SLEEP DISORDERS FOLLOWING TRAUMATIC BRAIN INJURY

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3-27-2014

Kevin A. Domingos, Ph.D., Clinical Neuropsychologist
- Received my Post Doctoral training at New England Rehabilitation Hospital
- Worked in 3 VA Hospitals
- Evaluated and treated patients at CRC
- Started the Russian Memory Clinic at St. Elisabeth's Medical Center
- Have run the out-patient Memory Clinic for the past 20 years at Hebrew SeniorLife
- Currently have privileges Braintree Rehabilitation Hospital; New England Rehabilitation Hospital and Metro West Neurology units
- Clinical Director - at Boston Neuropsychological Services in Needham and Beverly.

Goals/Objectives:
1. Learn About the Biology of Sleep
2. Learn About Types of Sleep Disorders
3. Learn About Sleep Disorders Following an Acquired Brain Injury
4. Sleep Hygiene
5. Treatment
Did you know?

You spend approximately 1/3 of your life sleeping

Why do we sleep?

Benefits of sleep:
1. Healing
2. Restoration
3. We can’t do without it
Even through researchers are still learning exactly why people need sleep, studies show that sleep is necessary for survival.

For example, rats normally live 2-3 years – but studies have shown a dramatic decrease in survival if REM sleep is deprived (only live for 5 weeks).

Rats deprived of all sleep only live for 3 weeks.

The Brain isn’t inactive when you’re sleeping…

It’s busy with legions of neurons crackling electrical commands.

Why is Sleep Important?

• Brain maturation
• Restoration of physical energy
• Regulation of immune functions
• Modulation of endocrine functions (cortisol)
• Promotion of neural plasticity
• Role in memory processing and learning
• Role in recovery of illness and injury
Homeostasis

- It is important to maintain balance
- Sleep is part of a homeostatic process
- You have to be asleep a certain amount of time to be fully alert, but you also have to be awake a certain amount of time to fall asleep
- Too much sleep can actually increase insomnia

SLEEP CYCLE

Stages of Sleep:

- Stage 1 - Drowsiness
- Stage 2 - Light Sleep
- Stage 3 - Deep Sleep
- Stage 4 - Slow-Wave Deep Sleep (restful)
- Rapid Eye Movement (REM sleep)
We spend almost 50% of our total sleep time in stage 2 sleep, about 20% in REM sleep and the remaining 30% in the other stages. Infants, however, spend nearly ½ of their sleep time in REM sleep.

A complete sleep cycle takes between 90-110 minutes. The first sleep cycles of the night contain short REM periods and long periods of deep sleep. As the night progresses, REM sleep increases in length while deep sleep decreases. By morning, nearly all sleep time is in stages 1, 2, and REM.
Activity:

How do you measure up against the National Average?
Sleep

- Majority of Americans – 7/10 – are sleep deprived
- Consequences:
  - Impairments in memory, concentration and performance
  - Health consequences
  - More prone to depression and anxiety
Sleep Disorders
So, Just What Is A Sleep Disorder?

There are over 70 different sleep disorders. Most of them can be managed successfully once they are diagnosed.

Categories: The Three “Non-Zzzzzzs”:

1) Disturbed Sleep
2) Excessive Sleep
3) Lack of Sleep

Nearly 70 million Americans suffer from a sleep disorder, many of which don’t know they have one.

Sleep disruption is also associated with worse quality of life, increased economic costs for the health care system, increase risk for hypertension and diabetes.
A lack of sleep can affect not only your energy level and mood, but also your health because sleep helps bolster your immune system.

Fatigue, at any age, leads to diminished mental alertness and concentration.

Most Common Types of Sleep Disorders

The Big 3

• Insomnia
• Sleep Apnea
• Restless Leg Syndrome

Insomnia
Insomnia

“A subjective complaint of difficulty initiating or maintaining sleep, waking up too early, or having nonrestorative sleep despite adequate opportunity for sleep”

Society today has learned to compensate for lack of sleep:

Oh man, I really shouldn’t have had that coffee in June.
These compensations decrease one's ability to realize they have been affected by a lack of sleep.
Many people have a false sense of reassurance that they can quickly recover from a chronic sleep debt with just one or two days of good sleep. However, the lingering effect of chronic sleep loss causes performance to deteriorate dramatically when these individuals stay awake for an extended period of time.
Compensating For Lack Of Sleep

When individuals with a history of chronic sleep loss attempt to work extended hours into the night, their reaction times become about 10 times slower, increasing the risk of accidents and errors.

Individuals who get too little sleep during the work or school week but try to catch up on weekends may not realize that they are accumulating a chronic sleep debt.

