

Case report

Periodic arousals or periodic limb movements during sleep?

José Haba-Rubio*, Luc Staner, Jean Paul Macher

FORENAP (Institute for Research in Neuroscience and Neuropsychiatry, CH Rouffach, France)

Received 16 July 2001; received in revised form 12 October 2001; accepted 19 October 2001

Abstract

Periodic limb movements during sleep (PLMS), frequently found in polysomnograms, are often accompanied by arousals. The relationship is not clear, however, because PLMS can occur before, after or simultaneous to the electromyographic (EMG) activation. We describe the case of a patient who presents PLMS during two of three consecutive recording nights, and periodic arousals without motor activation on the other night. We conclude that, at least in some patients with a periodic limb movement disorder, there exists an underlying arousal disorder that produces periodic activation and deactivation of the cerebral cortex. © 2002 Elsevier Science B.V. All rights reserved.

Keywords: Periodic limb movements; Arousal

1. Introduction

Periodic limb movements during sleep (PLMS) are a common dysfunction of motor control during sleep [1], characterised by periodic episodes of repetitive and highly stereotyped limb movements, accompanied by signs of arousal on the electroencephalogram (EEG). Periodicity appears to remain constant within and across recording nights [2]. Arousals have important clinical significance since they have been implicated in the impaired daytime function and pathological sleepiness experienced by subjects with obstructive sleep apnoea [3] and healthy volunteers after sleep disruption induced by passively produced leg movements [4], and may be responsible for the non-restorative sleep reported by patients with periodic limb movements disorder (PLMD) [1]. The study of the relationship of EEG arousals and leg movements has shown that they may precede, follow or occur simultaneously [5]. The arousals may also be periodic, in absence of PLMS [6], and it was hypothesised that leg movements are not primary, but rather a phenomenon associated with an underlying arousal disorder.

2. Case report

A 44-year-old woman consulted for sleep disturbance and excessive daytime fatigue. She had no significant medical history, and no clinical evidence of other sleep disorders (no

snoring, sleep attacks, cataplexy or restless leg syndrome (RLS)). During the previous year, she had taken zopiclone intermittently (approximately two times a week). She took no medication, including zopiclone, during the month preceding three consecutive nights of sleep recordings. On the first night, she had typical PLMS, often associated with arousals, with an index of 20.5 movements per hour of sleep (Fig. 1). During the second night, she had occasional PLMS (PLMS index = 5.1 movements per hour of sleep) but, as can be seen in Fig. 2, she had 'periodic arousals' with an interburst interval corresponding to that observed the night before for PLMS (index of 20.3 arousals per hour of sleep). The experienced technician who surveyed the recordings excluded an electrode dysfunction of the tibialis EMG. PLMS were again present on the third night (index = 18.5 movements per hour of sleep), with typical distribution and similar interburst interval and burst duration to those observed during the first night (Table 1).

3. Discussion

This report suggests that periodic cortical arousals without limb movements and PLMS associated with arousals can coexist in the same patient, supporting the idea that limb movements are not primary but rather a phenomenon associated with an underlying arousal disorder.

This hypothesis has been advanced by other studies. Karadeniz et al. [5] have shown that a significantly higher number of EEG arousals precede the PLM movement; Montplaisir et al. [7] have shown that a large amount of

* Corresponding author. Tel.: 3-89-78-71-43; fax: 3-89-78-51-24.

E-mail address: jose.haba@forenap.asso.fr (J. Haba-Rubio).

