Sleep Medicine 14 (2013) 668–674

Contents lists available at SciVerse ScienceDirect

Sleep Medicine

journal homepage: www.elsevier.com/locate/sleep

Original Article

Subjectively impaired bed mobility in Parkinson disease affects sleep efficiency

Maartje Louter [a,b], Ruud J.G. van Sloun [c], Dirk A.A. Pevernagie [b,d], Johan B.A.M. Arends [c,e], Pierre J. Cluitmans [c,e], Bastiaan R. Bloem [b], Sebastiaan Overeem [a,b,*]

[a] Sleep Medicine Centre Kempenhaeghe, Heeze, The Netherlands
[b] Radboud University Nijmegen Medical Centre, Donders Institute for Brain, Cognition and Behaviour, Department of Neurology, Nijmegen, The Netherlands
[c] Department of Electrical Engineering, University of Technology, Eindhoven, The Netherlands
[d] Department of Internal Medicine, Faculty of Medicine and Health Sciences, University of Gent, Belgium
[e] Epilepsy Centre Kempenhaeghe, Heeze, The Netherlands

ARTICLE INFO

Article history:
Received 18 September 2012
Received in revised form 15 March 2013
Accepted 19 March 2013
Available online 3 May 2013

Keywords:
Hypokinesia
Sleep disorders
Sleep efficiency
Sleep quality
Parkinson's disease
Bed mobility

ABSTRACT

Background: Impaired bed mobility (IBM) may be an important reason for the high prevalence of sleep insomnia in Parkinson disease (PD). Here we assessed the influence of subjectively IBM on both subjective and objective sleep parameters in insomnia PD patients with (PD+IBM) and without (PD−IBM) concerns of IBM and controls with primary insomnia.
Methods: We included 44 PD patients with sleep initiation or maintenance concerns and 44 control subjects with primary insomnia. Sleep questionnaires, polysomnographic sleep parameters, activity data, and the number of body position changes were compared between PD patients and controls as well as within the PD group between PD+IBM vs PD−IBM subjects.
Results: There were 54.5% of PD subjects who reported having IBM. In the PD+IBM group, the number of body position changes was significantly lower than in PD−IBM (0.4/h [0.0–1.8] vs 1.4/h [0.0–4.6], $P = .015$). Sleep efficiency (SE) was lower in PD+IBM patients (63.5; 26.2–85.6) compared to PD−IBM patients (78.4; 54.8–92.6; $P < .001$).
Conclusion: PD patients who report IBM have fewer sleep-related body position changes (i.e., nocturnal hypokinesia) than PD patients without such concerns. Furthermore, objective SE is significantly diminished in these patients.

1. Introduction

Sleep disorders are of considerable burden to patients with Parkinson disease (PD). Up to 90% of PD patients report some form of sleep concern [1–3]. Sleep can be disrupted by a wide variety of causes and multiple sleep disorders often are present, including rapid eye movement sleep behavior disorder, restless legs syndrome, or sleep-disordered breathing. Difficulties with sleep initiation or maintenance are among the most prevalent sleep-related concerns in PD, commonly referred to as insomnia [4–6]. However, insomnia itself can have several different causes. For example, early morning awakenings can be related to an underlying depression. Nocturia can result in frequent awakenings throughout the night. Importantly, 45 to 80% of PD patients with insomnia report to experience issues when turning around in bed and finding a comfortable sleep position [2,5,7]. As such, subjectively impaired bed mobility (IBM) may be one of the most important reasons for the high prevalence of insomnia in PD patients [2,3,8].

The precise mechanism behind subjectively IBM in PD is not clear. The concern often is referred to as nocturnal hypokinesia. In addition, pain and overall muscle weakness can hinder a patient in finding a comfortable sleeping position [9]. Regardless of the mechanism, PD patients seem to have less body position changes during the night compared to the general population [10]. However, it remains unclear if there is a relation between concerns of IBM, actual number of body position changes, and sleep quality. Such a relation would have clinical relevance, as decisions to start nocturnal dopaminergic therapy often are made based on a subjective concern of IBM.

In our study we assessed the influence of subjectively IBM on objective sleep quality in patients with PD. Nocturnal body movements and sleep parameters were compared between insomnia PD patients with and without subjective reports of difficulty turning around in bed. In addition these parameters also were compared between PD patients and controls with primary insomnia.

* Corresponding author. Address: Department of Neurology, Radboud University Nijmegen Medical Centre, P.O. Box 9101, 6500 HB Nijmegen, The Netherlands. Tel.: +31 24 3651202; Fax: +31 24 3617018.
E-mail address: s.overeem@neuro.umcn.nl (S. Overeem).

1389-9457/$ - see front matter © 2013 Elsevier B.V. All rights reserved.
http://dx.doi.org/10.1016/j.sleep.2013.03.010

2. Patients and methods

2.1. Setting and study population

All patients were recruited from the outpatient clinic of the Sleep Medicine Centre Kempenhaeghe, The Netherlands, which is a tertiary centre for patients with sleep disorders. At this centre PD patients are seen in a dedicated program with a consultation followed by attended video-polysomnography (vPSG) that night.

