Neurostimulants after a Brain Injury: What do we know?

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• Thank you to our federal sponsor, the National Institute on Disability and Rehabilitation Research (Department of Education)

• OT Department for their beautiful classroom
## Effects of Traumatic Brain Injury – problems with regulation

<table>
<thead>
<tr>
<th>TOO MUCH</th>
<th>NOT ENOUGH</th>
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<tbody>
<tr>
<td>Irritability</td>
<td>Apathy</td>
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<tr>
<td>Impulsivity</td>
<td>Akinetic mutism</td>
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<tr>
<td>Mood ups/downs</td>
<td>Poor memory search</td>
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<tr>
<td>Mania</td>
<td>Poor flexibility in thinking</td>
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<tr>
<td>Psychosis</td>
<td>Problems with staying on task</td>
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<tr>
<td>Aggression</td>
<td>Memory impairment</td>
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<tr>
<td>Increased sexual behavior</td>
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The Major Sections of the Brain

- Frontal Lobe
- Parietal Lobe
- Temporal Lobe
- Occipital Lobe
- Lateral Sulcus
- Central Sulcus
- Brainstem
- Cerebellum
Medial Frontal Cortex
Figure AB-24: Reticular Activating System

Pathways shown in brown.
Neurotransmitters

• Dopamine
• Norepinephrine (noradrenaline)
• Acetylcholine
Speed, Attention and Memory

Neurostimulants can affect:

How fast you think
How well you can pay attention (how really awake you are)
How much/well you can remember
Attention

- **Neural network**
  - Ascending reticular activating system (brain stem) working *from the bottom-up*
  - Global attention
  - Prefrontal, parietal, and limbic cortices working *from the top-down*
  - Attention specific to context, motivation, significance, and conscious volition
• Lesions of this area result in
  – Amotivational apathetic state
    • Less talking and gesturing
    • Decreased curiosity
    • Less vocal inflection and facial expression
    • Reduced social interest, diminished affection
    • Reduced initiation and poor maintenance of activities
• Lesion in superior medial frontal cortex – slowed response time
• Lesion in the Dorsolateral Prefrontal Cortex – no problems initiating but lots of errors (unable to switch sets)
• Lesion in the caudate nucleus – Might have both slowed processing time and perseverative errors
Memory

• Temporal lobe or diencephalon (hippocampus) – actual storage of memory

• Frontal lobe damage
  – Impaired recall that depends on self-initiated cues, organization, search selection, and verification of stored information
Neurostimulants

amphetamine
Norepinephrine (TCAs)
methylphenidate, dextroamphetamine
amantadine
L-dopa/carbidopa
bromocriptine
pergolide
physostigmine
donepezil
selegiline
apomorphine
caffeine
phenylpropanolamine
Naltrexone
atomoxetine
Methylphenidate (Ritalin)

• Dopaminergic agent
  – Small studies that indicate that MPH improves processing speed, and levels of attention (which may improve memory)
  – In rats, improves dopamine transmission between nerve cells as well
  – Probably true for amphetamines as well
Rivastigmine

- Cholinesterase inhibitor – stops the breakdown of acetylcholine in the brain
- Seems to have promising results in patients with specific memory impairments
- (donepezil – Aricept, tacrine – Cognex, memantine – Namenda, galantamine – Razadyne)
Other Dopaminergic Drugs

amantadine
L-dopa/carbidopa
bromocriptine
How to decide whether to prescribe or use?

• Helps to have a specific behavior in mind that you want to improve
  – Is it speed, alertness, or memory that is the issue
How to decide whether to prescribe or use?

• Are there any reasons NOT to take the drug?
  – Heart problems
  – Other medications that might interact
  – History of addiction
  – Irritability
How to decide whether to prescribe or use?

• When to take the drugs?
  – No one really knows
IF you and your doctor decide to try a neurostimulant:

• Be your own research project
  – Figure out what your desired results are
  – Begin a dose of the drug
  – Observe and keep records
  – May need to increase the dose of the drug
  – May need to go back off the drug to see if it was really working or not
Questions?