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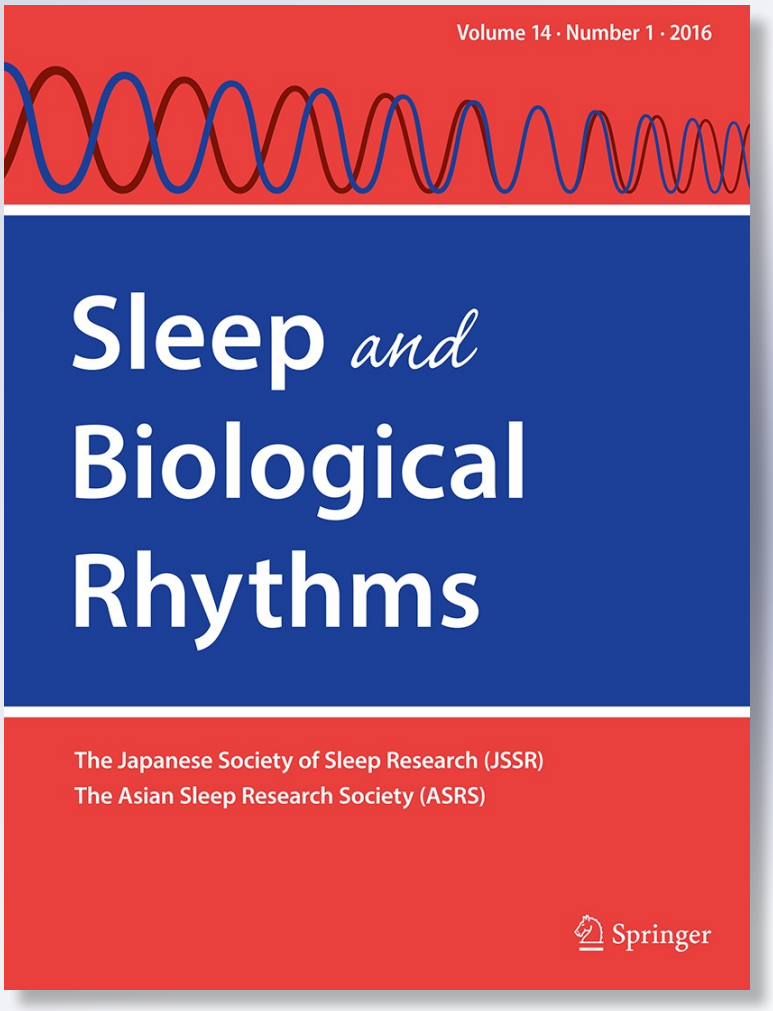

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CASE REPORT

An unusual circadian rhythm in an active duty service member

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Abstract The case of a 29-year-old active duty US Navy sailor with severe sleepiness is presented. He was diagnosed with mild obstructive sleep apnea which did not fully explain his sleepiness. At follow-up, positive airway pressure usage demonstrated a progressive, variable phase delay. His sleep periods aligned with his 5-h on/10-h off (5/10) military duty schedule. Treatment with bright light exposure and melatonin resolved his circadian arrhythmia. While it is known that military personnel are habitual shift workers who receive insufficient sleep, there is little documentation of shift work disorders in this population.

Keywords Military · Shift work disorder · Shift work · Ship crews

Introduction

Shift work is increasingly common due to advances in technology and the 24-h duty day; this results in humans remaining awake when they would ideally be asleep. Sleep and wakefulness are organized as a diurnal process driven by the endogenous circadian clock. There are multiple medical disorders associated with shift work. Shift workers are at increased risk of cardiovascular disease, cancer, metabolic syndrome and diabetes [1].

Military service frequently results in shift work. Despite this, few studies have assessed the acute and chronic effects of shift work on service members. What is known is that active duty service members tend to have short sleep duration [2]. Herein, we report a case of a young man whose military responsibilities exposed him to chronic circadian misalignment. The patient was initially diagnosed with mild obstructive sleep apnea (OSA) that aided in the diagnosis of his circadian rhythm disorder.

Case report

A 29-year-old active duty US Navy nuclear technician on a surface ship presented with symptoms of severe excessive daytime sleepiness (EDS). During ship deployments, typically 4–6 months at sea, the patient worked on a 5-h on/10-h off (5/10) watch standing schedule. The 5/10 is a three-section watch standing schedule in which a crewmember stands watch for 5 h followed by 10 h off watch. These 5-h watches commence at 0200, 0700, 1200, 1700, while the 2200 last watch period of the day is only 4 h in duration. This rotating pattern iterates every 3 days. The shift between 2200 and 0200 is 4 h long in order to make the daily 5/10 schedule add up to 24 h (four 5-h shifts and one 4-h shift). On shore duty, he would have two regular duty days, during which he reported sleeping from 22:30 to 06:00, and a watch day. During "watch days", he reported that his schedule included 6 h on duty, 6 h to complete other tasks, and approximately 4–5 h of sleep divided into two sleep periods.

