Post-stroke Cognitive Deficits: SLP Assessment & Cognitive Rehabilitation

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Audiology, Speech Language Pathology & Deaf Studies
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Objectives

Participants will be able to

1) identify cognitive domains likely impacted after stroke
2) list appropriate cognitive screenings & assessments, and
3) provide examples of functional cognitive tasks
Why stroke and cognition?
My background and experience
TBI units vs Stroke units
Stroke

795,000 new or recurrent strokes each year
6.8 million stroke survivors in U.S. (age 20+)
Americans are living longer, therefore more survivors
Stroke projections from 2012 - 2030

20.5% increase in prevalence: 2.3% to nearly 4%

(Mozaffarian, et al., 2016; Ovbiagele, et al., 2013).
Review

Stroke, cognitive deficits, and rehabilitation: still an incomplete picture

Toby B. Cumming¹*, Randolph S. Marshall², and Ronald M. Lazar²

International Journal Of Stroke 2013
Stroke and cognition
review by Cumming et al. 2013

• Cognitive deficits are common after stroke

• Distinct cognitive impairment after stroke?
  • Across all domains
  • Possibly weighted more toward **attention, executive function**, more than memory (Cumming, et al 2013)
  • Exclusion of patients with dementia in stroke studies
    • In vascular dementia long term memory superior & more frontal executive impairment than Alzheimer’s dementia
    • Speed of processing – major influence on cognitive domains

**Attention**
Stroke and cognition
review by Cumming et al. 2013

Stroke characteristics / factors more predictive of subsequent dementia

• Hemorrhagic stroke
  associated with cognitive deficits across multiple domains

• Left hemisphere strokes*
  • Language is confounding factor in testing

• Recurrent stroke
  • Associated with incident stroke at 2 year follow-up
Stroke and cognition
review by Cumming et al. 2013

- Laterality and recovery from cognitive deficits is unclear – research is conflicting with support for right vs left vs no difference
- Aphasia and hemispatial neglect are most common focal cognitive deficits
- Diffuse neuronal dysfunction associated with cognitive deficits
  - White matter disease; accumulation of small infarcts
Stroke and cognition
review by Cumming et al. 2013

- Internal capsule, caudate, thalamus
  - Slowed processing, attention, executive impairments

- Hypoperfusion – compromised blood flow

- Subcortical stroke
  - Basal ganglia- memory, attention, visuospatial, language
  - Thalamus – memory, executive function, attention
Stroke and cognition
JAMA, 2015
Cognition and stroke

• Cognitive deficits occur after stroke in older and younger populations

• Most survivors show some improvement in the first 4 months to one year

• Cognitive deficits may develop later – reassessment is important

• Rehabilitation and patient/family education are important

• Ballard et al., 2003 found 9% stroke survivors in their study, age 75+ developed dementia later on (n=115)

(Ballard, et al., 2003; Brainin, et al., 2015; Levine et al., 2015; Rasquin et al., 2013)
A word about aging and cognition

Cognitive function varies for **individuals**
- Influenced by personal factors
- Influenced by environmental factors
- Need for more longitudinal studies at the individual level to establish baseline for individuals

Areas of cognition that typically remain stable are
- Crystallized intelligence, Vocabulary, general knowledge
- semantic memory
- procedural memory
  
  (Hoyer & Verhaeghen, 2006; Simen, Bordner, Martin, Moy, & Barry, 2011; Schaie, 2005)
A word about cognition and aging

Cognitive areas that may decline with age are

- inductive reasoning,
- spatial orientation,
- speed of processing,
- verbal fluency,
- verbal memory vs. visuospatial memory
- episodic memory, working memory,
- attention (particularly for competing stimuli

(Allaire, & Marsiske, 2002; Hoyer & Verhaeghen, 2006; Simen, Bordner, Martin, Moy, & Barry, 2011; Schaie, 2005).
Major Domains of Cognitive Functions
Attention

Everyone knows what attention is...

[IT] is taking possession of the mind, in clear and vivid form, of one out of what seem several simultaneously possible objects or trains of thought.

Focalization, concentration of consciousness are of its essence. It implies withdrawal from some things in order to deal effectively with others.

