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Dream recall frequency and sleep quality of patients with restless legs syndrome

M. Schredl

Sleep Laboratory, Central Institute of Mental Health, Mannheim, Germany

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The present study investigated the dream recall frequency and the pattern of influencing factors of patients with restless legs syndrome in comparison with healthy controls. The patients' dream recall frequency did not differ from that of healthy controls. Dream recall, however, was negatively associated with the number of periodic leg movements with arousal (PLMAI). Subjective estimates of sleep quality or feeling of being refreshed in the morning, on the other hand, did not correlate with the PLMAI index. Whereas subjective sleep parameters were related to dream recall frequency in healthy controls, no substantial relationships were found in the patient group, except for the positive correlation between sleep latency and dream recall frequency. The results of the present study can not be interpreted as clear evidence for the arousal–retrieval model of dream recall; it seems plausible that other factors, e.g. the functional state of the brain, are of importance in explaining dream recall in this patient group.

Introduction

Besides factors such as personality, visual memory, and interest in dreams, it was shown that sleep variables are also related to dream recall frequency (cf. Schredl and Montasser, 1996–97). Several investigations found a positive correlation between dream recall frequency and the frequency of nocturnal awakenings (Cory *et al*., 1975; Halliday, 1988; Schredl and Montasser, 1996–97) and low sleep quality (Arand *et al*., 1972; Lugaresi *et al*., 1983; Borbely, 1984; Schredl *et al*., 1997). In light of this research, it seems fruitful to study patients with sleep disorders in order to test whether the specific sleep disturbance affects dream recall.

Schredl *et al*. (1998a) showed that dream recall of patients with insomnia was elevated in comparison with healthy controls. This difference was due to the heightened frequency of nocturnal awakenings (questionnaire measure) in the patient group and this result is, thus, in line with the findings in healthy controls. Similarly, a heightened dream-recall frequency was found in two samples of patients with sleep apnea (Schredl, 1998a; Schredl *et al*., 1999), which was, however, not explained by the rated frequency of nocturnal awakenings. In addition, Gross and Lavie (1994) reported that dream recall was better for REM awakenings after the occurrence of sleep apneas than for REM awakenings after regular breathing. These findings might be explained by the cognitive arousal prior to the awakening; a hypothesis which was formulated by Koukkou and Lehmann (1983). Their functional state-shift model would predict that the closer the functional state of REM sleep is to the waking state, the better dream recall is. In order to test this hypothesis, EEG studies have to be conducted. A direct relationship between sleep apnea parameters such as respiratory disturbance index (RDI) and dream recall frequency was not found (Schredl, 1998a). For patients with narcolepsy, a heightened dream recall frequency was demonstrated (Schredl, 1998b), which can be interpreted as an effect of the disinhibited REM sleep regulation.

To summarize, the investigation of dream recall frequency in patients with various sleep disorders seems appropriate for testing the common models of dream recall.

The present study investigated the dream recall frequency of patients with restless legs syndrome. The key symptoms are (a) a desire to move the limbs, usually associated with paresthesia or dysesthesia; (b) motor restlessness (during wakefulness patients move the limbs in an attempt to relieve the discomfort); (c) symptoms worse or exclusively present at rest with at least partial and temporarily relief by activity; and (d) symptoms worse in the evening or night (International Restless Legs Syndrome Study Group, 1995). In these patients, periodic leg movements during sleep were often present (e.g. Hening *et al*., 1999). These leg movements can be accompanied by short arousals and cause pronounced sleep fragmentation (Sforza *et al*., 1999). It was hypothesized that the arousals affect dream recall frequency in these patients. In addition,

Correspondence to: Michael Schredl, Sleep Laboratory, Central Institute of Mental Health, PO Box 122120, 68072 Mannheim, Germany (fax: +49 62123429;
e-mail: Schredl@as200.zi-mannheim.de).

influencing factors on dream recall were studied and compared to those that have found to be of importance in healthy controls.