His sleep history was notable for EDS with an Epworth Sleepiness Scale (ESS) score of 17. He reported loud

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snoring but no witnessed apneas. He denied cataplexy, sleep paralysis and hypnagogic hallucinations, but would doze off in any sedentary situation. There was no history of head trauma or viral infections. His physical examination was notable for a 16.5-in. neck and Mallampati class III oropharynx with 3+ tonsils.

A polysomnogram (PSG) was performed for suspected OSA (Table 1). He had mild OSA with an AHI of 12.9/h with otherwise fragmented sleep. On his post-PSG questionnaire, he commented that his fragmented sleep was caused by the monitoring electrodes which bothered him.

The patient was diagnosed with mild obstructive sleep apnea (OSA) and fragmented sleep, which appeared to be due to a first night effect in the sleep lab. As he had substantial tonsillar hypertrophy, tonsillectomy was discussed, but the patient opted for a therapy with auto-adjusting positive airway pressure (APAP). Due to clinical concerns regarding his EDS that seemed out of proportion to his mild OSA, his initial follow up was in 2 weeks.

At the follow up appointment, which occurred while the patient was on leave status and did not have a proscribed schedule, his APAP download indicated that he was adherent with APAP with an average daily usage of 7.37 h; his sleep-disordered breathing was corrected with a residual AHI of 0.9/h. The download was remarkable for a progressive phase delay (days 1 through 13). His delay was variable, in that some days his sleep onset was 2 h later and on others, such as the 17th, it was nearly 7 h later. The left part of Fig. 1 shows the data derived from the patients APAP compliance card. The patient was completely unaware of this pattern and, in fact, his sleepiness had improved with an ESS of 8.

Based on these findings, treatment for a circadian rhythm disorder was initiated with a regular nightly sleep prescription of midnight–0730 starting on day 14, bright light exposure upon awakening (going out into the direct sunlight for 10 min upon awakening) and 1 mg of melatonin 30 min prior to sleep [3, 4]. The patient reported some initial difficulties maintaining a regular sleep–wake cycle. However, as is evidenced by his APAP download, he re-entrained to a normal circadian rhythm starting on Day 31. His sleepiness further improved with an ESS of 5. Figure 1 shows the sleep–wake cycle obtained by the APAP compliance card. The progressive phase delay can best be seen starting on day 7. Figure 1 also shows the actual forward rotating watch and sleep pattern in the 5/10 as observed in the Reactor Department of an aircraft carrier [5].

Table 1 PSG variables

Sleep onset latency	1.5 min
REM latency	74 min
Sleep efficiency	72 %
Stage N1	30 %
Stage N2	49 %
Stage N3	10 %
Stage R	11 %
Wakefulness after sleep onset	125.5 min
Arousal index	39/h
Apnea-hypopnea index	12.9/h
Minimum oxyhemoglobin saturation	90 %

Discussion

We have described a case of a self-sustaining circadian rhythm of 5/10 shift work disorder. There is one previous report of a US Navy submariner on CPAP who also had a self-sustaining 6-h on/12-h off (6/12) circadian rhythm [6]. However, in our report, the therapy prescribed re-entrained the patient's circadian rhythm and resolved his symptoms of hypersomnia.

We postulate that the self-sustaining circadian rhythm observed in this patient was associated with his chronic exposure to the rotating 5/10 watch standing schedule. It is obvious that there are similarities in how sleep shifts from day to day when comparing the actual sleep pattern in the 5/10, schedule and the evaluation of the patient's sleep-wake cycle from the APAP compliance card, especially between days 7 to 13 (Fig. 1).

When allowed to return to a normal 24 h circadian cycle, his entrainment to the 5/10 was difficult to break. His sleep onset variation likely occurred in part due to his continued entrainment to the 5/10 schedule and partial adherence to his prescribed treatment regimen, with the largest variation occurring on Day 17, after treatment started. The patient reported recognizing the variability in his sleep pattern and it is likely that he did not became fully adherent to treatment for his circadian rhythm disorder until day 30. It was only with a combination of light therapy and melatonin that he re-entrained to a normal circadian rhythm. Our case, combined with the previous 6/12 report [6], suggests that chronic non-circadian military-shift schedules may result in circadian arrhythmia. This further highlights the potential long-term effects of extreme shiftwork on sleep [7, 8]. From a clinical perspective, when sleepiness is out of proportion to other findings (i.e. degree of OSA) clinicians should evaluate for other clinical disorders. Lastly, our results support that objective review of APAP usage can elucidate variations in

