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Original Article

Long-lasting sleep patterns of adult patients with minor traumatic brain injury (mTBI) and non-mTBI subjects

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Abstract

Background: Sleep disturbance is a common subjective complaint of minor traumatic brain-injured (mTBI) patients, but little is known about the characteristics of sleep disturbance in adults years after the injury.
Methods: Polysomnographic (PSG) and multiple sleep latency test (MSLT) records of 26 mTBI adult patients with normal brain computerized tomography and negative encephalographic studies, no past history of CNS pathology, no premorbid or present major psychiatric diagnosis, and no sleep apnea syndrome were compared to a matched group of apparently healthy individuals (controls).
Results: Sleep patterns were disturbed in the mTBI patients. Their sleep architecture was altered, with significantly higher light-sleep non-rapid eye movement (NREM) stage 2 scores compared to controls ($54.5 \pm 13.4\%$ vs. $46.6 \pm 10.4\%$, respectively, $p = 0.03$) and significantly lower REM sleep scores ($21.2 \pm 8.4\%$ vs. $25.4 \pm 4.5\%$, respectively, $p = 0.05$). The MSLT findings documented significant excessive daytime episodes of falling asleep.
Conclusions: Sleep disturbances of adult patients with chronic mTBI may manifest characteristic alterations in both timing and architecture of their sleep patterns. Sleep lab evaluations may help identify subgroups of mTBI patients who would probably benefit from treatment.

Keywords: Adults; Minor traumatic brain injury (mTBI); Multiple sleep latency test (MSLT); Polysomnography (PSG)

1. Introduction

Traumatic brain injuries (TBIs) cause more deaths and disabilities than any other neurological disorder before the age of 50 years [1,2]. The majority of victims are young, causing the cumulative number of patients to continuously rise. The victims of TBI often suffer long-lasting mental as well as physical impairments [3,4]. Minor TBI (mTBI) is a brain concussion that can cause a short (up to 30 min) transient loss or impairment of consciousness, accompanied by vomiting and some

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degree of amnesia (either anterograde or retrograde or both). Diagnosis can be difficult because patients with mTBI do not necessarily suffer evident structural brain damage, and emergency room Glasgow Coma Scale (GCS) scores are 13 or higher [5]. Therefore, the condition is frequently defined by the presence of several non-specific mental symptoms following brain concussion [6]. It has been suggested that even a mild brain trauma may cause neuronal damage, both in humans [7] and in animal models [8], in addition to other common long-lasting symptoms that include headaches, dizziness, sleep difficulties [9], cognitive disturbances (executive dysfunction, variable amnesia), affective symptoms (mostly depression, apathy and anxiety) and behavioral disturbances [10,11]. Although most mTBI cases resolve within 6–12 months, as many as 20–30% of the patients present with a protracted or even permanent array of complaints [12], the most prominent of which are headache and sleep disturbances. The benefit of most pharmacological or psychiatric therapies for TBI sequelae is uncertain, and even less so for mTBI [13].

Sleep difficulty is a common complaint of both TBI [12,14,15] and mTBI patients [16]. Sleep interruption and impaired sleep quality were included in a subjective questionnaire survey of 75 patients following TBI, but there was no mention of the percentage of patients experiencing sleep–wake complaints [14]. In another study, Hibbard et al. [15] found sleep disturbances and other chronic health problems to be significantly more common in individuals with TBI living in the community (10 years post-onset on average) than in individuals without disabilities who were matched for age, sex and urban/suburban/rural living environments [15]. In a recently published study, Ouellet and Morin [17] compared subjective (questionnaires) and objective (2 nights of polysomnography [PSG]) sleep complaints and patterns of 14 patients with mild to severe TBI and sleep disturbances, and a matched group of healthy good sleepers. TBI patients were found to have a tendency to overestimate their (subjective) sleep disturbances; however, the PSGs of 10 out of the 14 patients with TBI could be defined as having objective insomnias and the researchers conclude that the findings are similar to those found in patients with either primary insomnia or depression [17].

While most published studies have focused on the TBI spectrum of severity population as a whole (Ouellet and Morin [17] have studied a mixed group of adult patients, with only 4 mild and 1 mild to moderate TBI out of 14 patients; Prigatano et al. [18] studied a group of 10 patients, only 3 of them with mild TBI), mTBI studies have focused mainly on recent-onset cases [19] or on infants, young children or adolescents [20,21]. A high incidence of sleep disturbance was reported both in hospitalized patients with recent-onset (median of 3.5 months) TBI (72.7%) and in discharged patients with a median of 29.5 months post-TBI (51.9%) [22]. In addition, sleep disturbances have been shown to contribute to poor daytime performance and a poor individual sense of well-being in this population [23]. Long-term sleep disturbances have been documented in adolescents three years after having sustained an mTBI without any discernible clinical sequelae, and these complaints have been confirmed by both PSG and actigraphic monitoring [21].

There are only few data on the long-lasting sleep disturbances and other health issues in adults who underwent mTBI. One of those studies attempted to separate the effects on sleep complaints of the mTBI per se from those of chronic pain following other concomitant injuries. When comparing the incidence of sleep complaints of patients with mTBI to those of patients with orthopedic injuries who were matched for age, sex, distribution and time from injury, the former reported more difficulty in initiating and maintaining sleep at night and greater difficulty with sleepiness during the day than the latter [24]. A number of case reports suggest an association between circadian rhythms disorders or a narcolepsy-like disorder and mTBI [25–30], but our literature search failed to uncover any study addressing these phenomena.

In order to characterize the long-term sleep patterns of adult patients with chronic mTBI and sleep complaints, we compared their PSG and multiple sleep latency test (MSLT) findings with sleep lab findings of an age- and sex-matched convenience group of apparently healthy subjects who served as the control group.

2. Methods and materials

This study was approved by the Insitutional Review Board at the Tel Aviv Sourasky Medical Center (No. 6/06-014).

2.1. Setting

The Neuropsychological Unit for Treatment & Rehabilitation is accredited for clinical neuropsychological rehabilitation by the Israeli Ministry of Health.

2.2. Study group

Patients who present with the complaint of poor sleep are routinely referred for a sleep lab evaluation, the extent of which often varies depending upon each patient's medical insurance (HMO) coverage. Data were collected from the Unit's files for all patients admitted consecutively to ambulatory rehabilitation programs between 1996 and 2001, for whom there were any data from the sleep lab. The inclusion criteria were age between 21 and 50 years, documented and non-recent (one year or more) mTBI, no structural imaging findings