep quality questionnaires assessing the past month's sleep to evaluate sleep quality. Despite no direct correlation between nighttime asthma disturbances and poor sleep quality, the results suggest poor sleep quality is associated with inadequate asthma control. Accordingly, even asthmatics with well-controlled nighttime symptoms might not experience asthma symptoms as a result of poor sleep in real-life situations.

A quality of life questionnaire and the WASO and sleep efficiency were examined in relation to parameters of pulmonary function. Sleep parameters and did not show significant associations. The relationship between WASO and sleep efficiency was not significant. Asthma-related quality of life was significantly positively correlated with pulmonary function parameters. Although there may not be a direct correlation between nighttime sleep quality and improvements in respiratory functions during the day, the study suggests. The correlation between pulmonary function parameters and health-related quality of life should be taken into account when assessing sleep quality [17].

Characterized by persistent airflow limitations, COPD is a preventable and treatable disease. Individuals with COPD frequently encounter sleep disturbances [18], leading to oxygen desaturation, cardiac arrhythmias, and

pulmonary hypertension. A study found that the severity of COPD was linked to sleep disturbance [19].

These results differ from previous studies conducted on asthma patients. Nevertheless, elderly individuals with a history of smoking who have asthma may sometimes exhibit characteristics reminiscent of COPD.

A comprehensive study should investigate sleep quality, pulmonary functions, exacerbations, and mortality in patients with asthma–COPD overlap syndrome, as individuals with this overlap may experience more sleep disturbances compared to those with either disease alone. Our study subjects might not sleep as much as people without asthma despite the various methods used to evaluate sleep. Based on a study, 61% of subjects experienced less than 300 minutes of sleep per night, while 78% slept more than 390 minutes per night. Notably, 90 percent of subjects with sleep durations between 300 and 390 minutes survived. The findings suggest that patients with well-controlled asthma exhibited favorable actigraphic sleep time; however, additional research is warranted to ascertain the potential impact of sleep time on mortality.

CONCLUSION

In conclusion, sleep quality does not show an association with pulmonary function parameters or assessments of asthma-related quality of life in well-controlled asthma. The potential relationship between sleep disturbance and asthma control, along with considerations of comorbidities or medications, warrants further investigation. It is crucial to independently assess sleep quality in well-controlled asthma patients.

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