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Short communication

The first night effect during polysomnography, and patients' estimates of sleep quality

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ABSTRACTS

We surveyed patients the next morning after in-laboratory polysomnography (PSG) to compare the first night effect (FNE) and reverse first night effect (RFNE) in different sleep disorders. A questionnaire was given to 852 patients with insomnia (n = 171), restless legs syndrome (n = 186), obstructive sleep apnea (n = 369), simple snoring (n = 54), REM sleep behavior disorder (n = 39), and hypersomnia (n = 33). FNE was seen in 48.9%, 30.5% slept as usual, and 20.6% had RFNE. The highest incidences of FNE were seen in OSA, simple snoring, hypersomnia, and in men. We propose to use these findings as a reference when interpreting nocturnal in-laboratory PSG results.

1. Introduction

In-laboratory polysomnography (PSG) is performed in a different environment than the patients' usual one. Therefore, it may result in worse sleep quality (Tamaki et al., 2005). This is called the first night effect (FNE) (McCall and McCall, 2012) and is defined by longer sleep onset latency, lower sleep efficiency, longer REM latency, decreased REM, and increased alpha (Tamaki et al., 2005). On the other hand, some patients may sleep better than usual which is called the reverse first night effect (RFNE). Although "serial night PSG" may compensate for FNE and RFNE, it is less feasible and in fact some studies have indicated that it has no advantage over single night PSG (Le Bon et al., 2001). There have been few studies assessing the FNE in different sleep disorders. We hypothesized that different sleep disorders have different rates of FNE, RFNE, and usual sleep in a PSG lab environment. The purpose of this study was to assess FNE, RFNE, and patients' estimates of sleep quality following an in-laboratory PSG in various sleep disorders.

2. Methods

The study was approved by the Institutional Review Board of our regional tertiary university hospital. We retrospectively reviewed the records of all adult patients (20–80 years) who had visited our sleep clinic and had a nocturnal in-laboratory PSG between March 2016 and December 2017. Out of 1479 patients, those with overlapping sleep disorders (54), those who did not complete questionnaires (531), and those < age 19 (42), were excluded and the remaining 852 patients were included in the study. Sleep disorders were diagnosed according to the international classification of sleep disorders-3. Hypersomnia was defined as primary complaint of daytime sleepiness with ESS ≥10, and simple snoring was defined as snoring with an AHI <5. All patients had completed the Korean versions of the Insomnia severity index, Epworth sleepiness scale, Pittsburgh sleep quality index, Beck depression inventory, and Beck Anxiety Inventory questionnaires at the time of their clinic visit (Cho et al., 2014). The PSGs were performed according to the standards set by the American Association of Sleep Technologists guideline, and were scored according to the 2007 American Academy of Sleep Medicine criteria. The morning following PSG all subjects completed a questionnaire on quality of sleep the night before using Visual Analog Scale (VAS), self-reported bed time, sleep latency, time spent in bed, time leaving bed, sleep duration, number of arousals, and presence or absence of dreams. In this study the VAS was used to screen for FNE and RFNE. If the patient slept better than usual, numbers were added to zero, otherwise subtracted from zero (Paul-Dauphin et al., 1999). The distribution of VAS was confirmed by frequency analysis. Chi-Square test, one-way analysis of variance (one-way ANOVA), and Pearson's correlation were used to compare demographic data. For post-hoc comparison Scheffe test was used for one-way ANOVA. Statistical significance was based on p-value < 0.05.

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Table 1
Demographic, sleep characteristics and comparison of FNE and RFNE ratios in each sleep disorder.

		Total (n = 852)	Insomnia[a] (n = 171)	RLS[b] (n = 186)	OSA[c] (n = 369)	Simple snoring[d] (n = 54)	RBD[e] (n = 39)	Hypersomnia[f] (n = 33)	p-value (post-hoc)
	Age (years)	51.68 ± 14.62	51.12 ± 14.29	54.13 ± 13.40	51.79 ± 14.27	46.43 ± 12.55	65.56 ± 6.80	31.79 ± 13.52	< 0.001 (a < b,c,d,f < e)
	Females(%) /males(%)	363(42.6) / 489(57.4)	114(66.7)/57(33.3)	118(63.4)/68(36.6)	85(23.0)/284(77.0)	15(27.8)/39(72.2)	15(38.5)/24(61.5)	16(48.5)/17(51.5)	< 0.001
Sleep scale	ISI	13.57 ± 7.77	20.73 ± 4.65	16.05 ± 6.12	10.92 ± 7.29	6.05 ± 4.11	5.80 ± 4.59	6.97 ± 4.04	< 0.001 (d,e,f < c < b < a)
	PSQI	10.81 ± 5.07	14.52 ± 3.75	12.79 ± 4.34	9.29 ± 4.64	5.61 ± 3.41	6.27 ± 3.99	7.42 ± 3.59	< 0.001 (d,e < c < a,b)
	ESS	6.54 ± 4.97	5.08 ± 4.79	6.17 ± 4.50	7.02 ± 4.97	4.88 ± 2.66	5.70 ± 3.82	13.97 ± 4.37	< 0.001 (a,b,c,d,e < f)
	BDI	15.62 ± 9.97	18.95 ± 10.22	17.05 ± 10.83	13.71 ± 9.07	11.25 ± 7.81	12.79 ± 8.49	14.84 ± 8.63	< 0.001 (d < a)
	BAI	11.30 ± 10.02	14.00 ± 10.08	13.41 ± 11.83	9.61 ± 9.05	7.61 ± 5.82	7.76 ± 6.21	7.00 ± 5.44	< 0.001 (f < a)
Self-reported	Sleep latency (min)	72.37 ± 79.65	99.28 ± 82.01	94.04 ± 87.97	64.39 ± 76.45	42.64 ± 54.77	47.78 ± 68.15	31.06 ± 34.43	< 0.001 (d,e,f < a,b)
	Time leaving bed	5:40 ± 1:16	5:36 ± 1:31	5:32 ± 1:17	5:37 ± 1:07	5:53 ± 1:02	5:24 ± 0:45	7:01 ± 1:29	< 0.001 (a,b,c,d,e < f)
	Total Sleep time (hr)	4.59 ± 2.01	3.50 ± 2.01	3.95 ± 1.91	4.88 ± 1.75	5.61 ± 1.83	5.75 ± 1.27	6.96 ± 1.96	< 0.001 (a < d,e < f)
	Number of times awake during sleep	3.59 ± 3.01	4.24 ± 4.13	3.49 ± 2.54	3.54 ± 2.49	3.57 ± 4.37	2.16 ± 1.48	3.27 ± 1.96	0.005 (e < a)
FNE		417(48.9)	68(39.8)	76(40.9)	205(55.6)	31(57.4)	18(46.1)	19(57.6)	0.003
Usual sleep		260(30.5)	54(31.6)	67(36.0)	109(29.5)	12(22.2)	12(30.8)	6(18.2)	
RFNE		175(20.6)	49(28.6)	43(23.1)	55(14.9)	11(20.4)	9(23.1)	8(24.2)	