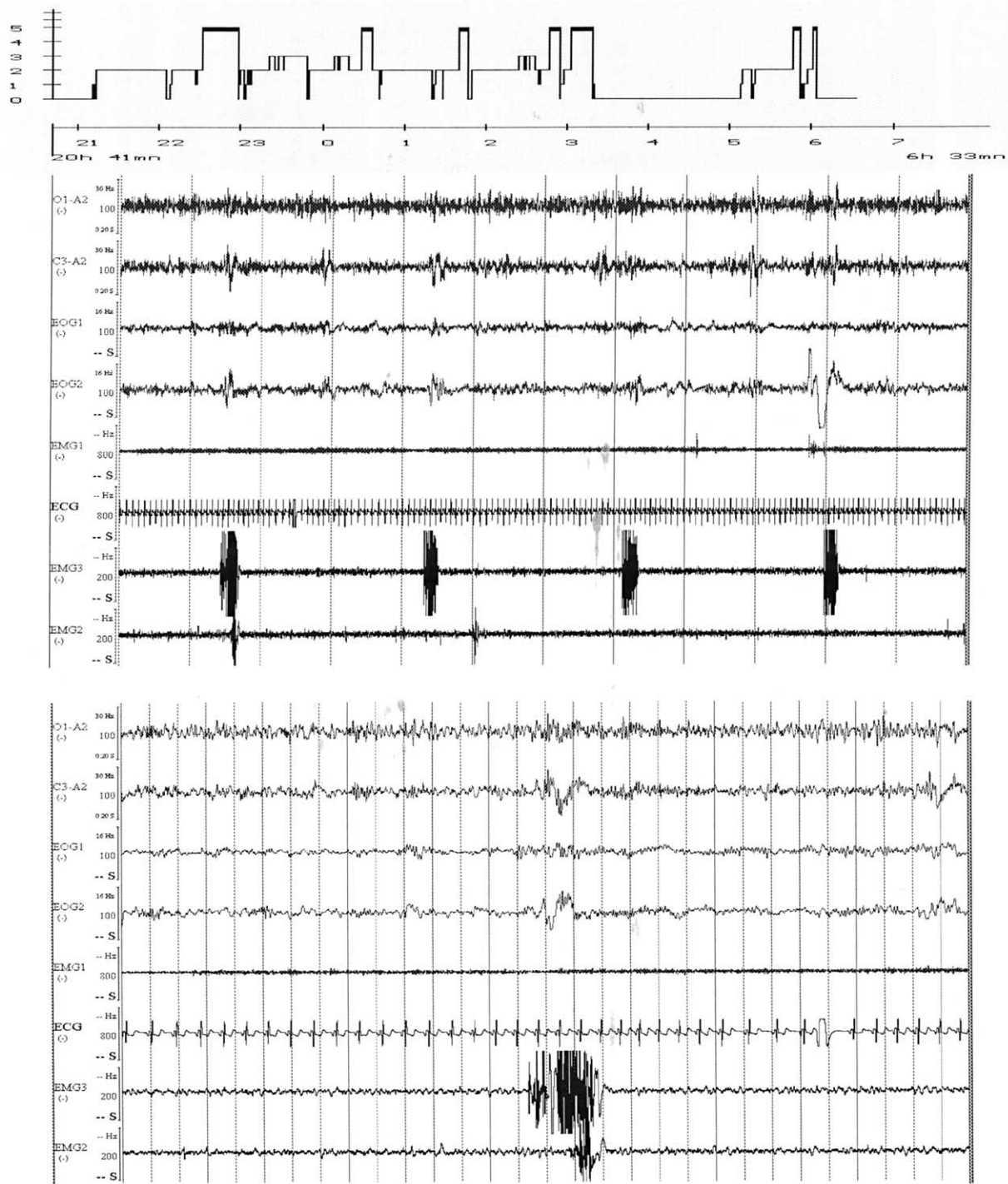


Fig. 1. (a) A 180-s polysomnogram segment of the first recording night, showing PLMS. (b) A 30-s polysomnogram segment of the first recording night.

K-alpha complexes appear prior to leg movements and, in addition, that the total amount of K-alpha activity remained unchanged after reduction of PLMS rate with L-Dopa. El-Ad et al. [8] recently described the case of a 'missing PLM' in a patient who has periodic arousals without limb movements, preceded and followed by PLMS associated with arousals, during the same night.

