TBI Recovery

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Recovery in TBI

• Predictors of outcome
  • Age
  • Previous TBI
  • Loss of conscious duration or Coma duration
  • Imaging findings- amount of hemorrhage, contusions, diffuse axonal injury
  • Length of Post-traumatic amnesia

• Depends on severity of injury
• Depends on complications after the injury
• Depends on pre-existing health
Prognosis
Imaging

• CT scan
  • Usually done in the Emergency room if the following criteria are met
    • Level of consciousness
    • Mechanism of injury
    • Use of blood thinners
    • Age
    • Neurological symptoms

• MRI brain
  • May or may not be completed depending on severity of injury, if there are ongoing neurological deficits, and/or recovery is not occurring as predicted

• How often is imaging done?
  • Acute phase depending on injury
  • Chronic phase- only if change/worsening of symptoms or follow-up after surgical interventions (usually CT scan not MRI)
CT scan

• Quick less than 15 minutes
• Better to evaluate acute blood products and fractures
• No contraindications
• Easy to access available in every hospital
MRI

• Takes longer
• Better evaluating microhemorrhages
• Not easy to access
• Contraindication: any metal implanted in the body that is not MRI compatible
• Claustrophobia- may need open MRI

• Different types of MRIs
  • Gradient echo
  • Diffusion Tensor Imaging
  • MR- Spectroscopy
Promoting recovery

• Managing co-morbid medical conditions
• Abstaining from substances:
  • Nicotine
  • Alcohol
  • Illicit substances
• Managing sleep
• Maintaining Physical Activity
• Participation in Rehabilitation
• Preventing another injury
Sleep Disturbances

• Common after TBI – 36-70% of people with TBI have some sort
  • Insomnia
  • Hypersomnia
  • Sleep-wake cycle disturbances
  • Sleep Apnea- central or obstructive

• How does poor sleep affect daily functioning?
  • Cognitive slowing
  • Mood changes/swings
  • Decreased physical endurance
Managing Sleep

**PATIENT HANDOUT**

**A sleep hygiene checklist**

- **Avoid naps.** Napping during the day can disturb the normal pattern of sleep and wakefulness.
- **Avoid stimulants**, such as caffeine and nicotine, and alcohol as bedtime approaches. While alcohol is well known to speed the onset of sleep, the process of the body metabolizing the alcohol can cause arousal, thus disrupting sleep.
- **Exercise.** All forms of exercise help to ensure sound sleep. Vigorous activities should be conducted in the morning or late afternoon, while a relaxing exercise, like yoga, can be done before bed to help initiate a restful night's sleep.
- **Avoid food too close to bedtime**—particularly large meals and chocolate (which contains caffeine). And try not to make any significant change to your diet. For example, if you’re struggling with a sleep problem, it’s not a good time to start experimenting with spicy dishes.
- **Soak up some natural light.** This is particularly important for older people who may not venture outside as frequently as children and younger adults. Light exposure helps maintain a healthy sleep-wake cycle.
- **Establish a regular bedtime routine.** Try to avoid emotionally upsetting conversations and activities before going to sleep.
- **Associate your bed with sleep.** It’s not a good idea to watch television, use your computer or phone, listen to the radio, or read while in bed.
- **Ensure a pleasant, relaxing sleep environment.** The bed should be comfortable, and the room should not be too hot, cold, or bright.


**Medications**

- Over the counter sleep aides
  - Melatonin
  - Diphenhydramine based sleep aides
- Rx medications
  - Discuss optimal medications with your physician
  - Many have side effects or interactions with other medications
- **Sleep Testing**
  - Sleep Study- overnight
  - Evaluates for potential causes of disordered sleep and daytime sleepiness such as sleep apnea
Managing Physical Activity

• Intensity Matters Initiative – Academy of Neurologic Physical Therapy
  • Intensity:
    • 60-80% max heart rate
      • HRmax = 220 - age
      • Rate of Perceived Exertion (RPE) = 12-16/20
  • Duration:
    • 20 – 30 minutes
  • Frequency:
    • 5 days a week
  • Mode / Type:
    • Based on your physical ability
    • Consult your doctor or rehab team (PT, OT and SLP) prior to initiation
Managing Physical Activity - Benefits

- **Physical Health**
  - Health and function
  - Weight management
  - Prevention and management of disease

- **Mental Health**
  - Stress management
  - Improved sleep
  - Emotion regulation / mood

- **Cognitive Function**
  - Improved learning, memory and attention

- **Social Engagement**

- **Increased Productivity**

Physio-pedia.com, Miczak A, ANPT
Rehabilitation – Physical Therapy

• Functional mobility impairments related to, but not limited to:
  • Hemiplegia or tetraplegia
  • Gait and balance
  • Posture
  • Range of motion limitations
  • Spasticity
  • Coordination impairments
  • Activity intolerance
  • Pain
  • Sensory integration Dysfunction
  • Impaired cognition / safety awareness related to function
Rehabilitation – Occupational Therapy

