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An Unusual Cause of Insomnia Following IED-Induced Traumatic Brain Injury

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A 20-year-old man presented to the sleep disorders clinic for evaluation of recurrent episodes of sleeping difficulties and a diagnosis of insomnia made by his primary care physician. Approximately 6 months prior to his initial presentation, he sustained multiple injuries following an improvised explosive device (IED) blast while serving in Operation Iraqi Freedom, including a mild-moderate traumatic brain injury and penetrating injuries to both eyes. His ophthalmologic trauma resulted in enucleation of his right eye and significantly reduced vision in his left. Since his injuries, he reports recurrent periods during which he is unable to initiate sleep at a desired time. During these periods, he experiences significant fatigue and daytime somnolence when trying to keep a normal sleep-wake schedule. He stated that these periods resolved slowly but then recurred without an identifiable precipitating cause. He had no significant past medical history and denies any sleep complaints prior to his injury. He was diagnosed with depression but stated that his symptoms worsened after starting a selective-serotonin reuptake inhibitor. Similarly, non-benzodiazepine sedative-hypnotics did not significantly improve his insomnia and resulted in worsening of his daytime fatigue.

Physical examination demonstrated an enucleated right eye and left visual acuity of 20/200, but was otherwise unremarkable; laboratory studies, including thyroid function testing, a complete blood count, and serum electrolytes were within normal limits. Nocturnal polysomnography revealed a sleep latency of 42 minutes, sleep efficiency of 96%, and preserved sleep architecture. The patient completed a sleep diary over the course of a month (**Figure 1**). Treatment was then initiated, and the patient reported marked improvements in sleep latency, sleep consolidation, and daytime sleepiness during a follow-up evaluation two months later. A repeat sleep diary showed normalization of his sleep-wake cycle (**Figure 2**).

Q: WHAT IS THE DIAGNOSIS AND HOW WOULD YOU INITIATE THERAPY?

Figure 1—Sleep diary pre-treatment.

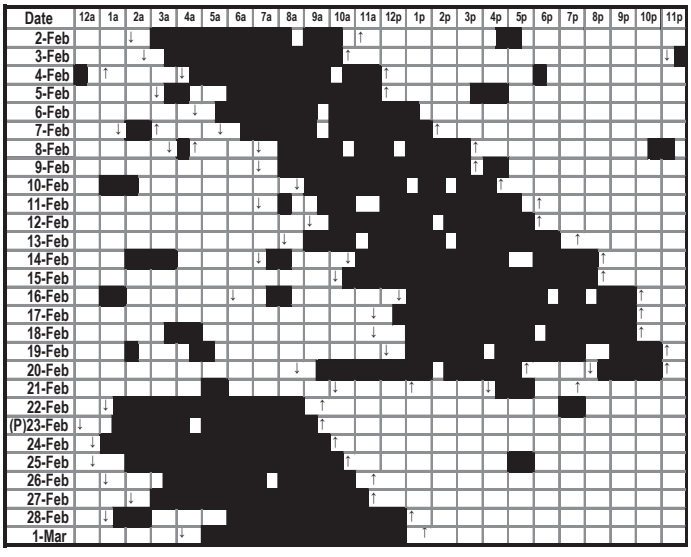
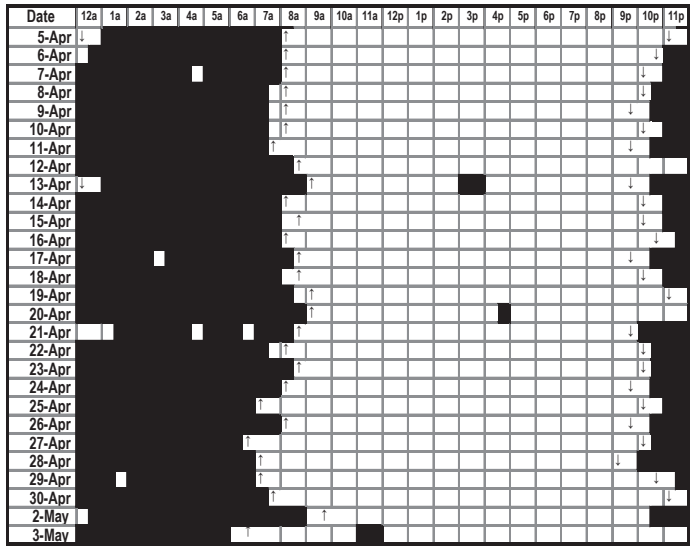


Figure 2—Sleep diary post-treatment.



□Awake; ■Sleeping; ↑Time out of bed; ↓Time in bed; P, Polysomnogram

A: CIRCADIAN RHYTHM SLEEP DISORDER, FREE-RUNNING TYPE (NON–24-HOUR SLEEP WAKE SYNDROME). BOTH EVENING MELATONIN ADMINISTRATION AND MORNING PHOTOTHERAPY HAVE BEEN SHOWN TO IMPROVE SYMPTOMS.

DISCUSSION

Most individuals have an intrinsic circadian rhythm longer than 24 hours—on average, 24.2 hours.[2] Normally, individuals are phase shifted to the external 24-hour day through entraining agents, such as light, melatonin, and physical activity. Of these, light is the primary synchronizer. Retinal blindness disrupts the transmission of light to the body's master circadian rhythm located in the suprachiasmatic nucleus. Without the aid of this powerful entraining agent, a free-running type circadian rhythm sleep disorder prevails. This disorder occurs predominantly in individuals with retinal blindness but has also been reported in sighted individuals. This non–24-hour sleep-wake cycle can lead to a variable sleep pattern and result in a slow and progressive phase shift until there is inversion of the sleep-wake cycle. It is not uncommon for patients trying to maintain a regimented sleep-wake pattern to experience some distress. They can experience recurrent periods of insomnia-like symptoms and perceived daytime sleepiness.

In the presented case, the diagnosis was suggested by the patient's symptoms of waxing and waning periods of sleep onset insomnia and daytime hypersomnolence, which began after significant loss of vision. The diagnosis was confirmed by his sleep diary which showed a free-running pattern. Treatment was initiated with melatonin 3 mg one hour prior to bedtime and one hour of morning phototherapy at 5000 lux, which resulted in marked clinical improvement and normalization of his sleep-wake cycle.

Treatment of free-running disorders is focused on establishing and maintaining a normal 24-hour sleep-wake cycle. Although hypnotics may be helpful, they should be used in combination with other modalities such as melatonin and phototherapy. Evening melatonin administration of 0.5-10 mg prior to desired bedtime may improve sleep onset and has been successfully used in various circadian rhythm disorders.[1,3] The timing of administration is not well established in this disorder, but one hour prior to desired bedtime or at 21:00 hours has been effective in previous reports. Morning phototherapy may also be beneficial, particularly in those with retained light perception. It should be noted that it is the non-cone/rod melanopsin-containing retinal cells that are responsible for this benefit. The exact dosing is not well established in this disorder, but limited case reports have demonstrated success in sighted individuals.[2]

Traumatic brain injury (TBI) may result in an inability to initiate sleep or excessive daytime sleepiness.[3] Posttraumatic insomnia, hypersomnia, and narcolepsy have been reported following moderate and severe TBI resulting from blunt trauma. While there are no published cases of sleep disorders secondary to improvised explosive device (IED) induced TBI, recent clinical experiences suggest that these blast injuries may precipitate sleep complaints and alterations of the sleep-wake cycle. We present an unusual case of recurrent insomnia and daytime hypersomnolence in a soldier who sustained a TBI following an IED injury while serving in Operation Iraqi Freedom.

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