Changes in nightmare frequency and nightmare distress after CPAP initiation in patients with obstructive sleep apnea syndrome: An observational study

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Summary. Nightmare frequency in patients with sleep-related breathing disorders is heightened compared to representative samples. In addition, several studies indicate that nightmares frequency decreases after initiating CPAP treatment. However, data are still scarce. The present study included 19 patients (11 male, 8 female, mean age: 60.53 ± 13.85 yrs.) with sleep-apnea syndrome (mean Respiratory Disturbance Index: 70.08 ± 21.95/hr.) who completed a retrospective eight-point nightmare frequency scale and a five-point nightmare distress scale twice within the context of another study. The first time point was prior to initiating CPAP in the sleep medical center and the second time point after about three to four months (elicited via telephone). Although nightmare distress was lower at t2, nightmare frequency was increased. Despite the limitations, e.g., no information about CPAP compliance, this paradox finding – as nightmare frequency and nightmare distress are inter-related - indicates that sleep-related parameters, e.g., oxygen desaturations, apnea-related arousal, might not explain totally the inter-individual differences in nightmares frequency and nightmare distress in CPAP-treated sleep apnea patients. As a considerable number of patients still suffered from nightmares after CPAP initiation and should receive treatment, further research on nightmares in this patient group seems desirable.

Keywords: Nightmares, Nightmare distress, Sleep-related breathing disorders

1. Introduction

In 1855, the German physician Boerner (1855) observed that – after awakening from nightmares – his mouth and nose were blocked by a bed sheet or pillow; he could also provoke nightmares by experimentally blocking mouth and nose of two sleepers with a woolen cloth, e.g., after 30 s a nightmare of a hairy beast – half dog, half ape – occurred. Modern researchers have studied Boerner's hypothesis that shortage of breath can trigger nightmares in patients with sleep apnea (BaHammam & Almeneessier, 2019). However, so far, only BaHammam, Al-Shimemeri, Salama, and Sharif (2013) reported that most patients reported dream content related to suffocation whereas other studies (Gross & Lavie, 1994; MacFarlane & Wilson, 2006; Pagel & Kwiatkowski, 2010; Schredl et al., 2012; Schredl, Kraft-Schneider, Kröger, & Heuser, 1999) found only very few examples, e.g., "I'm deep under water that is getting darker and darker. I'm holding my breath, but I can't any longer. As I breathe in water, I try to scream, but there's no sound. I wake up in a sweat." p. 70, (Pagel & Kwiatkowski, 2010). In 204 morning dream protocols, elicited after diagnostic nights in the sleep lab, only one report included a reference to breathing (Schredl et al., 2012). To sum up, dreams with direct references to the breathing interruptions seem to be very rare. Carrasco et al. (2006) hypothesized that apnea-related arousals and desaturations stimulate the limbic system and, thus, increase negatively-toned dreams and nightmares, independent of their content. Negatively-toned dreams were found in untreated sleep apnea patients (Carrasco et al., 2006; Fisher et al., 2011) and nightmare frequency is higher in patients with sleep-related breathing disorders compared to representative samples (Lundetræ et al., 2018; Schredl et al., 2012; Schredl & Schmitt, 2019) supporting this notion. BaHammam et al. (2013) reported an association of nightmares with the Apnea-Hypopnea-Index (AHI) in REM sleep but a variety of studies (Schredl et al., 2012; Schredl & Schmitt, 2009; Schredl et al., 2006) reported no relationship between Respiratory Disturbance Indices (RDI) and nightmare frequency. One study (Pagel & Kwiatkowski, 2010) even reported a decrease of nightmare frequency with apnea severity but a subsequent study (Lundetræ et al., 2018) controlling for age and gender found, again, no correlation between apnea severity and nightmares. In this study, the patient group with AHI below 5 showed the highest incidence of nightmares, suggesting that the symptoms that prompted the patients to seek help in a sleep center – whether sleep apnea-related or not – might be associated with nightmares. Indeed, several studies (Fisher et al., 2011; Schredl & Schmitt, 2009; Schredl et al., 2006) indicate that nightmare frequency in patients with sleep-related breathing disorders is related to

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Submitted for publication: July 2020
Accepted for publication: July 2020
DOI: 10.11588/ijodr.2020.2.73791

depressive mood and anxiety; findings that are in line with the current etiological models of nightmares that postulate an interaction between disposition and stress (Gieselmann et al., 2019).