(James, 1890/1950) cited in Kimbarow, p.2
Attention Model: Sohlberg & Mateer

*Sustained*

*Executive Control*

Selective
Alternating
Suppression

*Working Memory*

Clinical model
Divided into 2 broad basic abilities
1. Sustained attention
2. Executive control
**Memory Model**
-Baddeley & Hitch

Short Term Memory/
Working Memory
&
Long Term Memory
Executive Function

- A complex neuropsychological construct
- overlaps with attention & memory
- BUT distinct from attention & memory
- Definitions vary
- Plays a critical role in goal-directed and purposeful behavior by assisting in planning, organizing, initiating and adapting behaviors as the situation demands
<table>
<thead>
<tr>
<th>Domain of executive function model</th>
<th>Dysexecutive syndrome applied to communication disorder</th>
<th>Dysexecutive syndrome applied to grocery shopping</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initiation and drive</td>
<td>Does not initiate conversation; exhibits flat affect with limited expression</td>
<td>Does not initiate going to grocery store even when refrigerator is empty</td>
</tr>
<tr>
<td>Response inhibition</td>
<td>Makes inappropriate comments; does not wait for turn in conversation</td>
<td>Impulsive shopping; buys unnecessary items that look appealing during the shopping excursion</td>
</tr>
<tr>
<td>Task persistence</td>
<td>Loses interest in conversation; cannot maintain topic</td>
<td>Does not get all the items on the list</td>
</tr>
<tr>
<td>Organization</td>
<td>Poor verbal organization; jumps from topic to topic; seems to talk “around a subject” and not get to the main idea</td>
<td>Does not make a grocery list; does not use aisle headings to shop in an organized manner; inefficient use of time when gathering groceries</td>
</tr>
<tr>
<td>Generative thinking</td>
<td>Unable to generate conversation; seems to have little to say; has difficulty responding to open-ended questions</td>
<td>If desired item is not available, cannot generate appropriate substitute</td>
</tr>
<tr>
<td>Awareness</td>
<td>Seemingly unaware of communication deficits; does not seem to notice if others are not interested in topic</td>
<td>Is not aware that getting groceries is an area of concern</td>
</tr>
</tbody>
</table>


Executive Function:
Cognitive communicative consequences of executive dysfunction
Assessment: Screenings

- The Montreal Cognitive Assessment (MOCA)
- St. Louis University Mental Status (SLUMS)
- Mini-Mental State Exam (MMSE)
- Short Portable Mental Status Questionnaire

- Resource: Dementia KT website > measures and tools > dementia outcome measurement suite (DOMS)
## MONTREAL COGNITIVE ASSESSMENT (MOCA)

**Version 7.1 Original Version**

### VISUOSPATIAL / EXECUTIVE

<table>
<thead>
<tr>
<th>Points</th>
<th>Copy cube</th>
<th>Draw CLOCK (Ten past eleven)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>[ ]</td>
<td>[ ]</td>
</tr>
</tbody>
</table>

### NAMING

<table>
<thead>
<tr>
<th>Points</th>
<th>Contour</th>
<th>Numbers</th>
<th>Hands</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>[ ]</td>
<td>[ ]</td>
<td>[ ]</td>
</tr>
</tbody>
</table>

### MEMORY

**Read list of words, subject must repeat them. Do 2 trials, even if 1st trial is successful. Do a recall after 3 minutes.**

<table>
<thead>
<tr>
<th>1st trial</th>
<th>VELVET</th>
<th>CHURCH</th>
<th>DAISY</th>
<th>RED</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>2nd trial</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
</table>

### ATTENTION

**Read list of digits (1 digit/sec.). Subject has to repeat them in the forward order in 2 trials.**

<table>
<thead>
<tr>
<th>Forward Order</th>
<th>[ ] 2 1 8 5 4</th>
</tr>
</thead>
</table>

**Subject has to repeat them in the backward order in 2 trials.**

<table>
<thead>
<tr>
<th>Backward Order</th>
<th>[ ] 7 4 2</th>
</tr>
</thead>
</table>

**Read list of letters. The subject must tap his hand at each letter.**

|----------------------|------------------|

**4 or 5 correct subtractions:**

<table>
<thead>
<tr>
<th>Correct subtractions</th>
<th>3 pts, 2 or 3 correct: 2 pts, 1 correct: 1 pt, 0 correct: 0 pt</th>
</tr>
</thead>
</table>

