

**TELE-REHABILITATION GUIDELINE****Sleep and Fatigue after Traumatic Brain Injury**

Drafted:

Peer Review:

Finalized:

**I. Define, Assessment, Diagnosis****A. Definition:**

1. Post Traumatic Fatigue (PTF) (Zasler, Katz, & Zafonte, 1996): Subjective complaint for which there is no universally accepted definition.
  - A. Central Fatigue: the result of cerebral dysfunction
  - B. Peripheral Fatigue: origins are purely physical, metabolic or muscular in nature
  - C. There is overlap in central and peripheral causes of fatigue in patients with brain injury. Brain trauma often results in injuries to pathways involved in sensory and motor function causing weakness, spasticity, ataxia, etc. This central motor impairment translates into peripheral increases in energy requirements and reduction of efficiency.
  - D. Fatigue is often under-reported and the reported incidence varies in the literature from 2% to 98% of Traumatic Brain Injury (TBI) patients.
2. Sleep disorders:
  - A. 36-70% of TBI patients. Acute TBI patients, especially those hospitalized, more commonly suffer from of Initiating and Maintaining Sleep (DIMS) whereas post acute TBI patients more commonly experience Disorders of Excessive Somnolence (DOES).
  - B. The severity of the TBI does not correlate with the severity of sleep disorder. (Clinchot, Bogner, & Mysiw, 1998). Because of the variability in severity, recovery, and reporting of TBI there is inconsistent data on sleep disorders after TBI
  - C. TBI patients are also “two to four times more likely to experience problems with sleep maintenance and efficiency, nightmares, excessive sleepiness, early awakenings, and sleep walking” (Mathias et al, 2012).
  - D. Secondary factors including weight changes, mood disturbances, medications, pain, and premorbid sleep disorders can exacerbate central sleep disorders resulting from TBI (Zafonte et al, 1996)
  - E. Sleep disorders can cause behavioral and cognitive issues in patients with TBI
  - F. Types of Sleep Disorders (Castriotta et al 2011, Mathias et al 2012)
    - i. Obstructive sleep apnea (OSA): Intermittent apnea and asphyxia from upper airway obstruction and/or collapse that occurs despite continued respiratory effort. OSA is most commonly associated with obesity however central sleep apnea may occur with TBI due to dysregulation of the autonomic system and injury to the ascending

reticular activating system, prefrontal cortices, anterior cingulate, hippocampus, and parietal cortices. (Webster et al, 2001; Yochelson & Dasgupta, 2012; Desseilles et al, 2008)

- ii. Central sleep apnea: characterized by lack of respiratory effort resulting in lack of airflow.
  - iii. Periodic limb movement disorder (PLMD): bilateral rhythmic jerking or twitching movements in the lower extremities more so than the upper extremities. Often this movement goes unnoticed by the patient but disturbs quality of sleep resulting in fatigue.
  - iv. Restless leg syndrome (RLS): unpleasant sensations in the legs or feet that are temporarily relieved by movement; symptoms are worse at night.
  - v. Circadian Rhythm Disorder
  - vi. Hypersomnia
- G. There is an increased risk for hypertension, heart disease, diabetes, and stroke in patients with sleep disorders, especially OSA.

## B. Assessment:

1. Differential diagnosis:
  - a. Central fatigue or sleep disorder
  - b. Obstructive sleep apnea
  - c. Periodic limb movement disorder (PLMD)
  - d. Restless leg syndrome (RLS)
  - e. Circadian Rhythm Disorder
  - f. Hypersomnia
  - g. Nutritional deficiency (Vitamin D, iron deficiency, etc)
  - h. Endocrine disorder (Hypothyroidism, diabetes mellitus, growth hormone deficiencies, etc)
  - i. Anemia
  - j. Cardiovascular disease
  - k. Dehydration
  - l. Infection
  - m. Hydrocephalus
  - n. Recurrent hemorrhage
2. Sleep and fatigue disorders are often overlooked by medical professionals and often patients will not mention problems with sleep and/or fatigue
  - a. History:
    - i. Past medical history of sleep disorder, TBI, stroke, other neurological disorder, obesity, endocrine disease
    - ii. Day time sleepiness
    - iii. Frequent napping
    - iv. Mood impairments and/or agitation
    - v. Cognitive impairments (i.e., memory difficulties, slow processing speed, impaired attention)

- vi. Snoring
- vii. Morning headaches
- viii. Sleep and wake times
- ix. Sleep hygiene: caffeine intake, sleep environment, electronic devices
- x. Review of daily function: work, activities of daily living, etc.
- b. Physical exam:
  - i. Vital signs
  - ii. General appearance/level of alertness
  - iii. Head and neck exam for structural causes of OSA
  - iv. Cranial nerve exam including light/dark differentiation
  - v. Cardiovascular exam
  - vi. Thyroid palpation
  - vii. Integumentary exam
3. Fatigue: No validated measurement for PTF; there are measurements that evaluate the *effect* of fatigue.
  - A. Fatigue Severity Scale
  - B. Fatigue Impact Scale
  - C. Modified Fatigue Impact Scale
  - D. TBI patients demonstrate significantly greater fatigue scores on the Fatigue Severity Scale and the Fatigue Impact Scale as compared to non-TBI controls. (Lachapelle 1998)
4. Sleep disorders: scales are used to help quantify sleep impairments but do not diagnose sleep disorders.
  - a. Epworth Sleepiness Scale
  - b. Pittsburgh Sleep Quality Index

### C. Diagnosis

1. Laboratory studies:
  - a. Complete blood count
  - b. Basic metabolic panel
  - c. Thyroid function panel
  - d. Iron panel
  - e. Growth hormone & Insulin-like growth factor
  - f. Testosterone level
2. Supplemental tools/assessments (Yochelson & Dasgupta, 2012):
  - a. Polysomnography: evaluates for OSA, central sleep apnea, & restless leg syndrome. Evaluates sleep architecture and efficiency.
  - b. Electroencephalography (EEG): evaluates for seizure activity is used to evaluate for seizure activity.
  - c. Actigraphy: evaluates for circadian rhythm impairments or poor sleep hygiene.

