AINO JOURNAL, Vol. 5, 2006, pp. 3－5

Review

Sleep-wake rhythm disorders

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Introduction

The term sleep-wake rhythm disorders was introduced to the field of somnology in early 1980's. Weitzmann et al. reported a paper entitled delayed sleep phase syndrome (DSPS) in 1981 (Weitzman et al., 1981) reporting 30 cases who showed both extreme delayed onset of bed time and wakeup time. Following several papers described unique cases who showed free-running of wake-sleep rhythm in spite they lived in the community exposed to strong time-cues (Kamgar-Parsi et al., 1983; Okawa et al., 1990). Gradually it is admitted that such rhythm disorders exist, although they tended to be thought that they were idle and lazy and the rhythm problems were raised by their idle life style and their weak will. Furthermore, progress in treatment, such as light therapy, methycobal therapy, melatonine therapy and so on accelerate the conceptualization of the disorders (Okawa et al., 1990; Dahlitz et al., 1991; Brown, 1994; Watanabe et al., 1999).

Now, sleep-wake rhythm disorders are categolized into two types, delayed sleep phase syndrome (DSPS) and non-24 hour sleep-wake syndrome (Fig. 1). The diagnostic criteria made by are shown in Table 1 and 2.

Table 1 Daignostic criteria for DSPS

1. A complaint of an inability to fall asleep at the desired clock time, or inability to awaken apontaneously at the desired time of awakening, or excessive sleepiness.
2. There is a phase delay of the major sleep episode in relation to tke desired time for sleep.
3. Symptoms present at least one month.
4. When not required to maintain a strict schedule patients will
i have a habitual sleep period that is sound and of normal quality and duration
ii awaken spontaneously
iii maintain atable entrainment to a 24-hour sleep-wake pattern at a delayed phase

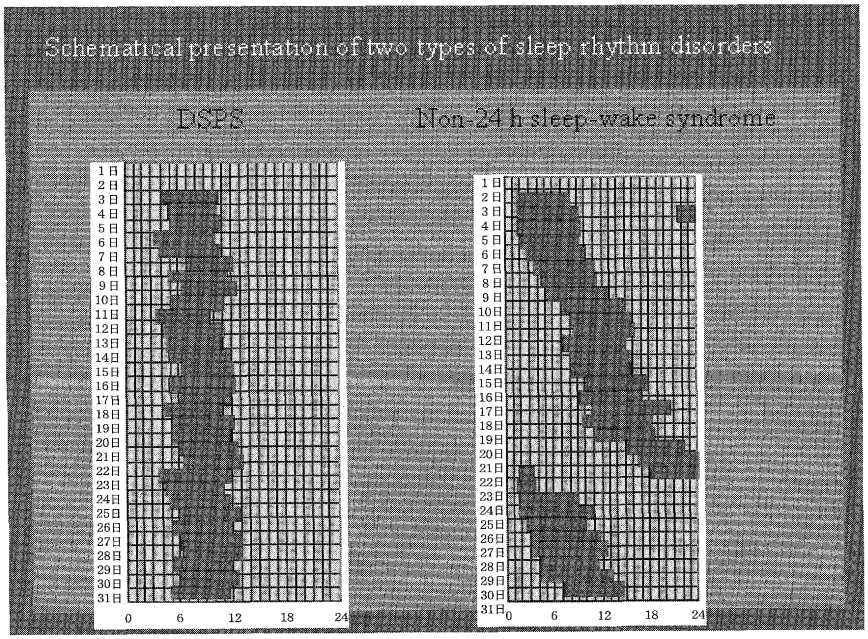

Fig. 1

Table 2 Daignostic criteria for Non-24 hour sleep-wake syndrome

1. Primary complaint of either difficulty initiating sleep or difficulty in awakening
2. Progressive delays of sleep onset and offset with the inability to maintain stable entrainment to a 24-hour sleep-wake pattern
3. Presence of the sleep pattern for at least 6 weeks

Epidemiology

The exact incidence has not been known yet. One of the two Japanese researches done by Kayukawa et al. (1995) showed 0.4% in the high-school age population. On the contrary, Yazaki et al. (1999) reported more than 0.13% in adults. Although it is hard to estimate exact rate in Japanese, at least one in a thousand people may suffer from rhythm disorders. This number resembles that reported form Norway by Schrader et al. in 1993. They demographically studied 10,000 subjects (18–67 years of age) and reported that the prevalence of DSPS was 0.17%.