### LANGUAGE

**Repeat: I only know that John is the one to help today.**

<table>
<thead>
<tr>
<th>[ ] The cat always hid under the couch when dogs were in the room.</th>
</tr>
</thead>
</table>

**Fluency/Name maximum number of words in one minute that begin with the letter F.**

<table>
<thead>
<tr>
<th>[ ] ______ (at least 8 words)</th>
</tr>
</thead>
</table>

### ABSTRACTION

**Similarly between e.g. bananas - orange = fruit.**

<table>
<thead>
<tr>
<th>[ ] train - bicycle</th>
<th>[ ] watch - ruler</th>
</tr>
</thead>
</table>

### DELAYED RECALL

**Function: Has to recall words WITH NO CUE.**

<table>
<thead>
<tr>
<th>FACE</th>
<th>VELVET</th>
<th>CHURCH</th>
<th>DAISY</th>
<th>RED</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Points for UNRECOGNIZED recall only</th>
<th>[ ] 5</th>
</tr>
</thead>
</table>

### Optional

**Category List:**

<table>
<thead>
<tr>
<th>[ ] Multiple choice cue</th>
</tr>
</thead>
</table>

### ORIENTATION

<table>
<thead>
<tr>
<th>Date</th>
<th>Month</th>
<th>Year</th>
<th>Day</th>
<th>Place</th>
<th>City</th>
</tr>
</thead>
</table>

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Administered by: [ ]

TOTAL: 26 / 30

Add 1 point if ≤ 12 yrs old
VAMC
SLUMS Examination

Questions about this assessment tool? E-mail slumsinfo@va.gov

Name ____________________________ Age ______________________

Is patient alert? __________ Level of education __________________

1. What day of the week is it?
2. What is the year?
3. What state are we in?
4. Please remember these five objects. I will ask you what they are later.
   apple   pen   tie   house   cat
5. You have $100 and you go to the store and buy a dozen apples for $3 and a tricycle for $20.
   a. How much did you spend?
   b. How much do you have left?
6. Please name as many animals as you can in one minute:
   9-14 animals   5-9 animals   1-4 animals   14+ animals
7. What were the first objects I asked you to remember? I point for each one correct.
8. I am going to give you a series of numbers and I would like you to give them to me backwards.
   For example, if I say 42, you would say 24.
   47   649   8537
9. This is a clock face. Please put in the hour markers and the time of ten minutes to eleven o’clock.
   
   Hour markers okay
   Time correct
10. Please place an X in the triangle.
   
   Which of the above figures is largest?

11. I am going to tell you a story. Please listen carefully because afterwards, I’m going to ask you some questions about it.
   Jill was a very successful stockbroker. She made a lot of money on the stock market. She then met Jack, a devastatingly handsome man. She married him and had three children. They lived in Chicago. She then stopped work and stayed at home to bring up her children. When they were teenagers, she went back to work. She and Jack lived happily ever after.
   a. What was the female’s name?
   b. What work did she do?
   c. When did she go back to work?
   d. What state did she live in?

TOTAL SCORE __________________________

SCORING

<table>
<thead>
<tr>
<th>High School Education</th>
<th>Less than High School Education</th>
</tr>
</thead>
<tbody>
<tr>
<td>27-30</td>
<td>Normal</td>
</tr>
<tr>
<td>21-26</td>
<td>MND</td>
</tr>
<tr>
<td>1-20</td>
<td>Dementia</td>
</tr>
<tr>
<td>* Mild Neurocognitive Disorder</td>
<td></td>
</tr>
</tbody>
</table>
Assessments

- Functional Assessment of Verbal Reasoning and Executive Strategies (FAVRES)
- Behavioral Assessment of the Dysexecutive Syndrome (BADS)
- Repeatable Battery for the Assessment of Neuropsychological Status (RBANS)
- Arizona Battery for Communication Disorders of Dementia (ABCD)
- Test of Everyday Attention (TEA)
- Ross Information Processing Assessment 2 (RIPA2)

(NIH Cognitive Toolbox)
Offering valuable enhancements, the RBANS Update provides a brief, individually administered battery to measure cognitive decline or improvement across these domains:

- **Immediate Memory** – List Learning and Story Memory
- **Visuospatial/Constructional** – Figure Copy and Line Orientation
- **Language** – Picture naming and Semantic Fluency
- **Attention** – Digit Span and Coding
- **Delayed Memory** – List Recall, List Recognition, Story Memory, and Figure Recall