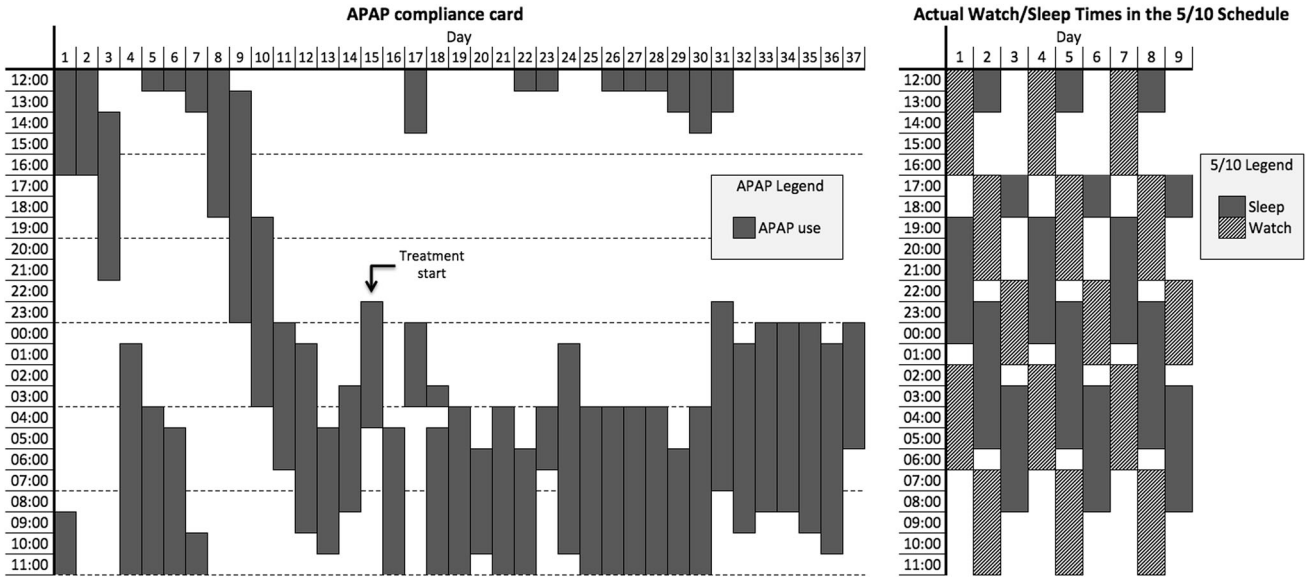

Fig. 1 *Left part* Evaluation of sleep–wake cycle through the APAP compliance card; *right part* sleep and watch standing pattern in the 5/10 schedule

sleep–wake patterns that can prove helpful in the management of patients with OSA.

Compliance with ethical standards

Conflict of interest No author has any conflicts of interest to disclose.

References

1. Wang X-S, Armstrong MEG, Cairns BJ, Key TJ, Travis RC. Shift work and chronic disease: the epidemiological evidence. Occup Med. 2011;61:78–89.
2. Miller NL, Matsangas P, Kenney A. The Role of Sleep in the Military: Implications for Training and Operational Effectiveness. In: Laurence JH, Matthews MD, editors. The Oxford handbook of military psychology. New York: Oxford University Press; 2012. p. 262–81.
3. Morgenthaler TI, Kapur VK, Brown T, Swick TJ, Alessi C, Aurora RN, et al. Practice parameters for the treatment of narcolepsy and other hypersomnias of central origin. Sleep. 2007;30(12):1705–11.
4. Kuźniar TJ, Kovačević-Ristanović R, Nierodzik CL, Smith LC. Free-running (non-entrained to 24-h period) circadian sleep disorder in a patient with obstructive sleep apnea, delayed sleep phase tendency, and lack of social interaction. Sleep Breath. 2012;16(2):313–5.
5. Shattuck NL, Matsangas P, Powley EH. Sleep patterns, mood, psychomotor vigilance performance, and command resilience of watchstanders on the "five and dime" watchbill. Monterey: Naval Postgraduate School; 2014.
6. Bradshaw DA, Praske SA. An unusual pattern CPAP usage. J Clin Sleep Med. 2011;7(5):557–9.
7. Drake CL, Wright KP. Shift work, shift-work disorder, and jet lag. In: Kryger MH, Roth T, Dement WC, editors. Principles and practices of sleep medicine. 5th ed. St. Louis: Elsevier Saunders; 2011. p. 784–98.
8. Monk TH, Buysse DJ, Billy BD, Fletcher ME, Kennedy KS, Begley AE, et al. Shiftworkers report worse sleep than day workers, even in retirement. J Sleep Res. 2013;22:201–8.