



Original Article

Gender differences in REM sleep behavior disorder: a clinical and polysomnographic study in China



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ABSTRACT

Objective: Rapid eye movement (REM) sleep behavior disorder (RBD) has been considered a male-predominant parasomnia, and there is little comparative data on potential differences between males and females. Therefore, the aim of our study was to examine and characterize gender difference in RBD. **Methods:** Ninety patients diagnosed with RBD were consecutively recruited from a sleep medicine clinic. All patients were assessed by a RBD questionnaire and overnight video polysomnography. Demographic, clinical data, presence of dreams and dream-enacting behaviors, sleep parameters and electromyographic (EMG) activity were compared for male and female patients with RBD.

Results: Females were significantly younger than males, both in the mean age of RBD onset (45.3 ± 19.3 vs. 56.2 ± 14.1 ; $p = 0.027$) and the mean age at diagnosis (50.4 ± 18.2 vs. 61.1 ± 14.1 ; $p = 0.022$). Secondary RBD was 21% in males and 44% in females ($p = 0.021$). Antidepressant use was more common among females (22%) than males (2%; $p = 0.003$). There was no significant gender difference in dream content (eg, violent and frightening dreams) of RBD patients. However, females had less dream-enacting behaviors, especially in movement related dreams and falling out of bed. Interestingly, no significant difference was found in the quantification of EMG activity during REM sleep between male and female patients.

Conclusions: We found significant gender differences in demographics, associated comorbidities, and dream-related behaviors in patients with RBD. Female RBD patients reported significantly less behavior during dreams, but there was no significant gender difference in EMG activity during REM sleep.

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1. Introduction

Rapid eye movement (REM) sleep behavior disorder (RBD) is a parasomnia characterized by a loss of muscle atonia during REM sleep and dream-enacting motor activity. These abnormal behaviors can cause sleep disruption and injury for the patient or bed partner [1]. Recently, the prevalence of RBD was updated to 2.01% in the elderly population [2]. Previous studies have reported a striking male predominance in typical RBD, with more than 80% of the patients being male [3–7]. Some studies also report that males had more aggressive and violent RBD behaviors than did females [8,9]. However, most existing studies involved small case series or provided very little information about female patients, and gender differences in patients with RBD have not been well characterized. Thus, we performed a

study on 90 male and female RBD patients to explore possible gender differences in demographics, RBD symptoms, sleep architecture and REM sleep without atonia (RWSA).

2. Methods

2.1. Subjects

A consecutive series of 90 patients with a diagnosis of RBD were recruited from the Sleep Medicine Clinic in West China Hospital. RBD was diagnosed based on the criteria of International Classification of Sleep Disorders (edition 2) (ICSD-2) as follows: (1) clinical history of RBD symptoms that are potentially harmful or result in sleep-related injuries to self or sleep partner and/or the presence of abnormal REM sleep behaviors during polysomnography (PSG) monitoring; (2) PSG evidence of REM sleep without atonia (RWSA) including excessive augmentation of submental electromyographic (EMG) tone or excessive submental or limb EMG phasic twitching; and (3) absence of electroencephalography (EEG)

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epileptiform activity during REM sleep [1]. This study was approved by the hospital ethics committee, and all patients gave written informed consent.

Patients were interviewed to obtain demographic information (eg, age and gender) and clinical details including disease duration, associated comorbidities, and the use of medications or substances. Associated neurological disorders were diagnosed according to the common clinical criteria used by consulting neurologists. RBD was classified as secondary or idiopathic. When it was associated with a neurological disorder (eg, narcolepsy, neurodegenerative disease) or medication use (eg, antidepressant), RBD was categorized as secondary. All other cases with absence of any known neurological or clinical disorder were categorized as idiopathic. Patients were defined as early-onset (≤ 50 y) or late-onset (> 50 y) according to the onset age.

2.2. Assessment of RBD questionnaire

All patients were assessed for dream contents and dream-enacting behaviors by a 13-item self-reported RBD questionnaire (RBDQ-HK). This questionnaire measures two domains: factor 1 (items 1–5, 13) describes the dream contents and disrupted sleep and factor 2 (items 6–12) assesses the sleep-related behaviors [10]. Each RBD symptom was measured according to the frequency of occurrence of dream and enactment behaviors in a lifetime and on a yearly basis. The maximum score was 5 in each item of factor 1 and 10 in each item of factor 2; thus, the total score was 100 for the questionnaire. The RBD-HK has been demonstrated to be a useful quantitative instrument for clinical symptoms and severity of RBD.

2.3. Video-polysomnography (VPSG) and quantification of EMG activity

All patients underwent one overnight VPSG assessment. Recording of the PSG included EEG (F4–M1, C4–M1, O2–M1, F3–M2, C3–M2, O1–M2), bilateral electrooculogram (EOG) (ROC–M1, LOC–M2), submental and bilateral anterior tibialis EMG, electrocardiogram (ECG), nasal–oral airflow, thoracic, and abdominal respiratory efforts, oxygen saturation and body position. Video was recorded simultaneously with the PSG. Sleep stages and associated events were manually scored in 30 s epochs according to the criteria described in the American Academy of Sleep Medicine (AASM) manual [11].