**Uses & Applications**

This instrument is used by clinicians and neuropsychologists to help:

- Screen for deficits in acute-care settings
- Track recovery during rehabilitation
- Track progression of neurological disorders
- Screen for neurocognitive status in adolescents

**Features & Benefits**

RBANS Update provides significant improvements, including:

- Downward age extension to 12:0 years
- Equating studies for Forms C and D and Spanish Form A
- Subtest scores now available in addition to Index scores
- Manual updates, including new information on adolescents and review of RBANS-specific research conducted since original publication (1998)
Informal assessments

• Tailored to the client

• Based on client’s needs and/ or personal goals

• Examples {combines domains}
  • Give me directions to your room; then, “Take me to your room”
  • Given a specific budget, find items online and put them in a shopping cart
  • Use this grocery store flyer and a specific amount of money, make a list to prepare a specific meal
  • Plan a fishing trip for me: Use resources to locate the place, purchase license, and equipment. Provide costs, etc.
Treatment
Primary Goals of cognitive rehabilitation

Ameliorate injury related deficits in order to maximize safety, daily functioning, independence, and quality of life.

  - The American Congress of Rehabilitation Medicine
Primary Goals of cognitive rehabilitation

- Emphasis on progress in these long term goal areas

1) Problem orientation, awareness and goal setting
2) Compensation
3) Internalization
4) Generalization

Haskins, et al. (2012)
Primary Goals of cognitive rehabilitation

• Emphasis on progress in these long term goal areas

1) Problem orientation, awareness and goal setting
   Recognition of the problem
   Collaborative goal setting
   Developing self-awareness
   Emotionally supportive & positive environment

Haskins, et al. (2012)
Primary Goals of cognitive rehabilitation

- Emphasis on progress in these long term goal areas

2) **Compensation**
   
   Function effectively despite deficits
   Achieve similar outcomes using new ways

Haskins, et al. (2012)
Primary Goals of cognitive rehabilitation

• Emphasis on progress in these long term goal areas

3) Internalization
   Increasing automaticity of practiced strategies
   Less reliance on external assistance or cueing
   Increasing independence in task performance

Haskins, et al. (2012)
Primary Goals of cognitive rehabilitation

• Emphasis on progress in these long term goal areas

4) Generalization

Apply skills learned in one task or setting to other similar tasks or settings

Use of skills in personally relevant areas of function

Haskins, et al. (2012)
Intervention techniques

- Optimizing Cognitive Rehabilitation: Effective Instructional Methods
  - Sohlberg & Turkstra (2011).
  - Research Evidence – review of 857 studies > 57 used for final evidence base

Systematic instructional methods vs Conventional methods
Intervention techniques: Instructional Methods

**Systematic instructional methods**
- educational approach
- steps are planned and sequenced
- careful analysis of learner
- simple to complex
- error-controlled (includes errorless learning)

**Conventional methods**
- “trial and error” or “test and correct”
- materials adapted based on learner style
- correction or feedback after error

Sohlberg & Turkstra (2011)
What is functional?

What criteria is used to determine if a task is "functional" for a stroke survivor?

"Functional" is based on applicability to the needs and/or interests of the client.

What’s functional for me might not be functional for you.
Treatment Examples

**Food & meal management**

Finding recipes/ Making a list of ingredients

Determining the cost of the purchases needed

Sales flyer. Index cards with grocery items and prices

Sort index cards to show what should /should not go in a recipe

Cookbook? Or Youtube?

Use of video allows for self awareness and problem-solving.

Use of pauses? Slower speed? Taking notes?
Treatment Examples

Car maintenance and repair

Create a checklist

Have steps to do a basic repair (change the oil) (visual or written).

Sequence or determine what is missing

Watch video of basic sequence

Identify self-management strategies to view the video

Retell the steps (or write them down)
Treatment Examples

**Multi-step tasks**

Examples

- Crafting - Napkin folding, scrapbooking, etc.
- Cooking/ baking
- Shopping at a store

Plan do review goal sheet
Goal-Plan-Do-Review Sheet

GOAL
What do I want to accomplish?

PLAN
How am I going to accomplish my goal?