In most patients with sleep apnea and nightmares, CPAP treatment seems to decrease negatively-toned dreams and nightmares (BaHammam et al., 2013; Carrasco et al., 2006; Lovin, Rusu, Mutică, Necula, & Georgescu, 2013; Xue et al., 2020) with BaHammam et al. (2013) reporting a direct relationship between CPAP adherence and decrease in nightmare frequency. The positive effect of CPAP treatment on nightmare frequency was also reported for PTSD patients (El-Solh, Vermont, Homish, & Kufel, 2017; Krakow et al., 2000; Tamanna, Parker Jefferson, Lyons, & Ullah, 2014; Youakam, Doghraniji, & Schutte, 1998). One plausible explanation would be that the reduction of apneas and the resulting consolidation of sleep would have beneficial effects. Based on the disposition-stress model, one can also argue that the reduction of the burden related to untreated sleep-related breathing disorders like somnolence, cognitive deficits, depressive mood, reduced quality of life (Greenberg, Lakticova, & Scharf, 2017) would be the key to lower nightmare frequencies after CPAP initiation. To summarize, nightmare frequency seems to be associated to the presence of a sleep-related breathing disorder with two possible pathways that do not exclude each other: (1) a direct effect of apneas on REM sleep physiology and brain activation on nightmare occurrence, and (2) an indirect effect of daytime symptomatology that accompanied sleep apnea (or other sleep disorders), i.e., increased daytime stress levels that are associated with heightened nightmare frequency.

The present analyses are based on data stemming from a nightmare counselling study within which the patients completed scales measuring nightmares frequency and nightmare distress twice: prior to the diagnostic night in the sleep laboratory and after starting CPAP treatment (prior to the intervention). Based on the positive effects of CPAP treatment on sleep physiology and daytime symptomatology (Greenberg et al., 2017), we expected a reduction in both nightmare measures.

2. Method

2.1. Research Instruments

To elicit nightmare frequency, an eight-point frequency scale (0 = never, 1 = less than once a year, 2 = about once a year, 3 = about 2 to 4 times a year, 4 = about once a month, 5 = 2 to 3 times a month, 6 = about once a week, and 7 = several times a week) was presented. A specific definition for nightmares was not given in this study. Re-test reliability (4 week-interval) of the scale was high (r = .75) (Stumbrys, Erlacher, & Schredl, 2013). A previous study (Schredl, Dehmlow, & Schmitt, 2016) that include a question about nightmare topics indicated that “Alptraum” (German word for nightmare) is correctly understood by patients as they provided dream summaries displaying typical nightmare themes like being chased, falling etc.To determine the distress associated with the nightmares a five-point scale “If you currently experience nightmares, how distressing are they?” (0 = None, 1 = Low, 2 = Medium, 3 = High, and 4 = Very high) was presented. The retest reliability of this scale over a two-week interval was r = .673 (Schredl, Berres, Klingauf, Schellhaas, & Göritz, 2014).

2.2. Procedure and Participants

Overall, 29 patients who completed the nightmare questionnaire (nightmare frequency, nightmare distress) during their polysomnographic evaluation in the sleep laboratory of the Theresienkrankenhaus, Mannheim from February 2019 to August 2019 and indicated interest in nightmare-related telephone counselling were contacted by the second author. Eight persons (6 male, 2 female) were no longer interested in participating or wanted to postpone the counselling. Their mean age was 57.00 ± 11.30 yrs.; their mean Respiratory Disturbance Index (RDI) was 60.81 ± 15.25/hr. (N = 7). Of the remaining 21 patients, two male patients (age: 48 yrs. and 62 yrs.) were evaluated during CPAP treatment. The RDIs of 3.7/hr. and 7.0/hr. indicated that they were treated optimally. The other 19 patients (11 male, 8 female, mean age: 60.53 ± 13.85 yrs.) underwent diagnostic procedures in the sleep laboratory for the first time (including a full-night of cardia-respiratory polysomnography). The mean RDI was 70.08 ± 21.95/hr. (Range: 31.7 to 103.8/hr.) indicated that patients suffered from moderate to severe sleep apnea syndromes. All patients received a diagnosis of an obstructive sleep-apnea syndrome, with one patient diagnosed with a co-morbid insomnia disorder. After the first night, CPAP treatment was initiated and monitored for one or two nights in the sleep laboratory which is certified along the quality criteria of the German Sleep Society. The polysomnographic recordings were evaluated by a certified sleep physician (third author; JS). Other possible diagnoses like REM sleep behavior disorder could be excluded with high certainty, especially as polysomnography recordings were also available for the first (and second) CPAP night. Most of the 19 patients had additional somatic diagnose: Diabetes (N = 4), hypertension (N = 6), thyroid diseases (N = 4), heart diseases including coronary heart disease, atrial fibrillation, cardiomyopathy, heart failure etc. (N = 11), asthma (N = 2), lung diseases like chronic obstructive pulmonary disease (N = 2), and mental disorders like mood disorders, anxiety disorders (N = 4). Other diagnoses like allergies, cancer, and neurological disorders occurred only once in the patient group.