Method

Participants

Patients

131 patients (56 women, 75 men) diagnosed for restless legs syndrome both by polysomnographic recording of their night sleep and by clinical interviews were included in the study. Common diagnostic criteria (International Restless Legs Syndrome Study Group, 1995) were applied. Patients with a diagnosis of mental disorder such as major depression, dysthymia or anxiety disorder were excluded. Sleep apnea was ruled out by measuring nasal and oral airflow, chest and abdomen movements and blood oxygen saturation. The patients' mean age was 53.7 ± 12.1 years. The mean number of periodic leg movements during sleep associated with arousals per hour (PLMAI) was 9.54 ± 9.10. All patients were free from drugs (e.g. L-dopa, dopamine agonists) that might have affected symptomatology.

Healthy controls

Most of the questionnaire data were made available by the test author (Görtelmeyer, 1986); the control group comprised 762 persons (256 women and 506 men) whose mean age was 37.4 ± 11.3 years (Schredl *et al.*, 1998b). Controls were included if they did not report current complaints associated with sleep.

Research instruments

Sleep questionnaire

The sleep questionnaire (SF-B; Görtelmeyer, 1986) comprises 28 items measuring composite scores such as sleep quality (eleven items), feeling of being refreshed in the morning (seven items), emotional balance in the evening (seven items), tiredness in the evening (three items), sleep-related psychosomatic symptoms (four items), several waking stressors, dream recall frequency and the frequency of 'engagement with dreams' over the past two weeks. Waking stressors were assessed by one item covering four areas of possible problems, i.e. partnership, occupational, family-related and health problems, and a sum score was derived by adding the occurrences (ranging from 0 to 4). Dream recall frequency and 'engagement with dreams' were measured by five-point scales (1, never; 2, rare; 3, sometimes; 4, often; 5, very often). The five composite scores (averages) ranged from 1 to 5, since most scales of the sleep questionnaire, e.g. 'frequency of nocturnal awakenings', followed this five-point format. Sleep latency was measured by a six-point scale (1, less than five minutes; 2, 5–10 min; 3, 10–20 min; 4 , 20–30 min; 5, 30 min to one hour; 6, more than one hour).

Procedure

The patients completed the SF-B sleep questionnaire (Görtelmeyer, 1986) prior to their first night and spent two consecutive nights with standard polysomnographic recordings (EEG, EOG, EMG, ECG, respiratory parameters, blood oxygen saturation and anterior tibialis EMG) in the sleep laboratory. The questionnaires were part of the diagnostic routine in the sleep laboratory and were administered by a staff member who explains the polysomnographic procedures to the patient. Applying common classification criteria, the number of periodic leg movements during sleep associated with arousals per hour (PLMAI) were included in the analysis.

Questionnaire data provided by Görtelmeyer (1986) stemmed from surveys in different companies. The other subjects participated in different sleep and dream studies (Schredl *et al.*, 1998b). Only persons without

Table 1 Sleep questionnaire data of patients with restless legs syndrome and healthy controls (mean ± SD; *n* in parentheses)

Variable	Patients	Controls	*F*	*P*
Sleep quality	2.80 ± 0.85 (112)	4.15 ± 0.66 (635)	237.8	0.0001
Feeling of being refreshed in the morning	2.52 ± 1.05 (116)	3.35 ± 0.87 (638)	126.0	0.0001
Emotional balance in the evening	3.24 ± 0.80 (116)	3.69 ± 0.66 (636)	47.8	0.0001
Tiredness in the evening	3.80 ± 0.83 (117)	3.65 ± 0.71 (636)	7.3	0.0072
Sleep-related psychosomatic symptoms	2.34 ± 0.72 (130)	1.42 ± 0.40 (366)	143.3	0.0001
Jerks in legs or arms at sleep onset	2.82 ± 1.40 (129)	1.44 ± 0.71 (243)	86.4	0.0001
Sleep latency	3.68 ± 1.65 (130)	2.11 ± 1.14 (638)	101.6	0.0001
Nocturnal awakenings	3.79 ± 1.16 (129)	2.42 ± 1.07 (637)	80.1	0.0001
Number of problems	0.70 ± 0.80 (128)	0.41 ± 0.66 (516)	13.1	0.0003
Dream recall frequency	2.45 ± 1.06 (130)	2.33 ± 0.96 (761)	2.1	0.1453
Engagement in dreams	1.70 ± 0.95 (131)	1.71 ± 0.87 (762)	0.3	0.5785

