The Use of Brief Assessment Batteries in Multiple Sclerosis

Robert L. Kane, Ph.D. ABPP-Cn

Assoc. Director Communications

VA MSCE East

History of Cognitive Studies in MS

- Since MS is a CNS disorder is there a cognitive component
- What is the severity
- With what frequency does it occur
- Is there a particular pattern or presentation
- Does the pattern or severity vary with subtype of course

3

Clinical Questions

- Who needs to be assessed
- What cognitive domains need to be covered
- With what frequency should the assessments take place
- Strategies for assessment related to purpose
- *Comprehensive*: Assessment for rehabilitation, benefits, vocational planning
- *Detection*: Identification of individuals showing deficits
- *Monitoring*: Assessing cognitive changes as a treatment outcome

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4

Neurocognitive Assessment as Review of Systems

- Neurologic
- Musculoskeletal
- Cardiovascular
- Respiratory

- GI
- GU
- Integumentary (skin)
- (Pain)

- Attention
- Immediate memory
- Sustained focused
- Working memory
- divided
- Memory
- Learning
- Recall
- Recognition
- Language
- Fluency
- Comprehension
- Repetition
- Problem Solving
- Executive Functioning
- Processing Speed

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5

Strategy

- If you have a population where ~50% of the patients may have problems does it make

sense to screen first before embarking on a comprehensive exam?

- Is there sufficient consistency in deficits to permit short screening approaches?
- Can short batteries be used to monitor treatment progression and outcome?

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6

Characteristics of a Screening Examination

- Brief
- Inexpensive
- Sample pertinent disease parameters (domains, constructs, predictability)
- Balance Sensitivity and Specificity
- Sensitivity: ability to make correct identification
- (*detect true positives*)
- Specificity: ability to not identify everything else in the process
- (*minimize false positives)*

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7

Characteristics of a Screening Examination: for sequential monitoring

- Brief
- Inexpensive
- Sample pertinent disease parameters
- Balance Sensitivity and Specificity
- ***Repeatable with methods of identifying meaningful change***

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8

Screening Approaches

- MSNQ (MS Neuropsychological Screening Questionnaire)
- MMSE (Mini Mental Status Examination)
- *BRB-N (Brief Repeatable Battery-Neuropsychological*
- *BNPB (Brief Neuropsychological Battery)*
- SEFCI (Screening Examination for Cognitive Impairment)
- RBANS (Repeatable Battery for the

Assessment of Neuropsychological Status)

- BSB (Basso Screening Battery)
- MACFIMS (Minimal Assessment of Cognitive Function in MS)
- ANAM (Automated Neuropsychological Assessment Metrics)

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9

Dimensions for Battery Review

- Time
- Yield
- Repeatability
- Sensitivity/Specificity

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10

MSNQ

MS Neuropsychological Screening Questionnaire

- Time
- 5 min (patient and informant)
- Yield
- Reported symptoms of cognitive and

behavioral problems
- Repeatability
- Utility as change measure not established
- Sensitivity/Specificity (Informant)[1]
- Sensitivity: .83
- Specificity: .97

[1] Benedict R et al (2003) Mult Sclr. V9 95-101

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11

MMSE

Mini Mental Status Examination

- Time
- 5-10 minutes
- Yield
- Global summary score
- Repeatability
- Single form
- Sensitivity/Specificity[1]
- Sensitivity: 21-36% MS
- Generally poor with specific or subcortical lesions
- Specificity: 89-100%

- [1] Fischer JS (2001) in SD Cook (Ed) Handbook of MS 3rd ed.

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12

BRB-N

Brief Repeatable Battery-Neuropsychological

- Time
- 30-35 minutes
- Yield
- Selective Reminding, 10/36 Spatial Recall, PASAT, Digit Symbol Modalities, *COWA*
- Repeatability
- Some measures have alternative forms
- Not all alternate forms are equivalent
-

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13

BRB-N

Brief Repeatable Battery-Neuropsychological

- Sensitivity/Specificity (memory)
- Sensitivity: 93%[1]

- Specificity: 48%
- Sensitivity
- 1+ impaired tests:41.9%[2]
- 2+ impaired tests: 16.2%
- Performance and performance changes correlated with MRI findings[3]

[1] Dent A & Lincoln NB (2000) Br J Clin Psychol v39 p. 311-5

[2] Solari A. et al. (2002) Mult Scler v8 p. 169-76

[3] Hohol MJ et al (1997) Arch Neurol v54 p. 1018-25

BNPB

Brief Neuropsychological Battery

- Time
- 20 min
- Yield
- Selective Reminding, 7/24 Spatial Recall, PASAT, COWA
- Repeatability
- Alternate forms available for most measures

- Sensitivity/Specificity

- Sensitivity: 71%[1]
- Specificity: 94%

- Sensitivity: 68%[2]
- Specificity: 85%

[1] Rao SM et al. (1991) Neurology v41 p.685-91

[2] Fischer JS (2001) in SD Cook (Ed) Handbook of MS 3rd ed.