## II. Management (Zasler, Katz, & Zafonte, 2007):

1. Fatigue & general sleep disorders:
  - a. Compensatory techniques for energy efficiency
  - b. Education of patient and care giver
  - c. Sleep hygiene:
    - a. Routine sleep and wake times
    - b. Caffeine limitations, avoiding caffeine 4-6 hours before sleep
    - c. Avoidance of nicotine
    - d. No heavy eating before bedtime
    - e. Daily exercise late afternoon or early evening; at least 3 hours prior to bedtime
    - f. Appropriate sleep environment: comfortable bed, minimization of noise, minimizing light, avoiding extremes of temperature.
  - d. Psychiatric care or psychological care including biofeedback, meditation, and relaxation therapies.
  - e. Medications:
    - a. Stimulants:
      - i. Ritalin
      - ii. Dextroamphetamines
      - iii. Atomoxetine
      - iv. Provigil
    - b. Antihistamines: Often purchased over the counter to assist with sleep but can have adverse cognitive effects in TBI patients due to anticholinergic properties.
    - c. Antiepileptics: Sleep disorders are treated with antiepileptic medications by utilizing the sedating side effects of the medications.
    - d. Antidepressants: directly affects sleep by improving sleep architecture and efficiency. Indirectly effects sleep by treating mood disorders resulting in impaired sleep.
    - e. Sedatives/hypnotics: Although this class of medications works well by decreasing phasic interruption of sleep and increased total sleep time, sedatives/hypnotics can result in physical dependence, sedation, and physical/cognitive impairments.
      - i. Benzodiazepines
      - ii. Zolpidem
    - f. Antipsychotics
    - g. Ginkgo Biloba
    - h. Melatonin
2. Specific sleep disorders:
  - a. OSA: Dental devices, Oxygen supplementation via nasal cannula, CPAP or BiPAP, uvulopalatopharyngoplasty, tracheostomy
  - b. RLS:
    - i. Avoidance of exacerbating substances: caffeine, alcohol, & nicotine
    - ii. Physical modalities: hot or cold baths, whirlpools, massage, vibratory or electrical stimulation
    - iii. Vitamin supplementation, electrolyte replenishment, iron supplementation

- iv. TED hose for patients with varicose veins
- v. Medications: dopaminergic agents are first line.
  - 1. Levodopa with carbidopa: Start at 10/100mg PO TID-QID.
  - 2. Pramipexole 0.125mg-0.5mg PO QPM 2-3 hours before bedtime. Start 0.125mg QPM and increase by 0.125mg/day q4-7 days. Max dose 0.5mg/day.
  - 3. Ropinirole hydrochloride: 0.25mg-4mg PO QPM. Start 0.25mg QPM x2 days then increase to 0.5mg x5 days, then 0.5mg/day qwk until 3mg QPM. Max 4mg/day.
  - 4. Benzodiazepines: Clonazepam
  - 5. Opioids
  - 6. Gabapentin indicated for patients with associated pain/neuropathy

*This guideline was developed to improve health care access in Arkansas and to aid health care providers in making decisions about appropriate patient care. The needs of the individual patient, resources available, and limitations unique to the institution or type of practice may warrant variations.*

### **Guideline Developers**

Guideline developed by Rani Haley Lindberg, MD, in collaboration with the TRIUMPH team led by Thomas S. Kiser, MD, and Rani H Lindberg, MD.

### References:

LaChapelle L., Finlayson MA. An evaluation of subjective and objective measures of fatigue in patients with brain injury and healthy controls. *Brain Injury*. 1998; 12(8):649-69

Yochelson MR and Dasgupta K. Sleep disorders in diseases of the central nervous system. *AAPMR Knowledge NOW*(8/17/2012). <http://me.aapmr.org/kn/article.html?id=37> Accessed 4/4/2016

Clinchot DM, Bogner J, Mysiw W, et al. Defining sleep disturbance after TBI. *Am J Phy Med Rehabil*. 1998;77:291-295.

Mathias JL, Alvaro PK. Prevalence of sleep disturbances, disorders, and problems following traumatic brain injury: A meta-analysis. *Sleep Medicine*. 2012; 898-905.

Zafonte RD, Mann NR, Fitchenberg NL. Sleep disturbance in traumatic brain injury: pharmacological options. *NeuroRehabilitation*. 1996; 7:189-195.

Webster JB, Bell KR, Hussey JD, Natale TK, Lakshminarayan S. Sleep apnea in adults with traumatic brain injury: A preliminary investigation. *Archives of Physical Medicine and Rehabilitation*. 2001; 82: 316-321.

Castriotta RJ, Murthy JN. Sleep disorders in patients with traumatic brain injury: a review. *CNS Drugs*. 2011;25:175-185.

Desseilles M, Dang-Vu TD, Shabus M, et al. Neuroimaging insights into the pathophysiology of sleep disorders. 2008;31:777-794.