Statistical test: ANCOVA with factors 'diagnosis' and 'gender' and with covariate 'age'; factor 'diagnosis' is depicted.

current complaints of sleep disorders were included. Since the test author applied slightly different versions of the questionnaire, the sample size for each scale differed considerably; minimal sample size ($n = 243$) was given for measures of jerks in legs and arms at sleep onset, whereas for sleep quality sample size was $n = 635$ (for details see Table 1).

Statistical analyses included ANCOVAs in order to control for age and gender. For ordinal scales, e.g. dream recall frequency, sleep latency ranks were analysed. For all group comparisons (ANCOVA) d.f. = 1.

Results

Sleep variables and dream recall

The comparison between patients with insomnia and healthy controls in terms of composite scores of the sleep questionnaire and scores of waking stressors are depicted in Table 1. Patients reported considerably lower scores for sleep quality as well as for the feeling of being refreshed in the morning and for emotional balance in the evening. Elevated scores were reported for tiredness in the evening, sleep-related psychosomatic symptoms, jerks in legs and arms at sleep onset, sleep latency, nocturnal awakenings, and the occurrence of problematic areas. Dream recall frequency and the scores of the 'engagement with dreams' item did not differ substantially between the two groups.

Factors influencing dream recall and engagement in dreams

For the healthy controls and the patient group, dream recall frequency and the variable 'engagement in dreams' declined slightly with age (see Table 2). To control for this effect, partial correlations were computed.

Dream recall frequency was negatively related to the number of periodic leg movements during sleep with arousals ($r = -0.183$, $P < 0.05$, Spearman-Rank correlation with age partialled out). Whereas dream recall frequency was significantly related to low sleep quality, frequent nocturnal awakenings, elevated sleep latency, low emotional balance in the evening and engagement in dreams in healthy controls, these variables, except for sleep latency and engagement in dreams, did not correlate substantially with dream recall frequency in the patient group. For the 'engagement with dreams' variable, the pattern of influencing factors between patients and healthy controls was quite comparable.

Subjective sleep quality and PLMAI index

In Table 3, the correlations between the subjective estimates of sleep quality, the feeling of being refreshed in the morning, the frequency of nocturnal awakenings, sleep latency, the frequency of jerks in legs or arms at sleep onset and the number of periodic leg movements associated with arousal are depicted. Interestingly, none of these variables correlated significantly with the extent of periodic leg movements during sleep; only the item 'jerks in legs or arms at sleep onset' was slightly related to the PLMAI index.

Discussion

The results concerning subjective sleep parameters, especially sleep quality, sleep latency, frequency of

Table 3 Correlations between subjective sleep parameters and the number of periodic leg movements with arousal during sleep (PLMAI) for the patient group

Variable	r	P
Sleep quality	0.011	0.9438
Feeling of being refreshed in the morning	−0.039	0.3477
Jerks in legs or arms at sleep onset	0.138	0.0668
Sleep latency	0.041	0.3273
Nocturnal awakenings	0.092	0.1609

Correlation coefficients were tested one-tailed.

