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Gender difference and laterality of sleep position

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ABSTRACT

Objective: A higher incidence in women (approximately 7:3) and a predominant involvement of the right ear (approximately 7:5) are interesting features of BPPV (benign paroxysmal positional vertigo). It is speculated that these features are related to sleep position. The first aim of this study was to compare the frequency of position shifts during sleep between men and women. The second aim was to elucidate any differences in sleep position between men and women. The third aim was to clarify the laterality of sleep position.

Methods: We retrospectively selected the data of 30 males (mean, 53.1 years) and 22 females (mean, 50.6 years) diagnosed as mild or moderate obstructive sleep apnea. A position sensor was attached to the patient's anterior chest. Supine position was defined as less than 45° tilt, and lateral position was defined as more than 45° tilt. A single overnight laboratory polysomnography provided the number of position shifts, total sleep time, sleep time spent in the supine position (S), sleep time spent in the right-side-down lateral position (R), and sleep time spent in the left-side-down lateral position (L).

Results: The mean value and standard deviation of the number of position shifts per hour was 2.4 ± 1.3 in males, and 2.3 ± 1.1 in females. There was no significant difference between males and females. Twelve cases (40%) were lateral type ($S < R + L$), and 18 (60%) were supine type ($S > R + L$) in males. Ten cases (45%) were lateral type, and 12 (55%) were supine type in females. There was no significant difference between males and females. Seventeen cases (56.6%) were right-dominant type ($R - L > 0$), and 13 (43.3%) were left-dominant type ($R - L < 0$) in males. Thirteen cases (59%) were right-dominant type, and 9 (41%) were left-dominant type in females.

Conclusion: Body position and the number of position shifts during sleep differ substantially between individuals. There is no gender difference in the frequency of position shifts. Although the supine type is more common than the lateral type, there is no gender difference in sleep position. Therefore, the reason of higher incidence in women is not related to sleep. The right-dominant type occurs more than the left-dominant type in both genders. It is possible that this behavior is the reason for the predominant involvement of the right ear in BPPV.

1. Introduction

Peripheral vestibular disorder, which involves provocative vertigo and characteristic rotatory nystagmus in a head-hanging position, has been known as BPPV (benign paroxysmal positional vertigo) and was formerly thought to be an otolith organ disorder [1]. However, the canalith repositioning procedure [2] and operative findings [3] proved the theory of canalolithiasis (moving debris) in the posterior semicircular canal. Furthermore, the same condition in the horizontal semicircular canal has been globally accepted [4,5]. A higher incidence in women (approximately 7:3) [6,7] and a predominant involvement of the right ear (approximately 7:5) [8,9] are

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interesting features. Several researchers considered that the reason for the higher incidence in women is related to calcium metabolism. Although Vibert et al. [10] reported the relationship between BPPV and osteoporosis, it is unclear why osteoporosis causes canalolithiasis. We have assumed some other factors, because young men sometimes suffer BPPV and not all osteoporosis patients have BPPV.

The disease is closely related to sleep as more than 75% of patients experience vertigo during sleep or at the time of awakening. Ichijo [9] proposed a micro-otoconia accumulation theory in which the pathological debris is the aggregate of micro-otoconia over a long time period, and which begins to slide by its own weight during sleep. According to this theory, the longer one remains at rest during sleep, the more likely one is to suffer BPPV. We propose a hypothesis that the frequency of position shifts in women is lower than that in men. Can we say that the motionlessness of women during sleep makes it easier to accumulate dislodged micro-otoconia in the semicircular canals? The first aim of this study was to compare the frequency of position shifts between men and women.

Shigeno et al. [11] reported that the affected-side-down position during sleep is related to BPPV recurrence. It has been assumed that sleep position is a factor relevant to the etiology of BPPV. We speculated that the longer the time spent in the lateral position, the more likely one is to suffer BPPV, and hypothesized that women spend more time in the lateral position than men. The second aim of this study was to elucidate the differences in sleep position between men and women.

It has been assumed that the predominant involvement of the right ear is related to the laterality of sleep position. Several researchers have considered that BPPV is associated in some way with sleep position, and reported the relationship between the affected side and head-lying side during sleep [12,13]. However, these studies did not adopt an objective evaluation. Self-reported body position during sleep is not reliable [14], because ordinary people turn over many times in bed, and do not remember their sleep position.

We can classify subjects roughly into two groups; right-dominant type (sleep time spent in the right-side-down position is longer than that in the left-side-down position) and left-dominant type (sleep time spent in the left-side-down position is longer than that in the right-side-down position). The third aim of this study was to clarify which type is more common.

We have performed single overnight laboratory polysomnography (PSG) to evaluate patients with snoring or sleep apnea for several years. Subjects in this study were selected patients with mild or moderate obstructive sleep apnea because it is difficult to involve normal volunteers and BPPV patients.

2. Materials and methods

AHI (apnea-hypopnea index) is defined as the number of instances of apnea and hypopnea per hour. We retrospectively selected the data of 30 males (mean, 53.1 years) and 22 females (mean, 50.6 years) diagnosed as mild or moderate obstructive sleep apnea (AHI < 20) from January 2014 to January 2016.

PSG (Philips, 225AABZI00015000) was performed by one night hospitalization in our clinic. A position sensor was attached to the patient's anterior chest. The supine position was defined as less than 45° tilt, and the lateral position was defined as more than 45° tilt. We counted the number of position shifts based on the body position records. PSG analyses provided the total sleep time, sleep time spent in the supine position (S), sleep time spent in the right-side-down lateral position (R), and sleep time spent in the left-side-down lateral position (L).

Table 1
The mean value and standard deviation of subjects' body weight and BMI.

	Weight (kg)	BMI (kg/m^2)
Males	68 ± 8.9	23.5 ± 2.2
Females	58.5 ± 9.6	23.8 ± 3.8

Table 1 shows the mean value and standard deviation of subjects' body weight and BMI (body mass index, weight/height/height).

3. Results

Fig. 1 shows the records of two subjects.

3.1. Number of position shifts

Males: minimum value was 4 and maximum value was 37. Females: minimum value was 5 and maximum value was 50. We calculated the number of position shifts per hour (Fig. 2) because total sleep time differs by patient. As a result, the mean value and standard deviation was 2.4 ± 1.3 in males, and 2.3 ± 1.1 in females. There was no significant difference between males and females (unpaired t test).

3.2. Total sleep time (min)

Males: minimum value was 283 and maximum value was 663. The mean value and standard deviation was 441 ± 81.4. Females: minimum value was 326 and maximum value was 617. The mean value and standard deviation was 463 ± 72.8. There was no significant difference between males and females (unpaired t test).

3.3. Sleep time spent in the supine position (S, min)

Males: minimum value was 28 and maximum value was 454. The mean value and standard deviation was 235 ± 114.9. Females: minimum value was 17 and maximum value was 476. The mean value and standard deviation was 263 ± 131.5. There was no significant difference between males and females (unpaired t test).

3.4. Sleep time spent in the right-side-down position (R, min)

Males: minimum value was 0 and maximum value was 256. The mean value and standard deviation was 108 ± 75.8. Females: minimum value was 0 and maximum value was 296. The mean value and standard deviation was 106 ± 92.6. There was no significant difference between males and females (unpaired t test).

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