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15

SEFCI

Screening Examination for Cognitive Impairment

- Time
- 20-30 min
- Yield
- List learning and recall, Symbol Digit Modalities, Shipley ILS
- Repeatability
- Alternate forms not available for all measures

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16

SEFCI

Screening Examination for Cognitive Impairment

- Sensitivity/Specificity[1]
- 86% : 1+ cog measure
- 100%: 3+ cog domains

- 90%: 0 cog domains
- Sensitivity/Specificity[2]
- Sensitivity: 74-86%
- Specificity: 90-91%
- Sensitivity[3]
- 1+ impaired tests: 31.5%
- 2+ impaired tests: 18.5%

[1] Beatty WW et al (1995) Neurology v45 p. 718-23

[2] Fischer JS (2001) in SD Cook (Ed) Handbook of MS 3rd ed

[3] Solari et al (2002) Mult Sclr v8 p. 169-76

RBANS

Repeatable Battery for the Assessment of Neuropsychological Status

- Time
- 25 Minutes
- Yield
- Index scores
- Individual test norms now available
- Repeatability
- 2 alternate forms
- Supplemental release contains change score information
- Sensitivity/Specificity[1]

- =MMSE
- <BNPB
- <SEFCI

[1] Aupperle RL et al. (2002) Mult Sclr v8 p. 382-9

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18

BSB

Basso Screening Battery

- Time
- 20 min
- Yield
- Logical Memory, COWA, Seashore Rhythm, graphesthesia, sterognosis
- Repeatability
- No alternate form for memory measure
- Sensitivity/Specificity[1]
- Sensitivity: 100% (not independent of criterion)
- Specificity: 80% (not independent of criterion)

[1] Basso MR et al. (1996) Arch Neurol v53 p. 980-4

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19

MACFIMS

Minimal Assessment of Cognitive Function in MS

- Time
- 90 Min
- Yield
- Working Memory, Processing Speed, Learning/Memory, Executive Functioning, Perception/Spatial Processing, Word Fluency
- Repeatability
- Alternate forms available for most measures
- Sensitivity/Specificity

Benedict RHB et al (2002) Clin Neuropsyol v16 p. 381-397

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20

ANAM

Automated Neuropsychological Assessment Metrics

- Time
- ~25 Minutes
- Yield

- Scores related to processing speed/attention, working memory, memory, executive fx
- Repeatability
- Multiple computer produced forms
- Sensitivity/Specificity[1]
- Time 1
- Sensitivity: 87.5%
- Specificity: 97.5
- Time 2
- Sensitivity: 85.7%
- Specificity: 100%

[1] Wilken J et al. (2003) Mult Sclr v9 p. 119-27

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21

Sensitivity in Early MS

Classification Agreement MS Patients: Time 1

Computerized Tests

Intact

Impaired

Percent Correct

Traditional Measures

Intact

39

1

97.5

Impaired

1

7

87.5

Overall Rate

95.8

Classification Agreement MS Patients: 6 Month Follow-up

Computerized Tests

Intact

Impaired

Percent Correct

Traditional Measures

Intact

29

0

100

Impaired

1

6

85.7

Overall Rate

97.2

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22

Attention/Processing Construct Validity: Correlation of indicator tests with latent construct

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23

Working Memory Construct Validity: Correlation of indicator tests with latent construct

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24

DS Back

LNS Tot

Math

TP

.

85

.

49

.

71

.

76

Arith Tot

Note. Arith Tot = Wechsler Adult Intelligence Scale- III (WAIS-III) arithmetic total score. DS Back = WAIS-III digit span backward. LNS Tot = WAIS-III letter-number sequencing total score. Math TP = ANAM Math TP score.

Working Memory

Construct Validity - Working Memory

N = 65. $c^2(2)=1.94$, GFI = 0.99, RMSEA=.00

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DS Back

LNS Tot

RM TP

.

81

.

60

.

56

.

63

Arith Tot

Note. Arith Tot = Wechsler Adult Intelligence Scale- III (WAIS-III) arithmetic total score. DS Back = WAIS-III digit span backward. LNS Tot = WAIS-III letter-number sequencing total score. RM TP = ANAM Running Memory TP score.

Working Memory

Construct Validity - Working Memory

N = 65. $c^2(2)=1.31$, GFI = 0.99, RMSEA=.00

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26

Note. CVLT

Sav = California Verbal Learning Test savings score; HS Loss =

Heaton Story percentage loss

T-score; HF Loss =

Heaton Figure percentage loss T-score; MTS

TP =

WinSCAT Matching to sample

thtroughput.

CVLT

Sav

HS Loss

HF Loss

MTS

TP

Memory

.

52

.

.47

.

42

.

51

n = 66 $c^2(2)=1.15$, GFI = .99. RMSEA=.00

Memory Construct in a Clinical Sample Matching to Sample Throughput

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27

Remote ANAM

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28

Reliable Change Index (RCI)

- RCI = (postest – baseline) / SE_{meas}
- Where $SE_{meas} = sd_{baseline} * sqrt(1-r_{xx})$
- r_{xx} is the reliability of the measure
- Baseline = sd of last three trials prior to observations of interest
- Assumption: Once stable baseline has been attained, differences among an individual's scores are due to measurement error
- Changes significantly greater than measurement error reflect true change (<= 95% confidence interval)

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29

Number of Significant Changes to RCI

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30

Summary

- Compelling reasons to make neurocognitive assessment more obtainable
- Data support the focus on using brief screens to identify individuals in need of further assessment
- Focus should also be on patient monitoring
- Selecting measures that are repeatable
- Developing good procedures for assessing change