Table 2 Correlations between dream recall frequency, the scale 'engagement in dreams', sleep parameters and occurrence of problems

	Dream recall		Engagement in dreams	
Variable	Patients	Controls	Patients	Controls
Sleep quality	−0.081	−0.186***	−0.240**	−0.290***
Sleep latency	0.181*	0.119**	0.128	0.179***
Nocturnal awakenings	0.052	0.170***	0.245**	0.212***
Emotional balance in the evening	−0.071	−0.110**	−0.429***	−0.250***
Number of problems	0.136	0.046	0.235**	0.117**
Engagement in dreams	0.435***	0.486***		
Age	−0.096	−0.085*	−0.118	−0.138***

*$P < 0.05$, **$P < 0.01$, ***$P < 0.001$, Spearman-Rank correlations with age partialled out (except for the variable age).

nocturnal awakenings and jerks in legs and arms at sleep onset, clearly reflect the clinical diagnosis of restless legs syndrome. In addition to poor sleep, patients reported lower emotional balance in the evening and more waking-life problems, possibly reflecting the stress due to the sleep disorder. However, the subjective estimates of various aspects related to sleep quality are not related to the severity of periodic leg movements with arousal during sleep. Whereas the restless legs symptomatology can be elicited by the clinician, the diagnosis of periodic limb movements during sleep requires a complete polysomnography. This is of special importance in the pharmocological treatment of these patients (administering retard L-dopa medication).

Dream recall frequency was not elevated in comparison with healthy controls, a finding which was predicted by the arousal–retrieval model (Koulack and Goodenough, 1976), as the frequency of nocturnal awakenings was considerably higher in the patient group (similar to the findings in patients with insomnia; Schredl *et al*., 1998a). The negative correlation between the index of periodic leg movements during sleep accompanied by arousals and dream recall may indicate that a second mechanism has to be considered. That is, the microarousals which cause a distinct sleep fragmentation interfere with the process of dreaming itself or with the process of dream recall (transition period between sleep and wakefulness). A recent study (Schredl *et al*., 1999), for example, reported that the respiratory disturbance index (RDI) was strongly related to dream bizarreness, i.e. high RDIs were associated with less bizarre dreams, a finding which may also be interpreted as a disturbance of the dream process caused by the arousals at the end of an apnea. Future studies which apply sophisticated EEG technology and analysis may shed more light on this topic. This will be very important for testing the functional state-shift model of Koukkou and Lehmann (1983).

The findings regarding the factors influencing dream recall frequency showed an interesting pattern. In the patient group, sleep variables were not related to dream recall (cf. arousal-retrieval model) as reported for healthy controls; only sleep latency correlated with dream recall frequency. Since sleep latency may reflect the severity of the restless legs syndrome, it can be hypothesized that symptom severity has an effect on dream recall, maybe in a sense of it being an emotional stressor. Since frequency, duration and intensity of symptoms were not measured in the present investigation, future studies should measure severity of restless legs symptomatology by questionnaires or immobilization tests, and relate these measures to dream recall frequency. As with patients with insomnia and sleep apnea (Schredl *et al*., 1997), sleep parameters did not affect dream recall. This can be seen as evidence that the presence of a sleep disorder impairs the relationship between sleep variables and dream recall.

Regarding the 'engagement with dreams' variable, the pattern of influencing factors was comparable between patients and healthy controls, i.e. low sleep quality as well as waking-life stress correlated positively with the frequency of engaging with dreams during the day. This can be explained in two different but not exclusive ways. On the one hand, research has shown that waking-life stress causes negatively toned dreams and that these, in turn, affect day-time mood (overview: Schredl, 1999). Negative dream emotions were significantly related to the 'engagement with dreams' variable in a previous study (Schredl, 1998a). In this line of argument, patients think about their dreams in order to cope with the dreams' negative effects on waking life (e.g. mood). On the other hand, empirical research as well as countless case reports have also shown that a person benefits from working on dreams (cf. Hill, 1996) and it thus seems plausible that persons in crisis are engaged with their dreams in order to find solutions to their waking-life problems. More detailed studies of dream use are necessary to test these two different hypotheses.

To summarize, while the results of the present study can not be interpreted as clear evidence for the arousal–retrieval model of Koulack and Goodenough (1976); it seems plausible that other factors, e.g. the functional state of the brain (cf. Koukkou and Lehmann, 1983) are of importance to explain dream recall in this patient group. Overall, it was demonstrated that the investigation of patients with sleep disorders can contribute valuable insights to the field of research in dream recall.

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