3. Results

The 852 subjects were grouped as insomnia (n = 171), restless legs syndrome (RLS, n = 186), obstructive sleep apnea (OSA, n = 369), simple snoring (n = 54), REM sleep behavior disorder (RBD, n = 39), and hypersomnia (n = 33; 6 narcoleptic, 27 idiopathic hypersomnia). Overall mean age was 51.68 ± 14, 489 males (57.4%), and 363 females (42.6%). Male ratio by disorder group was: insomnia 33.3%, RLS 36.6%, OSA 77%, simple snoring 72.2%, RBD 61.5%, hypersomnia 51.5% (Table 1).

For all groups, 48.9% reported sleeping worse than usual (FNE), 20.6% better than usual (RFNE), and 30.5% same as usual. Insomnia and RLS groups had relatively higher rates of RFNE and usual sleep than other sleep disorders. The OSA and simple snoring groups showed relatively higher rates of FNE while the hypersomnia group had relatively lower rates of usual sleep. Overall, the highest FNE ratio occurred in OSA, simple snoring, and hypersomnia groups. Instead, the RFNE ratio was highest in insomnia, RLS, RBD, and hypersomnia groups. The highest ratio of usual sleep was seen in insomnia and RLS groups.

There was a significant gender difference (P = 0.007). Overall, men had more FNE while women had more usual sleep and RFNE. Men in insomnia and OSA groups had higher rates of FNE while women had more RFNE or usual sleep (insomnia P = 0.004, OSA P = 0.046). There were no significant gender differences in other groups.

For all patients, older (>65 years) patients had higher rates of usual sleep, while younger patients had more FNE or RFNE (P = 0.002). In OSA, older patients reported more usual sleep and RFNE, while FNE was more frequent in those <65 years (P = 0.029). The other sleep disorders did not show any significant age-dependent differences in FNE, usual sleep, or RFNE.

There was no significant correlation between BAI and VAS (P = 0.099) in any sleep disorder. The correlation between BDI and VAS was significant (P = 0.044) in the total group, although the degree of correlation was weak (r = 0.077). There was no significant difference in the correlation between BDI and VAS in any sleep disorder.

4. Discussion

We found more FNE than RFNE (48.9% vs. 20.6%, respectively), but with varying rates in different sleep disorders. Sleeping in a foreign environment while connected to the equipment, as well as innate factors such as depression and anxiety, may explain FNE (McCall and McCall, 2012). The incidence of FNE was higher in OSA, simple snoring, and hypersomnia. A previous study also showed significant FNE in various sleep disorders but more pronounced in insomnia (Newell et al., 2012). We found relatively high rates of usual sleep and RFNE in insomnia and RLS patients, while some studies have reported high rates of RFNE and FNE only in insomnia (Ridedel et al., 2001). The RFNE likely reflects absence of perpetuating factors that are present in the patients' usual sleep environment triggering conditioned arousal (McCall and McCall, 2012). RLS patients have been reported to have more RFNE and usual sleep but in these patients night-to-night variability is often present, especially in the presence of periodic limb movements during sleep.

Patients with insomnia, RLS, RBD and hypersomnia showed higher rates of RFNE possibly because the disease features offset the discomfort of sleeping in a new environment (Zhang et al., 2008). A condition such as insomnia with higher rates of both FNE and RFNE might be better studied through serial night PSG. Women report poor quality of sleep more than men do, however PSG findings indicate otherwise (Akerstedt et al., 2016). We found higher rates of FNE in men especially those with insomnia and OSA, while women had more RFNE and usual sleep. Further research is needed to determine whether there are additional variables involved in FNE and RFNE, and whether serial PSG and home sleep test would shed more light on this issue.

Conflict of interest

None.

Disclosures

All authors report no disclosures.

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Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.psychres.2019.02.011.

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