All patients within the study period were asked to fill out the questionnaire prior to their first night in the sleep laboratory which was embedded within the standard diagnostic routines. The patients who were interested in being contacted by the research team for the telephone counselling had to read and sign a 6-page informed consent according to the European General Data Protection Regulation (valid since May 25th, 2018) in order to use the personal data (addresses and phone numbers) by the experimenters. All patients willing to participate in the telephone counselling were included; there were no predefined exclusion or inclusion criteria. The patients who participated in the counselling were asked about nightmare frequency and nightmare distress using the same format of the questionnaire scales again at the beginning of the telephone session. The counselling was conducted by the second author. (KL). The statistical analyses were carried out with SPSS 25.0 for Windows. As nightmare frequency and nightmare distress were measured on ordinal level, Wilcoxon Ranks Sum tests and Mann-Whitney-U tests were applied.

Table 1. Changes in nightmare frequency scale and nightmare distress (N = 19 patients)

Category	Diagnostic night in the sleep lab (t_1)	Telephone interview (t_2)	Wilcoxon test	Correlation t_1-t_2
Nightmare frequency (NF)	4.84 ± 1.57	5.68 ± 0.82	z = 2.2, p = .030	r = .392, p = .097
$NF_2 > NF_1$: 10				
$NF_2 = NF_1$: 6				
$NF_2 < NF_1$: 3				
Nightmare distress (ND)	1.89 ± 0.96	1.33 ± 1.03	z = -1.8, p = .073	r = .414, p = .087
$ND_2 > ND_1$: 2		(N = 18)		
$ND_2 = ND_1$: 7				
$ND_2 < ND_1$: 9				

3. Results

Of the 19 patients who were first diagnosed in the sleep laboratory and provided nightmare measures at both time points, the distribution of nightmare frequency was as follows: Several times a week (N = 2), about once a week (N =7), two to three times a month (N = 3), about once a month (N = 1), about two to four times a year (N = 5), and about once a year (N = 1). High nightmare distress, moderate nightmare distress, and low nightmare distress was reported by 6 participants each, whereas one participant reported no nightmare distress. The changes from t1 to t2 (average interval: 108.32 ± 85.81 days; range: 28 to 355 days) are depicted in Table 1. Ten patients reported an increase in nightmare frequency, whereas only three patients reported a decrease, the difference between t1 and t2 was significant. For nightmare distress, a marginally significant decrease was observed (see Table 1): Nine patients reported lower nightmare distress at t2, and two patients reported an increase. For the two patients who were studied under CPAP treatment there was an increase in nightmare frequency (from 'about once a year' to "2 to 3 times a month") in one patient (parallel nightmare distress increased from none to low). The other patient reported nightmares several times a week at t1 but the t2 value is missing, nightmare distress decreased from high to medium. Both patients participated in the telephone counselling (the interval between t1 and t2 was 56 days for both patients).

The patients who were contacted but did not want to take part in the telephone counselling did not differ regarding age, gender distribution, and RDI (see Table 2) but reported – as expected – lower nightmare frequencies and nightmare distress.

4. Discussion

The longitudinal data showed an interesting time course of nightmares after CPAP initiation: On the one hand, nightmare distress decreased which is in line with previous research (BaHammam et al., 2013; El-Solh et al., 2017) but nightmare frequency increased within the time interval of about three to four months.