It has been shown that PLMS can vary considerably from night to night in middle aged and elderly individuals [9]. However, variation seems to occur somewhat randomly, and is particularly marked in individuals with sleep complaints or daytime fatigue. Single night polysomnography should not be enough to exclude a PLMD.

The absence of PLMS on one night with the continuing

presence of arousals on other nights suggests a threshold for motor activation, which may be influenced by factors like sleep instability or emotional state.

Periodic arousals may be the result of a central nervous system oscillator that produces periodic activation and deactivation of the cerebral cortex, a mechanism that may under-

lie such sleep phenomena as the cyclic alternating pattern [10]. The leg movements in PLMD could play an additive role in sleep disruption by inducing full awakenings. Treatments that reduce PLMS without affecting arousals, while ameliorating the symptoms, address an epiphenomenon rather than the underlying nervous system dysfunction.

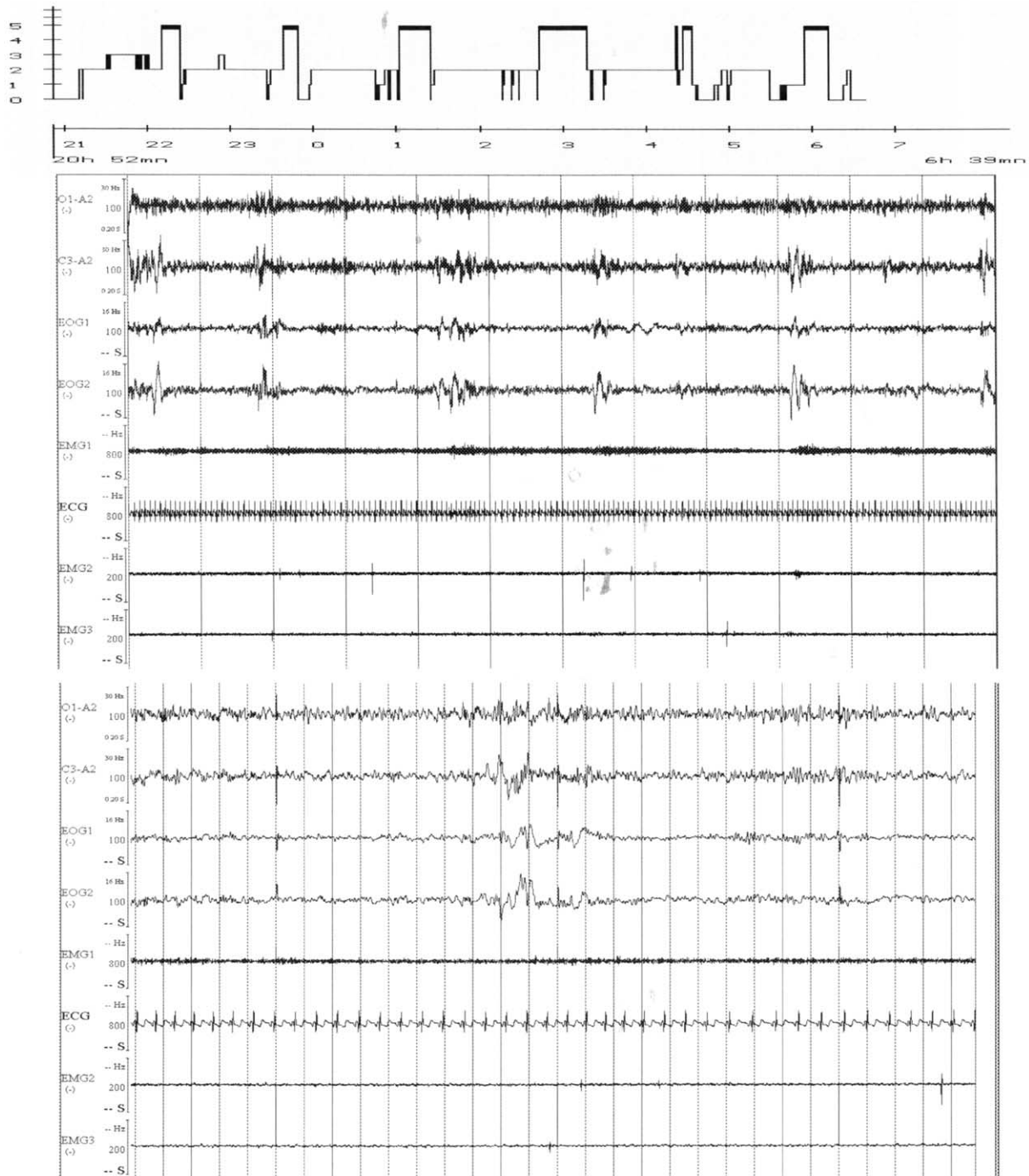


Fig. 2. (a) A 180-s polysomnogram segment of the second recording night, showing periodic arousals, without motor activation. (b) A 30-s polysomnogram segment of the second recording night. Channels shown include two EEG channels (O1–A2, C3–A2), two electro-oculogram channels (Hor_OC, Vert_OC), chin EMG channel (Mchin), electrocardiogram channel (ECG), two anterior tibial EMG channels (L Tibial, R tibial).

Table 1
Results of polysomnographic data

	Night 1	Night 2	Night 3
Total sleep time (min)	407.5	502.5	442.5
Sleep latency (min)	29.5	16.6	10.5
Sleep efficiency (%)	69.2	86	77.7
Stage 1 (%)	4.8	8.4	4.3
Stage 2 (%)	66.9	64.8	71.4
Slow wave sleep (%)	10.7	5.8	5.7
REM sleep (%)	17.7	21.1	18.7
Number of PLMS	139	43	137