- ADL and iADL impairments related to, but not limited to:
  - Hemiplegia or tetraplegia
  - Range of motion limitations
  - Spasticity
  - Coordination impairments
  - Activity intolerance
  - Pain
  - Sensory integration Dysfunction
  - Impaired cognition / safety awareness related to function
  - Vision
  - Functional problem solving skills
  - Return to Driving
Rehabilitation – Speech Therapy

• Functional Cognitive and speech impairments related to, but not limited to:
  • Communication
  • Memory strategies
  • Attention strategies
  • Organization
  • Completion of daily routine
  • Managing appointments, money, medications, etc.
Questions

*Brain Injury Recovery: Conventional Interventions*
Traditional Medications to Assist in Recovery

• Amantadine- most studied and used in severe TBI
• Methylphenidate
• Donepezil
• Memantine
• Selective Serotonin Reuptake Inhibitors

Medications are used to assist in recovery not create recovery
New medication considerations for Neurostimulation

• Zolpidem (Ambien)- traditionally a sleep medication but reports of paradoxical reactions causing increased alertness
  • Mainly case reports
  • Short lived improvement
  • Unclear which patients will respond

• Apomorphine infusion
  • Currently in clinical trial
  • Used for neurostimulation in patients with coma, minimal conscious states, or unresponsive wakefulness state
  • Thought to promote dopamine- neurotransmitter
New Frontiers in Neurostimulation

• Transcranial Direct Current Stimulation

• Transcranial Magnetic Stimulation

• Deep Brain Stimulation
Transcranial Direct Current Stimulation

Potential uses
- Cognition
- Arousal/Alertness
- Depression
- Anxiety
- Chronic Pain

Potential Side effects
- Skin Irritation
- Tingling sensation
- Fatigue
Transcranial Direct Current Stimulation

• Differing responses d/t Individual differences in brain anatomy associated with TBI
  • post-traumatic skull defects
  • lesions that increase cerebrospinal fluid relative to brain volume
  • presence of shunt hardware, alter current flow

• May necessitate pre-stimulation current density modeling to optimize stimulation parameters to the patient.
Transcranial Magnetic Stimulation

Potential Uses
- Chronic Pain
- Stroke Recovery
- Depression
- Other Mood disorders
- Alzheimer’s Disease
Transcranial Magnetic Stimulation

- Potential Side effects
  - Headache
  - Scalp discomfort at the site of stimulation
  - Tingling, spasms or twitching of facial muscles
  - Lightheadedness
  - Seizures
  - Mania (particularly in people with bipolar)
  - Hearing loss if inadequate ear protection
Deep Brain Stimulation

- Lead
- Lead wire
- Extension
- Electrode
- Subthalamic nucleus
- Neurostimulator

- Pulse generator implanted subcutaneously on the anterior chest wall
- Thalamus
- Electrode
- Subthalamic nucleus
- Substantia nigra

Increased dopamine release in the substantia nigra
High frequency stimulation serves to resynchronize the electrical activity of the subthalamic nucleus
Deep Brain Stimulation

- 7 case reports for DBS with MCS
  - Thalamic implant, most emerged

- 40 case reports for DBS with VS
  - Thalamic or reticular formation implant
  - < 50% emerged
  - Those that did no respond were postulated to have loss of cortical connectivity and would be permanent VS
<table>
<thead>
<tr>
<th>TYPE</th>
<th>Deep Brain Stimulation (DBS)</th>
<th>Vagus Nerve Stimulation (VNS)</th>
<th>Rythmic Transcranial Magnetic Stimulation (rTMS)</th>
<th>Transcranial Direct Current Stimulation (tDCS)</th>
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<tbody>
<tr>
<td>TARGET</td>
<td>Midbrain Thalamus Pallidum Striatum</td>
<td>Vagus Nerve</td>
<td>Right or left dorsolateral prefrontal cortex or Right or left primary motor cortex or Posterior parietal cortex</td>
<td></td>
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<td>CURRENT</td>
<td>Low (8-30 Hz) or high frequencies (50-250 Hz) 1-20 V voltages</td>
<td>30 Hz 1.5 mA intensity</td>
<td>Single or repeated sessions 5-20 Hz</td>
<td>20 minutes sessions (single or repeated) 1-2 mA intensities</td>
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<td>INVASIVE</td>
<td>Yes</td>
<td>Moderately</td>
<td>No</td>
<td>No</td>
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Light Therapy

• Concept
  • Exposure to blue light in the morning can help with circadian rhythm and promote better sleep wake cycles, Promote alertness and Cognition
  • Exposure to red light improve cerebral blood flow and cognition

• Studies in mild TBI/Concussion

• Small studies but show promise in mild TBI or repetitive mild TBI
PHOTOBIOMODULATION

HEALING SUBSTANCES
- Anti-inflammatories
- Analgesics
- Immune Boosters
- Glutathione
- Growth Factors

PRECURSOR ELEMENTS
- A = Amino acids
- B = Polysaccharides
- C = Co-factors
- D = Fatty Acids
- X = Trace Minerals

NITRIC OXIDE
MITOCHONDRIA
ATP

ATP = Adenosine Triphosphate
Questions

Brain Injury Recovery: Non-Conventional Interventions