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Original Article

Daytime somnolence in adult sleepwalkers

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ABSTRACT

Objectives: Sleepwalkers often complain of excessive daytime somnolence (EDS). Our retrospective study aimed to document the presence of EDS in a substantial sample of sleepwalkers and to explore the contribution of other sleep disorders, nocturnal sleep disruption, and sleep depth to the alteration of their daytime vigilance.

Methods: Seventy adult sleepwalkers and 70 control subjects completed the Epworth Sleepiness Scale (ESS). Sleepwalkers also were studied for one night in the sleep laboratory. We compared the sleep profiles of 32 somnolent vs 38 nonsomnolent sleepwalkers and investigated the relationship between ESS scores and sleep-related variables.

Results: No differences were found in polysomnographic (PSG) parameters. Slow-wave activity (SWA) also was similar in the two subgroups. Sleepwalkers' ESS scores were not correlated with their body mass index (BMI) or periodic limb movements during sleep (PLMS) index, but they tended to be negatively correlated with indices of respiratory events.

Conclusions: The EDS reported by adult sleepwalkers does not appear to be explained by the presence of concomitant sleep disorders or PSG signs of nocturnal sleep disruption. These results raise the possibility that EDS is part of the sleepwalking phenotype and that it is linked to its underlying pathophysiology.

1. Introduction

Somnambulism (or sleepwalking) is defined by the American Academy of Sleep Medicine as "a series of complex behaviors that are usually initiated during arousals from slow-wave sleep (SWS) and culminate in walking around with an altered state of consciousness and impaired judgment." Episodes generally develop from sudden but incomplete arousals from SWS and less often from stage 2 sleep [1–4]. No major differences in the percentage of sleep stages or in sleep stage distribution have been observed between sleepwalkers and age-matched controls. The main distinguishing findings are the increased number of awakenings and electroencephalographic (EEG) microarousals (MA), specifically occurring in the SWS of sleepwalkers even on nights without episodes [2,5,6]. Some studies also found decreased slow-wave activity (SWA) in sleepwalkers' first sleep cycles of the night [6,7] and a different time course of their δ activity decay across the night [2].

Despite the documented increase in sleepwalkers' nocturnal awakenings during SWS and their reduced SWA, there is a paucity of information on sleepwalkers' daytime functioning. Recently a large survey of the general population reported that somnambulism was associated with sleepiness [8]. Additionally a laboratory study of 10 adults who consulted a sleep clinic for chronic somnambulism revealed that they reported excessive daytime somnolence (EDS) [9], even after a night without sleepwalking episodes. In fact, the sleepwalkers had significantly lower mean sleep latencies on the Multiple Sleep Latency Test (MSLT) than matched control subjects. Moreover, 7 of the 10 sleepwalkers had a mean latency below 8 min, which is the accepted threshold for clinical somnolence [10].

Our study aimed to better document the presence of EDS in a larger sample of subjects consulting for sleepwalking and to use polysomnography to assess the contribution of nocturnal events, nocturnal sleep disruption, and poor sleep depth to sleepwalkers' EDS.

2. Methods

2.1. Subjects

Seventy sleepwalkers (40 women, 30 men; mean age, 33.1 ± 10.1 years; age range, 17–60 years) were included in our

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study. All subjects were investigated for at least one night in the sleep laboratory and completed the Epworth Sleepiness Scale (ESS) [11]. None of the subjects had sleep-disordered breathing or concomitant neurologic or psychiatric disorders, and none of the subjects were taking psychotropic medications. Seventy control subjects (42 women, 28 men; mean age, 35.5 ± 14.0 years; age range, 20–56 years) without a sleep disorder only completed the ESS for comparisons purposes.

2.2. Data collection

The ESS is a self-administered scale in which the subject is asked to rate his or her chance of dozing off in each of the 8 daily life situations based on a 4-point scale (0–3). Thus the total score can range from 0 to 24. The cutoff point for pathologic EDS was established as a score of greater than 10 [12]. The body mass index (BMI) was obtained for every subject. Information regarding familial history of sleepwalking was obtained from the subjects during the clinical interview. A positive family history was defined as the presence of current or prior sleepwalking in at least one first-degree relative of the patient.

Polysomnographic (PSG) recordings were performed between 2007 and 2011 using a 32-channel Grass polygraph (sensitivity, 7 μV/cm; bandpass, 0.3–100 Hz). Signals were relayed to a PC, digitized at a sampling rate of 256 Hz using commercial software (Harmonie, Stellate Systems, Montreal, Canada). PSG recordings and electrode placement were performed according to the international 10–20 system and included electrooculograms, submental electromyography, electrocardiogram, and EEG, which were recorded with a linked-ear reference (or a linked-mastoid reference). Surface electromyography of the bilateral anterior tibialis also was used to quantify periodic limb movements during sleep (PLMS) according to the standard method [13]. Respiration was monitored using an oronasal cannula and a thoracoabdominal plethysmograph. Oxygen saturation was recorded with a finger pulse oxymeter. None of the subjects had an index of respiratory events (number of apneas + hypopneas) greater than 15 per hour of sleep.