EMG activity during REM sleep was scored manually according to the criteria of the 2007 AASM Manual [11]. Tonic EMG activity was defined as sustained EMG activity more than 50% of the 30-sec epoch with amplitude greater than the minimum amplitude in non-rapid eye movement (NREM) sleep. Phasic EMG activity was scored from a 30-sec epoch of REM sleep in which at least 50% of 3-sec mini-epochs contained bursts of EMG activity lasting for 0.1 to 5.0 sec with amplitudes of four times that of the baseline EMG tone. Quantification of the RSWA was conducted separately in the percentage of 30-sec epochs with tonic and phasic EMG activity. EMG activities associated with respiratory events, periodic leg movements, arousals or signal artifacts were excluded from the analysis.

2.4. Statistical analysis

Statistical analysis was performed using SPSS version 17. Descriptive data were presented as mean $\pm$ standard deviations or frequencies (percentages). Univariate analysis of categorical data was performed using chi-square or Fisher's exact test as appropriate. Comparison between two groups on continuous data was conducted using Student's *t*-test or Mann–Whitney *U*-test. $p < 0.05$ was considered as statistically significant.

Table 1

Comparison of clinical variables between males and females with rapid eye movement sleep behavior disorder.

Clinical features	Male (n = 63)	Female (n = 27)	<i>p</i>
Age at onset (years) (Mean $\pm$ SD)	56.2 $\pm$ 14.1	45.3 $\pm$ 19.3	0.027
Early onset (≤ 50 years), n (%)	12 (19%)	11 (41%)	0.031
Late onset (> 50 years), n (%)	51 (81%)	16 (59%)	0.031
Age at diagnosis (years) (Mean $\pm$ SD)	61.1 $\pm$ 14.1	50.4 $\pm$ 18.2	0.022
Idiopathic RBD, n (%)	50 (79%)	15 (56%)	0.021
Secondary RBD, n (%)	13 (21%)	12 (44%)	0.021
Neurodegenerative disease, n (%)	11 (17%)	3 (11%)	0.055
Narcolepsy, n (%)	1 (2%)	3 (11%)	0.079
Antidepressant use, n (%)	1 (2%)	6 (22%)	0.003
RBDQ-HK (Mean $\pm$ SD)			
Factor 1 dreams	16.9 $\pm$ 5.4	16.8 $\pm$ 5.9	0.884
Factor 2 behaviors	38.2 $\pm$ 10.8	31.6 $\pm$ 10.2	0.019
Total score	55.0 $\pm$ 12.4	48.4 $\pm$ 12.1	0.098

RBD, rapid eye movement (REM) sleep behavior disorder; RBDQ-HK, REM sleep behavior disorder questionnaire–Hong Kong.

3. Results

Of the 90 patients with RBD, 63 (70%) were male and 27 (30%) were female. Demographic and clinical data were analyzed according to gender. Table 1 presents the characteristics of age, comorbidity, dreams, and enacting behaviors of male and female patients with RBD. There was a significant gender difference regarding age of onset (56.2 $\pm$ 14.1 vs. 45.3 $\pm$ 19.3, $p = 0.027$) and diagnosis (61.1 $\pm$ 14.1 vs. 50.4 $\pm$ 18.2, $p = 0.022$). Females had a higher proportion of early-onset RBD than did males. Idiopathic RBD (IRBD) was found in 79% (50/63) of the males and 56% (15/27) of the females; the difference was significant ($p = 0.021$). RBD in males tended to be associated with neurodegenerative diseases, including Parkinson's disease (PD), dementia with Lewy bodies (DLB), and multiple system atrophy (MSA) (17% vs. 11%, $p = 0.055$). Of the patients with neurodegenerative diseases, 11 were males (9 PD, 1 DLB and 1 MSA) and three were females (2 PD and 1 MSA). The secondary form of RBD was associated with narcolepsy in 2% of males and 11% of females ($p = 0.079$). Antidepressant use resulted in RBD in more females compared to males (22% vs. 2%, $p = 0.003$).

The males had significantly higher scores for behavioral manifestations (factor 2) ($p = 0.019$), whereas the mean score of dream contents (factor 1) showed no significant gender difference ($p = 0.884$). A more detailed analysis in the 13 items of the RBD questionnaire, using scoring in two profiles, showed significant gender differences (Fig. 1). Males had significantly more dream-related movements and more falling out of bed during sleep. However, there were no significant differences in amounts of vivid, violent, and frightening dreams between the two groups. Reported incidences of disturbed sleep was similar for male and female patients with RBD (2.1 $\pm$ 2.1 vs. 2.2 $\pm$ 2.2, $p = 0.914$).

Comparisons of PSG parameters for male and female RBD patients are presented in Table 2. Females had a significantly higher percentage of slow wave sleep ($p = 0.032$) than did males. In contrast, males spent more time in stage 1 sleep than did females ($p = 0.028$). Other sleep stages, sleep latency, total sleep time, and sleep efficiency in sleep architecture did not show statistical differences between males and females. Likewise, apnea–hypopnea index (AHI) and periodic limb movement index (PLMI) did not show significant gender differences. Interestingly, behaviors during sleep were fewer in females, but no gender differences were found in the percentages of either tonic or phasic EMG activities ($p > 0.05$).

4. Discussion

The present study is consistent with previous reports showing a male predominance (70%) for RBD. We found clear differences in

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