Sleep Apnea

- A disorder of sleep characterized by pauses in breathing during sleep (sometimes with a loud choke or snort), often causing the person to wake up.
- Disruptions can occur hundreds of times per night, resulting in fragmented and dreamless sleep and exhaustion during the day.
- Often goes undiagnosed.
Restless Leg Syndrome

- Nervous system disorder, but because it often interferes with sleep, also categorized as a sleep disorder
- Severe cases are more often found in middle-aged or older adults
- Characterized by the irresistible urge to move legs to relieve feelings of itch or "pins and needles"
- Sleep deprivation may trigger symptoms of RLS or make them worse

"I probably shouldn't wake him. He needs the exercise."
Changes In Sleep Following TBI

Sleep problems are common after traumatic brain injury. They can be a primary effect of the trauma itself or occur as secondary effects of neuropsychiatric disturbances associated with the TBI.

Changes In Sleep Following TBI

Side effects of medications used to treat TBI and psychological distress associated with trauma may also influence sleep patterns.

Additionally, pain and treatment of pain after TBI can interfere with sleep processes.

Traumatic Brain Injury (TBI)

- “An alteration in brain function, or other evidence of brain pathology, caused by an external force”
- One of the leading causes of death and disability among children and young adults
- ~ 1.6 million people sustain TBI each year in the United States
  - 52,000 deaths
  - 80,000 cases with irreversible neurological impairment
- One of the most common comorbidities of TBI is disruption of normal sleep
Decreased Alertness (Fatigue)

- Fatigue is a common symptom reported by individuals with TBI and seems to persist months and even years after the injury.
- It has been shown to cause significant distress and have detrimental impacts on daily functioning and overall well-being.
- May hinder the speed or quality of the rehabilitation process and ability to resume daily activities.

Brainstem Involvement and Sleep

- Numerous autopsies have shown that when a person’s brainstem suffers damage, no matter the cause, that person falls into deep sleep or a coma.
- These findings show that the brainstem plays an essential role in maintaining the state of wakefulness.
- Specifically, the reticular formation within the brainstem receives incoming messages via the sensory pathways, and is given the name of “wakefulness centre.”
Changes In Energy Level

• Of the most distressing symptoms following TBI is the behavioral or personality changes taking the form of apathy and diminished motivation.
• Rehabilitation training is likely to be limited by the individual’s lack of effort.
• Dependence on other people for basic self-care is heightened by their lack of motivation to initiate these activities.
• Such motivational disturbances may reflect emotional reactions to the impact of the injury.

Common Symptoms of TBI

- Dizziness
- Loss of Balance
- Poor coordination
- Headaches
- Nausea
- Visual disturbance
- Light sensitivity
- Hearing difficulty
- Noise sensitivity
- Body/external numbness
- Altered taste or smell

- Appetite change
- Poor concentration
- Forgetfulness
- Difficulty making decisions
- Slowed thinking
- Fatigue
- Insomnia
- Feeling anxious
- Feeling depressed
- Easily irritated
- Poor frustration tolerance

Insomnia

• The most common disorder of sleep in the general population.
• Higher prevalence in those who have experienced a TBI.
• Occurs in 40% of individuals with a TBI of any severity.
• In a questionnaire study, more than 50% of 452 TBI patients reported insomnia symptoms.
• Studies have shown insomnia frequencies in TBI patients up to 84%.
Insomnia:
- Female
- Aging
- Family history
- Hyperarousability
- Biological vulnerability
- Psychological vulnerability

Specific to TBI:
- Hormonal alterations
- Neurotransmitter
- Hypocretin levels
- Alterations of intracranial pressure during sleep
- Comorbid psychopathology

Influencing Factors

Sleep Disorders and Motor Vehicle Accidents
- Several studies have shown that patients with clinically diagnosed sleep apnea perform poorly on driving simulation tests
- Also, these individuals tend to have an accident rate between two and seven times higher than those without sleep apnea

Coexisting Effects With Sleep Disturbances After TBI
- Anxiety
- Depression
- Irritability
- Fatigue
- Cognitive deficits
- Pain and functional impairments
- Negative impact on rehabilitative treatments
Potential Causes of Sleep Disturbances Post-TBI

Pathophysiological factors:
- Damage to structures of the brain important for sleep
- Hormonal and neurotransmitter alterations

Stressors:
- Interpersonal problems, self or identity issues
- Grief, adjustment to limitations

Medical Conditions:
- Hospitalization, pain, complications
- Medication

Environment:
- Hospital or rehab center
- Return home

TBI and Fatigue

- Affects up to 70% of persons with TBI
- Linked to problems with mood, cognition, pain
- Remains a major issue even several years post accident
**Behaviors:**
- Avoid or stop certain activities completely
- Cancel social occasions
- Seek rest (naps, increased time in bed)