The scoring of the sleep stages was performed by trained technicians according to the standard method [13]. MA were scored on the central and occipital leads according to the standard criteria [13]. The MA index represents the number of MA per hour of sleep. In addition to these indices, the following sleep architecture variables were retained for analysis: sleep latency, sleep duration, sleep efficiency, total number of awakenings, percentage of time spent in each sleep stage, duration (in minutes) of SWS, percentage of SWS in each third of the sleep period, number of awakenings during SWS, all-night MA index, MA in SWS index, and number of somnambulistic episodes during the PSG investigation.

Finally, the SWA (0–4.5 Hz) during nonrapid eye movement (NREM) sleep and also during SWS in the first two sleep cycles was measured in two subgroups of sleepwalkers: 15 subjects with an ESS score below 7 (9 women, 6 men; mean age, 31.3 years) and 15 subjects with an ESS score greater than 12 (9 women, 6 men; mean age, 33.4 years). Five subjects in each subgroup had the linked-mastoid reference and 10 subjects in each group had the linked-ear reference. Spectral analyses were computed with a commercial software package (Stellate Systems, Montreal, Canada) on the C3 to A2, F3, and F4 leads using fast Fourier transform algorithms with cosine tapering on 4-s artifact-free sections, yielding a spectral resolution of 0.25 Hz.

2.3. Statistical analyses

To determine if the distribution of sleepwalkers' scores on the ESS was significantly different from that of nonsleepwalkers, *t* tests were used to compare the group of 70 sleepwalkers to a group of 70 control subjects (distributions were normal). To fully explore the relationship between EDS and other variables, two statistical approaches were taken. First sleepwalkers were divided into two groups based on their ESS score. Based on established cutoff points, sleepwalkers with an ESS score between 0 and 10 were considered nonsomnolent and those with an ESS score $\geqslant 11$ were classified into the somnolent group. The *t* tests were used to compare the two subgroups on all variables. The second approach consisted of using correlational analyses with Pearson product moment correlation coefficients to assess if a linear relationship existed between ESS scores and the other variables of interest. Finally Mann–Whitney *U* tests were used to compare the mean SWA of the two subgroups of 15 subjects. In all statistical analyses, the significance level was set at $P < .05$.

3. Results

The mean ESS score for the 70 sleepwalkers was significantly higher than that of controls (9.1 ± 4.5 vs 5.8 ± 3.4; $P = .000003$). Thus nearly half (45.7%) of the subjects who consulted a sleep disorders center for sleepwalking without concomitant depression reported EDS, as indexed by a score greater than 10 on the ESS. The distribution of ESS scores per group is shown in Fig. 1.

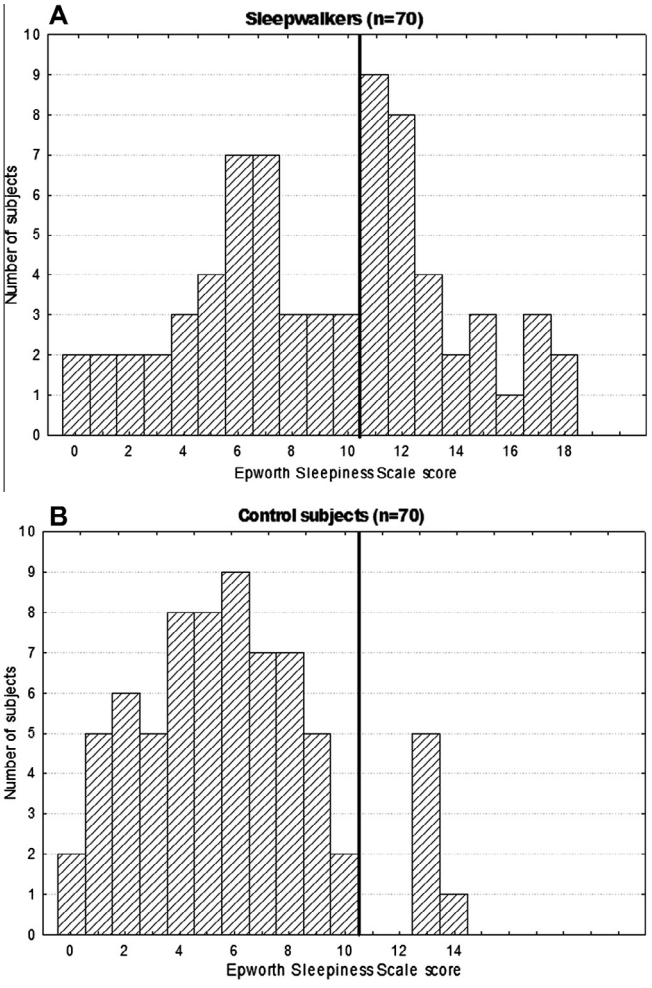

Fig. 1. Distribution of Epworth Sleepiness Scale scores in 70 adult sleepwalkers (A) and 70 adult controls (B). The bold vertical line represents the cutoff point for pathologic somnolence.