Over a 2-year period, we included 44 consecutive PD subjects with a primary report of sleep initiation or maintenance issues (insomnia). All subjects were referred to our sleep centre as part of their regular care. Only subjects with idiopathic PD were included. As a control group, we included 44 subjects with primary psychophysiologic insomnia who received a nocturnal polysomnography as part of their clinical workup. Insomnia subjects with a primary nocturnal sleep disorder such as sleep-disordered breathing were excluded. The study was performed according to the guidelines of the Medical Ethical Committees of The Netherlands. All patients gave informed consent.

2.2. Clinical characteristics

Using a semistructured interview, PD patients were divided in those with a subjective concern of IBM (PD+IBM) and those without (PD−IBM). Demographic and clinical characteristics were recorded including disease duration. Disease stage was rated using the Hoehn and Yahr staging system during the on phase [11]. Overall dopaminergic treatment was quantified by calculating the levodopa equivalent dose (LED) in mg daily [12]. In addition, nocturnal dopaminergic treatment was estimated by the dopaminergic dose taken before going to bed in LED.

2.3. Sleep questionnaires

Subjective sleep quality was measured using the Pittsburg Sleep Quality Index (PSQI) [13]. The questionnaire assessed different aspects of nocturnal sleep, including sleep latency, duration and efficiency, subjective sleep quality, and use of sleep medication. Subscores were combined to yield a total score ranging from 0 to 21. Higher scores indicated worse quality of sleep. Poor sleep quality was defined as a PSQI score >5 [13]. Daytime sleepiness was assessed using the Epworth sleepiness scale (ESS) [14]. The ESS is an easy to use questionnaire in which patients have to indicate the possibility to fall asleep in eight different situations. The ESS ranges from 0 to 24 and a score of >10 indicated excessive daytime sleepiness.

In the PD patients we additionally administered two sleep scales specifically designed for PD, the Parkinson Disease Sleep Scale (PDSS) and the scales for outcomes in Parkinson disease [15,16]. The PDSS is a visual analog scale that addressed 15 items concerning sleep such as general sleep quality, daytime sleepiness, and nocturnal movements. The scores on the separate items can be converted to a total score that ranged from 0 to 150, with higher scores indicating better sleep quality [15]. The scales for outcomes in Parkinson disease contained two sections, assessing nocturnal symptoms and daytime sleepiness, respectively [16]. In addition, there was a final single question rating overall sleep quality.

2.4. Polysomnography

All patients underwent one night of supervised vPSG, using a dedicated recording system (Schwarzer AHNS, PelviTec BV, Delft, the Netherlands), scored with BrainRT software (BrainlaB, OSG, Rumst, Belgium). The vPSG registration included electroencephalography, electromyography of the submentalis muscle and the anterior tibialis muscle, electrooculography, electrocardiography, and a full respiratory montage. Sleep stages were scored using the American Academy of Sleep Medicine 2007 criteria [17]. The main sleep outcomes were total sleep time (TST), sleep efficiency (SE), sleep latency, percentage of time in a specific sleep stage, and number of awakenings per hour of sleep. Body position and movements were recorded using a position sensor placed on the thorax. Body position changes were verified using the video signal. Afterwards, total number of body position changes was determined. The actual number of body positions changes per night is influenced by the TST; therefore, the number of body position changes per hour was calculated. The outcomes were divided into body position changes per hour of sleep, per hour awake, and per hour of the total time in bed. A turn causing a short awakening of maximum 30 seconds directly followed by sleep was defined as a turn during sleep.

2.5. Actigraphy

All PD patients simultaneously underwent a night of actigraphy with the vPSG. The activity watch (Actiwatch, Cambridge Neurotechnology Ltd, Cambridgeshire, United Kingdom) was worn on the least affected side. Activity data were synchronized with the sleep stages recorded by the vPSG. For each subject the frequency of activity periods during sleep and wake was determined. Finally the duration of the activity period and the level of activity were calculated.

2.6. Data analysis

All statistical analyses were performed using SPSS for Windows (version 18). Scores on sleep questionnaires, vPSG data, and actigraphy were compared between PD+IBM subjects and PD−IBM subjects. In addition, sleep outcomes and frequency of body position changes were compared between PD subjects and a control group with primary insomnia. Finally, an exploratory analysis was performed on the relation between sleep quality and body position changes in PD subjects, comparing subjects with small and large numbers of nocturnal body position changes.

Data were not normally distributed according to Kolmogorov–Smirnov testing. Therefore, statistical comparisons were performed using the independent samples Mann–Whitney *U* test. Data are shown as median (range) and *N* (%). All results were of 2-tailed tests and the level of significance was set at $p < .05$.

3. Results

3.1. PD+IBM and PD−IBM subjects

3.1.1. Clinical characteristics

Of the 44 PD subjects with insomnia, 24 (54%) also reported IBM with difficulties turning around or finding a comfortable sleep position. The other 20 subjects did not report such concerns. The main type of insomnia in PD+IBM patients comprised of sleep maintenance concerns, as present in 23 (95.8%) of the subjects. Eight (33.3%) PD+IBM patients solely had sleep maintenance concerns, two (8.3%) reported sleep maintenance and initiation difficulties, six (25.0%) reported sleep maintenance concerns and early morning awakenings, and six (25.0%) reported all three types of insomnia. Within the PD−IBM group, sleep maintenance concerns also were the most common type and were present in 16 (80.0%) of subjects. Four (20%) subjects only had sleep maintenance difficulties, three (15%) subjects had both sleep initiation and maintenance difficulties, seven (35%) subjects had sleep