PLMS index	20.5	5.1	18.5
Number of PLMS arousal	77	36	31
PLMS arousal index	11.3	4.3	4.2
Number of arousals	147	170	104
Arousal index	21.6	20.3	14.1

References

- [1] Hening WA, Allen RP, Walters AS, Chokroverty S. Motor functions and dysfunctions of sleep. In: Chokroverty S, editor. *Sleep disorders medicine*. Boston, MA: Butterworth Heinemann, 1999. pp. 441–507.
- [2] Montplaisir J, Godbout R, Boghan D, Dechaplain J, Young SN, Lapierre G. Familial restless legs with periodic movements in sleep: electrophysiologic, biochemical and pharmacological study. *Neurology* 1985;35:130–134.
- [3] Stepanski J, Lamphere J, Badia P, Zorik F, Roth T. Sleep fragmentation and daytime sleepiness. *Sleep* 1984;7(1):18–26.
- [4] Bonnet MH. Sleep restoration as a function of periodic awakening, movement or electroencephalographic change. *Sleep* 1987;10:364–373.
- [5] Karadeniz D, Ondze B, Besset A, Billiard M. EEG arousals and awakenings in relation with periodic leg movements during sleep. *J Sleep Res* 2000;9:273–277.
- [6] MacFarlane JG, Bonmarco C, Shahal B, Lue F, Moldowsky H. Sleep and symptoms in patients with periodic K-alpha EEG activity vs periodic limb movements during sleep. *Sleep Res* 1991;20:282.
- [7] Montplaisir J, Boucher S, Gosselin A, Poirier G, Lavigne G. Persistence of repetitive EEG arousals (K-Alpha complexes) in RLS patients treated with L-Dopa. *Sleep* 1996;19(3):196–199.
- [8] El-Ad B, Chervin RD. The case of a missing PLM. *Sleep* 2000;23(4):450–451.
- [9] Bliwise DL, Carskadon MA, Dement WC. Nightly variation of periodic leg movements in sleep in middle aged and elderly individuals. *Arch Gerontol Geriatr* 1988;7:273–279.
- [10] Terzano MG, Mancina D, Salati MR, Costani G, Decembrino A, Parrino L. The cyclic alternating pattern as a physiologic component of normal NREM sleep. *Sleep* 1985;8:137–145.