<table>
<thead>
<tr>
<th>MATERIALS/EQUIPMENT</th>
<th>STEPS/ASSIGMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>1.</td>
</tr>
<tr>
<td>2.</td>
<td>2.</td>
</tr>
<tr>
<td>3.</td>
<td>3.</td>
</tr>
<tr>
<td>4.</td>
<td>4.</td>
</tr>
<tr>
<td>5.</td>
<td>5.</td>
</tr>
</tbody>
</table>

PREDICTION
How well will I do? How much will I get done?

Self rating  1  2  3  4  5  6  7  8  9  10
Teacher Rating  1  2  3  4  5  6  7  8  9  10

DO

<table>
<thead>
<tr>
<th>PROBLEMS ARISE?</th>
<th>FORMULATE SOLUTIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>1.</td>
</tr>
<tr>
<td>2.</td>
<td>2.</td>
</tr>
<tr>
<td>3.</td>
<td>3.</td>
</tr>
</tbody>
</table>

REVIEW

<table>
<thead>
<tr>
<th>HOW DID I DO?</th>
<th>WHAT WORKED?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Self rating</td>
<td>1  2  3  4  5  6  7  8  9  10</td>
</tr>
<tr>
<td>Teacher rating</td>
<td>1  2  3  4  5  6  7  8  9  10</td>
</tr>
</tbody>
</table>

WHAT DIDN'T WORK?
1.
2.
3.

WHAT WILL I TRY DIFFERENTLY NEXT TIME?

Other Resources

CogSMART stands for: Cognitive Symptom Management and Rehabilitation Therapy

Workbooks: WALC, Source for Cognitive Rehabilitation, etc.

Wikis – How to do....... – step by step guides

Family photos

Study guides

Restaurant menus

Financial Templates - budgets
Treatment Programs/ Apps/ Software

Constant Therapy

Lingraphica Talk Path

Lumosity

http://www.lumosity.com/
  - use in therapy or have patient use independently

Braintrain

http://www.braintrain.com/#
  - software programs for professionals to use with clients

Cognifit

• https://www.cognifit.com/brain-games

software for general use
Spaced Retrieval methods

Expanded rehearsal time (spaced retrieval methods) (Brush & Camp, 1998- as cited by Sohlberg & Mateer 2001)

1) Learning should be effortless
2) Information or procedures should be concrete
3) Errors should be limited
4) One piece of information taught at a time
5) Data sheets used to track intervals but length does have to be exact
6) If clients cannot recall longer than 6 seconds after 6 sessions – poorer prognosis
Errorless Learning: Case Example 1

Ferland, Larente, Rowland, & Davidson (2013).

*Errorless (re)learning of daily living routines by a woman with impaired memory and initiation: Transferrable to a new home?*

22 year old woman; intracerebral and intraventricular hemorrhage post ruptured AVM

Severe episodic memory and initiation impairments

5 mos post – unable to recall new info after a few minutes
Errorless Learning

Ferland, Larente, Rowland, & Davidson (2013).

Training routines self-care and diabetes care in a new environment; transitional living unit

Training – 7 days a wk for 9 mos (table II); staff, eventually family

Progress over time
Case Example 2

• 54 year old female

• PMHx of old R PCA stroke 03/02/15; A-fib; Anemia; Right homonymous quadrantanopsia; Unspecified essential HTN

• Social Hx: Married; RN prior to dx

• Pt receiving OP services following dx of R MCA stroke 03/23/15

• Swallow Function: Regular diet with thin liquids

• Mild Dysarthria

• 20/30 on the MOCA
  • Poor recall and reasoning
  • Reduced visuospatial skills
  • Difficulty with sustained attention and short-term memory tasks

• Goals: Reintegrate in work/community environment
Case Example 2

What are your thoughts?
Case Example 3

- 71 year old female
- Complicated medical hx
- Admitted to LTACH with embolic and watershed CVA; Chronic respiratory failure-ventilator dependent; AKI; A-fib; DM; Dysphagia
- Social: Retired Teacher; Married; 4 Kids
- Completed Weaning Protocol: Trach Removed
- Dysphagia: Regular diet with thin liquids
- Cognition: Mild Cognitive Impairment
  - MOCA= 25/30
  - Primary deficit: Delayed Recall
- Goals: Reintegrate into Community
  - Functional tasks: grocery shopping; handling bills; medications etc.
Case Example 3

What are your thoughts?


