COGNITIVE FUNCTIONING IN MULTIPLE SCLEROSIS

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OVERVIEW OF TODAY’S TALK

- Overview of cognitive deficits in MS
- Screening Tools
  - BICAMS
  - Oral SDMT
  - Self-report
- Treatment of Cognitive Impairment
  - Medical MJ
  - Stimulant medication
  - Compensatory Strategies
SYMPTOM: COGNITIVE IMPAIRMENT

- “There is marked enfeeblement of memory; conceptions are formed slowly; the intellectual and emotional faculties are blunted in their totality.” (Charcot, 1877)
- 30-70%
SYMPTOM: COGNITIVE IMPAIRMENT

- Can occur in all stages
  - CIS, early RRMS, SPMS, PPMS
  - Some form seen in ~40% of patients within one month from onset of neurologic symptoms
  - 35-45% in RRMS
  - 50-60% with SPMS and PPMS
  - 20% of patients with “benign” MS
- Tends to be more severe with increased disease duration, although correlation is modest
- Poorly correlated with physical disability
- Stronger correlations with MRI parameters, particularly gray matter atrophy

Achiron & Barak (2003); Roy et al., (2016)
COGNITIVE CHANGES IN MS

- Highly variable: No two people are alike
- Changes can occur early or late or not at all; course is variable
- Sometimes confused with depression
COGNITIVE IMPAIRMENT

- **Commonly affected**
  - Information processing
    - Processing speed (PS)
    - Working memory (WM)
  - Learning and Memory
  - Executive Functioning

- **Less commonly affected**
  - Language
“Information processing efficiency may be conceptualized as involving working memory capacity in addition to speed of processing.”

Three Factors

1) simple speed/RT
2) complex information processing speed
3) verbal/spatial working memory

Archibald & Fisk, 2000; Chiaravalloti et al., 2003
PS: SIMPLE
PS: COMPLEX

\[ 16 + 17 = 42 \]
\[ 14 \times 8 = 56 \]
\[ 342 \times 3159 \]
The ability to maintain and manipulate information in short term memory
IMPACT OF COGNITIVE IMPAIRMENT

- Greater risk for employment problems
- Difficulties with activities of daily living
  - May need personal assistance
  - Dependent on others
  - More likely to be in MVA
- Affects interpersonal relationships
- Reduces quality of life
- May reduced ability to understand and adhere to treatment regimens

see Messinis et al. (2010)
What happens to the MS-related cognitive problems over time?

- Some people experience cognitive impairment early in the disease
- As the disease progresses, the number of people with MS who develop cognitive impairment tends to increase.
  - In long term studies, the proportion of MS patients who were cognitively impaired at the end of 10 years was 56%
- Early cognitive impairment (especially PS and memory) predict disability progression and SP conversion in newly diagnosed RRMS

Moccia et al. (2016)
Cognitive impairment can be difficult to detect during a neurological clinical examination.

- Suspect cognitive impairment - correct approximately 90% of the time.
- Suspect no cognitive impairment - correct approximately 50% of the time.

Benedict (2005)
Comprehensive neuropsychological assessment is the gold standard, but is time-intensive, expensive, and not available everywhere.

Screens:
- Expanded Disability Status Scale (EDSS)
  - Offers only a rudimentary estimate of cognitive function
- Mini-mental State Examination (MMSE)
  - Poor sensitivity with MS patients
  - Nearly 70% rate of false negatives

Beatty & Goodkin (1990)
Brief International Cognitive Assessment for Multiple Sclerosis (BICAMS)

- Recommended for smaller centers with only one or two staff, little NP training
- Constructed to maximize international use
  - Czech Republic, Hungary, Brazil, Ireland, Italy, Canada
- Developed to identify common cognitive deficits and monitor cognition over time

Langdon, et al. (2012)
5 min: SDMT (processing speed)
15 min:
  - SDMT (processing speed)
  - T1-T5 CVLT-II (verbal list learning)
  - T1-T3 BVMT-R (visuospatial learning)
Modest relationship with functional abilities
BVMT-R showed best prediction of employment status
Shows similar accuracy and reliability to longer, more comprehensive batteries, validating it’s use as a screen
Not meant to replace more comprehensive batteries that evaluate other areas of cognition, can personalize treatment/rehabilitation techniques

Dusankova et al. (2012); Walker et al. (2016)
**NEUROPSYCHOLOGICAL SCREENING**

- **Screen- Symbol Digit Modalities Test (SDMT)- oral version**
  - Can be administered and scored in less than 5 minutes
  - <55 accurately classified 72% of cognitively impaired patients
  - Sensitive to cognitive changes in MS
  - Test in BICAMS with the best sensitivity and specificity
    - Correctly classified 95% of participants compared to other tests (CVLT-II 81.5% and BVMT-R 81.0%)
  - False positives in patients with significant dysarthria

Parmenter et al. (2007)
Multiple Sclerosis Neuropsychological Questionnaire (MSNQ)

- Self-report
  - Not reliable
    - Poor insight—underestimate in up to a third of patients
    - Depression—can result in overestimation
    - MSNQ self report better correlated with depression than objective cognitive functioning

- Other report
  - 15-item questionnaire; informant report correctly classified up to 94% of cognitively impaired patients

Marijuana? Limited data

- Slowed information processing speed, although not necessarily differences in accuracy
- Some studies also found reduced visuospatial abilities, executive functioning, visual memory
- Increased activation in expected brain regions
- Additional activation in non-expected brain regions
  - Associated with greater errors
- Summary: “...cannabis appears to further compromise the brain’s structural integrity, as it pertains to cognitive abilities.” (Feinstein, Banwell, & Pavisian, 2015; p. 1757)
- Data equivocal with regard to pharmaceutically engineered cannabis and cognition in MS

Feinstein, Banwell, & Pavisian (2015)
Psychostimulants? Limited data

- Single dose methylphenidate appears to improve attention in patients with MS
- L-amphetamine
  - Single dose associated with improved cognitive processing speed in the treatment group administered the largest dose
  - Over 29-days, patients showed improvement on memory testing

Harel et al. (2009); see Roy et al. (2016)
Literature supports multidisciplinary rehabilitation for neurological disorders, but few studies have been done specifically looking at MS patients.

Can involve both group and individual treatments focused on both physical and cognitive functioning.

- Compensatory strategies
  - Compensate for cognitive difficulties

- Substitution strategies
  - Substitute an intact cognitive ability for an impaired one
Examples of Compensatory Techniques

- External memory aides
  - Notebooks
  - Smart phones

Example of Substitution

- Use of visual reminders
- Difficulty remembering that a load of laundry in the washing machine? Encourage him or her to place a laundry basket upside down in the hallway as a cue

Langill & Parmenter, 2009; Messinis et al., 2010; Shevil & Finlayson, 2010
Calendars: within view

Organization and Structure: Labels on drawers and shelves, creation of an organized environment

Prospective memory: dry erase boards, calendars, post-its
- Timers for turning lights/appliances on and off
- Watch or cell phone alarms and reminders
- Voice-messages or recordings
- Basket or designated places to put items
THANK YOU
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SELECTED REFERENCES

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