Sleep in Traumatic Brain Injury

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KEYWORDS

• Traumatic brain injury • Critical care • Sleep disorders • Delirium • Melatonin

KEY POINTS

- Traumatic brain injury (TBI) is a common indication for ICU admission.
- Disruptions in sleep architecture are nearly ubiquitous in this population.
- The most commonly diagnosed sleep disturbances are insomnias, hypersomnias, and sleep-disordered breathing.
- The diagnosis of a sleep disturbance requires appropriate testing of patients for whom there is a high index of suspicion.

EPIDEMIOLOGY

There are 2 factors that challenge epidemiologic assessments of head injuries. First among them is the lack of consistency in defining the disease. TBI is defined as a functional derangement of the brain after traumatic injury. This derangement can be mild, as in a sports-related bell-ringing concussion, or it may be profound and associated with loss of consciousness and death. The use of various classification strategies makes comparisons across studies difficult. Second, there is a lack of consistency in selecting inclusion criteria for study. Some investigations include all patients who present to a hospital with a diagnosis of TBI, whereas others exclude patients managed solely in the outpatient setting or in an emergency department, even if TBI was fatal.

Despite these challenges, a couple of generalizations can be made. First, TBI is a common cause of hospitalization and ICU admission in the United States. Second, it has a trimodal age distribution, with peaks at ages 0 to 4 and 15 to 19 years and

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a final upward slope over the age of 64 (Fig. 1).[1] The peak in early childhood is thought to be due to falls associated with increased independent activity when bipedalism is a new function. The second peak is found in adolescents and young adults who are society's greatest risk takers. The final rise is observed when sensory and motor abilities decline with advancing age.

In developed nations, the incidence of TBI requiring hospital admission is approximately 200 cases per 100,000 population per year. There has been a slight decrease in this incidence in recent years related to improved triaging after neuroimaging (Fig. 2).[2] In the United States, the Centers for Disease Control and Prevention estimates that approximately 25% of the nearly 2.4 million patients with TBI are hospitalized each year.[3]

There is no universal instrument for determining the severity of TBI. ICU admission is a poor surrogate for the severity of brain injury. Although mild TBI is characterized by minimal, temporary functional disability, a portion of such patients also have evidence of intracranial hemorrhage that requires close observation and frequent neurologic monitoring in an ICU. Many investigations default to the Glasgow Coma Scale score, which is often confounded by hemodynamic instability, intoxication, and preexisting conditions, such as deafness or dementia. Still others use radiographic classification, but when imaging is used alone it fails to reflect functional disturbances.

Nevertheless, up to 80% of TBI cases are classified as mild and require no further specific acute care.[2] The remaining cases are evenly divided between moderate and severe categories.[1,4] The most common mechanisms of injury among admitted patients are falls and motor vehicle collisions. Across all severities of TBI, the average ICU length of stay approximates 2 days, with an overall in-hospital mortality of 5.4%.[4] A percentage of these patients have ongoing or expanding hemorrhagic foci that subsequently have an impact on cerebral function and may lead to secondary brain injury. Patients with less severe TBI who warrant ICU admission are those with concomitant traumatic injuries of the torso, spine, or extremities and those who have suffered significant blood loss.

It has been well established that patients with TBI have a high incidence of sleep disorders, such as insomnia, hypersomnia, and sleep-disordered breathing.[5] Approximately 30% to 50% of patients complain of new-onset or worsening insomnia after

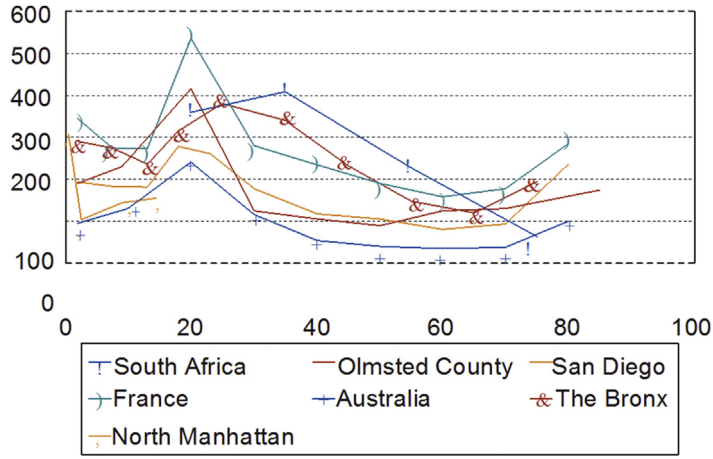

Fig. 1. Age-specific incidence of TBI. (*Data from* Bruns J Jr, Hauser WA. The epidemiology of traumatic brain injury: a review. Epilepsia 2003;44 (Suppl 10):2–10.)