The main weakness of the study was that we did not have any information about CPAP adherence. Unfortunately, the strict General Data Protection Regulation in Europe did not allow us to include data for which the participants withheld consent (the objective of the principal study was nightmare counselling). Interestingly, BaHammam et al. (2013) also reported a marked decrease in nightmare frequency in patients with sleep apnea syndrome and frequent nightmares (once a week or more often) – even if they were not using CPAP or any alternative treatment option. That is, the finding of increased nightmare frequency could not simply be explained by low adherence rates. A second methodological issue is that the patients might have not participated in the counselling because their nightmares decreased to such an extent that they were not in need of counselling any longer. However, the analysis indicated that these patients already had lower nightmares frequencies at t1, and thus a possible bias due to these drop-outs seems to be negligible. None of the patients suffered from a comorbid posttraumatic stress disorder and, thus, the presence of PTSD could not have biased the present findings.

As nightmare frequency is the major factor related to nightmare distress (Schredl & Göritz, 2019), the decrease in nightmare distress despite the increase in nightmare frequency might be suggestive for the hypothesis that patients

Table 2. Nightmare frequency and nightmare distress of patients who participated in the telephone counseling and patients who did not

Variable	Patients participating in counselling (N = 19)	Patients not participating in counselling (N = 8)	Statistical test[1]
Men/Women	11/8	6/2	χ^2 = 0.7, p = .401
Age (yrs.)	60.53 ± 13.85	57.00 ± 11.03	t = -0.6, p = .529
Respiratory Disturbance Index (RDI)	70.08 ± 21.95	60.81 ± 15.25	t = -1.0, p = .316
Nightmare frequency	4.84 ± 1.57	3.63 ± 1.06	z = -1.9, p = .028[2]
Nightmare distress	1.89 ± 0.94	1.13 ± 0.64	z = -2.0, p = .023[2]

[1]Chi-Square test (χ^2), t-tests (t), and Mann-Whitney-U test (z), [2]one-tailed

with sleep apnea syndrome overestimate nightmare distress (the effect of nightmares on waking mood, concentration, sleep, etc.) because some of these effects are due to the sleep-related breathing disorder and not to nightmares. Unfortunately, the study did not included measures like depression inventories or quality of life measures in order to test the hypothesis that changes due to changes in daytime symptoms affect changes in nightmare frequency. The increase in nightmare frequency is not in line with previous findings (BaHammam et al., 2013; Carrasco et al., 2006; El-Solh et al., 2017; Lovin et al., 2013; Tamanna et al., 2014), i.e., it seems very likely that nightmare frequency at t2 in this patient group might not be related to sleep physiology but to daytime stressors. Research indicated that current stressors are an important factor in nightmare etiology (Levin & Nielsen, 2007). Also, the findings of heightened nightmare occurrence in patients with sleep complaints and AHI below 5 emphasize that non-sleep related variables might be of importance. So far, waking-life stressors, whether related to the disorder (somnolence, concentration problems, etc.) or related to other domains like occupation, partnership etc., have not been measured in a pre-post design in patients with sleep apnea starting CPAP treatment. Also the cross-sectional findings that sleep apnea severity is not related to nightmare frequency in most studies (Pagel & Kwiatkowski, 2010; Schredl et al., 2012; Schredl & Schmitt, 2009; Schredl et al., 2006) but to depression and anxiety (Fisher et al., 2011; Schredl et al., 2012; Schredl & Schmitt, 2009; Schredl et al., 2006) would support that current stressors are the key to explain nightmare frequency in CPAP-treated patients with sleep apnea syndrome. The assumption is that this patient group experienced more stress at t2 compared to their stress levels at t1.

To summarize, the present findings – given the limitations – indicate that CPAP treatment might reduce overall nightmare distress but does not automatically reduce nightmare frequency. Future studies should include measures of daytime stress as a possible explanation for this paradox effect. Previous research indicates that a considerable number of patients with sleep-related breathing disorders suffer from nightmares (Krakow, 2006; Schredl et al., 2012), however, nightmares are still under-diagnosed and under-treated, even in sleep medicine centers (Nadorff, Nadorff, & Germain, 2015; Schredl, 2010). One might add that nightmares in patients with sleep-related breathing disorders are also under-studied and should receive more attention from researchers and clinicians alike in the future.

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