The International Criteria of Sleep Disorders (ICSD), described that the clinical characteristics of sleep-wake rhythm disorders, such as onset age, sex ratio, or relation to parents or siblings, are still to be elucidated. However, our previous report demonstrated that onset age was late teens and more than half of the patients with rhythm disorders started their disorders after special psychological or social burdens, such as translocation, entrance examination, heavywork till late night. Recently in the study on 57 sighted patients with non-24-hour sleep-wake syndrome, Hayakawa et al. (2005) demonstrated that the onset of the syndrome had occurred during the teenage years in 63% and number of men dominated than that of women as shown in Table 3.

One of the important aspects of the rhythm disorders is relationship with psychiatric problems. In some cases rhythm disorder seems to appear as symptoms of psychiatric disorders such as depression. On the other hand, rhythm disorder seemed to cause depressive state. In recent report, 28% had developed psychiatric problems before the onset of non-24-hour sleep-wake syndrome. It would be possible to speculate that withdrawal due to psychiatric problems might induce rhythm disorders owing to the reduction of the Zeitgeber (synchronizer).

Table 3 Characteristics of 57 consecutive patients diagnosed with non-24 hour sleep-wake syndrome

Characteristics	No
Sex ratio	
Men	41 (72%)
Women	16 (28%)
Age at onset, y	
Mean+SD	20.2+7.0
<10	0 (0%)
10–19	36 (63%)
20–29	13 (23%)
30–39	6 (11%)
40–49	2 (3%)
Marital status	
Married	6 (11%)
Unmarried	51 (89%)
Presence of family or roommate	
Yes	45 (79%)
No	12 (21%)
Social status at first visit	
Student	20 (35%)
Employed	12 (21%)
Part-time worker	3 (5%)
Unemployed	22 (39%)
Premorbid status	
Psychiatric problems	16 (28%)
Physical problems	1 (2%)
Delayed sleep-phase syndrome	15 (26%)
Family history of mental, sleep, or neurologic disorder	
Yes	5 (9%)
No	52 (91%)

Symptomatology

A typical DSPS has difficulty in fell asleep. Even if they made every effort to fall asleep early night, it was almost impossible for them to get asleep.

On the other hand, since their sleep traces regular pattern as normal adult, it was also hard for them to get up earlier, at the time they wanted to get up. They can not keep to attend school or job constantly and gradually they loose their confidence that they can fulfill their duties or their responsibilityies. Furthermore, people around them accuse them because of their idle behavior, which made them feel themselves weak-willed and depressed.

A typical non-twenty four sleep-wake rhythm disorder showed a normal pattern of active-rest cycle for a certain periods of days, while his activity rhythm reversed for another 1–32 weeks. When they tend to accelerate the readjustment of his rhythm by shortening their sleep time, the rhythm resulted in irregular pattern.

The mean period of the sleep-wake cycle was 24.9+0.4 hours

Treatment

A various types of treatments have been applied to treat the patients with rhythm disorders and now a combination of several ways of treatment is used in real cases. Firstly developed way of treatment was chronotherapy. Since it was hard for patients with DSPS to advance their sleep onset time, they are instructed to delay the sleep onset time for 2–3 hours per day, until their sleep-wake rhythm comes in desired phase. Although this method works well, usually patients cannot keep new sleep-wake rhythm for along periods and it goes back to the previous undesired rhythm in a short period.

In order to fix the new rhythm both bright light and methylcobalamine has been used. Bright light has been demonstrated to have a potential effect to set the circadian rhythm. Morning light advance the phase of waketime and evening light delays it. Furthermore, methylcobalamine was demonstrated that it may increase the sensitivity to light. Therefore, in some patients bright light and methylcobalamin successfully keep the desired rhythm for patient after it was adjusted by chronothrapy. More recently melatonine has been used to adjust the circadian phase. It has a potent effectiveness on set of circadian rhythm. Contrary to the case of bright light, evening melatonin advances and morning melatonin delays the circadian phase. Moreover, melatonin induces sleepiness and lowers core body temperature in some patients. Therefore, melatonin is utilized for the treatment insomnia, in particularly for the aged patients.

Further study on circadian rhythm disorders are necessary, since such disorders seem to be increasing in the society in which people is active even after midnight.

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