**Inactivity**

**Consequences:**
- Loss of sources of gratification
- Social isolation
- Loss of source of pleasure
- Loss of alternative ways to rest
- Frustration, depression
- Decreased motivation
- Sleep disturbances

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**Fatigue**

- Subjective feeling of weariness, depleted energy
- Multidimensional (e.g. mental, physical)
- No real objective measure

**Excessive Daytime Sleepiness:**
- Physiological drive to sleep
- Measurable signs (e.g. yawning, eyes dropping, reduced alertness)
- Can be measured in a sleep laboratory (MSLT)

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**The Epworth Sleepiness Scale**

*To assess risk of Obstructive Sleep Apnea*

Use the following scale to choose the most appropriate number for each situation:

0 = would never doze
1 = slight chance of dozing
2 = definite chance of dozing
3 = high chance of dozing

<table>
<thead>
<tr>
<th>Situation</th>
<th>Chance of dozing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sitting and reading</td>
<td></td>
</tr>
<tr>
<td>Watching TV</td>
<td></td>
</tr>
<tr>
<td>Sitting, inactive in a public place</td>
<td></td>
</tr>
<tr>
<td>As a passenger in a car for an hour without a break</td>
<td></td>
</tr>
<tr>
<td>Lying down to rest in the afternoon when circumstances permit</td>
<td></td>
</tr>
<tr>
<td>Sitting and talking to someone</td>
<td></td>
</tr>
<tr>
<td>Sitting quietly after a lunch without alcohol</td>
<td></td>
</tr>
<tr>
<td>In a car, while stopped for a few minutes in the traffic</td>
<td></td>
</tr>
</tbody>
</table>

Total:

Score:
- 0-10 = Normal range
- 11-15 = Borderline
- 16-24 = Abnormal
Sleep Hygiene

1. Do NOT spend too much time in bed
2. Caffeine is OK in the morning
3. Eating/Drinking/No alcohol
4. Exercise
5. Nicotine
6. Comfort
7. Avoid light

Sleeping Habits?

Effect Of Light

- Light is one of the strongest cues our body has to know when to go to sleep and when to wake up
- Bedroom environment – the darker the better
- Melatonin, the sleep hormone, helps us to sleep
  - Secreted in darkness
  - Light in the morning decreases secretion

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Bedroom environment – the darker the better

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Recent National Institute of Health conference – determined that Cognitive Behavioral Therapy is the most effective treatment of sleep disorders. 

However, depending on the sleep disorder, a combination of CBT and medication may prove to be more effective than the therapy alone.

Some medications can actually increase the severity of sleep disorders because of the deprivation it causes of stage 4 sleep. 

Over the counter medications:
- Tylenol PM = Benadryl
  - Too many side effects
  - Risks are too great
Why Do We Yawn?

It has long been thought (and is still commonly misinterpreted) that the function of a yawn is to increase O₂ levels in the blood. However, breathing increased levels of oxygen or carbon dioxide has been shown to have no effect on yawning. Studies have shown that yawning acts as a cooling mechanism for the brain; it removes hot blood from the brain and introduces cooler blood from the lungs, thereby cooling brain surfaces.

Why Do We Yawn?

Nearly all vertebrate animals yawn. Yawning is often present by the end of the first trimester of prenatal human development. Yawns are so infectious that simply reading or thinking about yawning can trigger a yawn.

Why Do We Yawn?
Overview

- The brain is always alert and functioning, even during sleep
- We need sleep in order to restore energy
- It is important to balance the amount of sleep you get – not too much or too little
- Adults should get an average of 7-9 hours of sleep per night (even more for children and adolescents)

Overview

- The majority of Americans are sleep deprived – many without even knowing so
- Insomnia is the most common sleep disorder among the general population
- A sleep disorder can be identified and placed into one of the three categories: Disturbed Sleep, Excessive Sleep, and Lack of Sleep
- The most common sleep disorders are: Insomnia, Sleep Apnea, and Restless Leg Syndrome

Overview

- Approximately 1.6 million people in the United States suffer a traumatic brain injury each year
- One of the most common comorbidities of TBI is disruption of normal sleep
- The damage to the brain causes impairments of secretion of the sleep hormone melatonin
Overview

- Using proper sleep hygiene will reduce the risks of developing a sleep disorder
- Not spending too much time in bed – refrain from doing work or watching television in the bedroom
- Maintaining a healthy diet
- Sleeping in an environment that is comfortable to you
- DARKER IS BETTER

Helpful Hints to wake up More Quickly
Do the opposite of trying to sleep:

1. Increase light and sound
2. Increase sugar - eat
3. Increase blood flow
4. Increase O2 – Deep breath
5. Drink water
6. Exercise - move
Thank You

QUESTIONS?

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