Assessing cognitive function after stroke

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- Write down 3 important cognitive problems after stroke

- What things are important to detect?
### OCS
#### Impairment incidences

<table>
<thead>
<tr>
<th>DOMAIN</th>
<th>Tasks</th>
<th>Impaired (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>LANGUAGE</td>
<td>Picture Naming, Semantics, Sentence Reading</td>
<td>42 %</td>
</tr>
<tr>
<td>MEMORY</td>
<td>Orientation, <strong>verbal</strong> &amp; episodic <strong>recognition</strong></td>
<td>35 %</td>
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<td>NUMBER</td>
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<td>39 %</td>
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<tr>
<td></td>
<td>(spatial)</td>
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<td></td>
<td>Object Neglect</td>
<td>26 %</td>
</tr>
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</table>
There is evidence that *neuropsychological factors* are *more important determinants of functional outcomes* after stroke than physical disability.

Post stroke cognitive problems are predictive of depression.
Studies have typically used either:

• Quick but general (non-specific) measures of cognitive function:
  • MMSE (Lawrence et al., 2001)
  • Clock drawing (Friedman, 1991)

• Time consuming measures of single cognitive functions:
  • Language (PALPA)
  • Neglect (BIT, Balloons)
  • Executive functions (BADS, TEA)
  • Memory (Rivermead, Doors and People)
• Short screens are easy to deliver but relatively uninformative

• More detailed tests give more information but often impractical
Some attempts to find a half-way house:

- MOCA (Montreal Cognitive Assessment)
- ACE-III (Addenbrooke’s Cognitive Examination)
MONTREAL COGNITIVE ASSESSMENT (MOCA)
Version 7.1 Original Version

VISUOSPATIAL / EXECUTIVE

End

Begin

Copy cube

Draw CLOCK (Ten past eleven) (3 points)

POINTS

NAME:
Education:
Sex:
Date of birth:
DATE:

POINTS

NAME:
Education:
Sex:
Date of birth:
DATE:

NAME:
Education:
Sex:
Date of birth:
DATE:

Points

FACE
VELVET
CHURCH
DAISY
RED

No points

MEMORY
Read list of words, subject must repeat them. Do 2 trials, even if 1st trial is successful. Do a recall after 5 minutes.

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

<table>
<thead>
<tr>
<th>2nd trial</th>
<th>FACE</th>
<th>VELVET</th>
<th>CHURCH</th>
<th>DAISY</th>
<th>RED</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Contour</th>
<th>Numbers</th>
<th>Hands</th>
</tr>
</thead>
</table>

| [ ] | [ ] | [ ] |

NAMING

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| ATENTION | Read list of digits (1 digit/ sec.). Subject has to repeat them in the forward order [ ] 21854 | 2/2 |
| Read list of letters. The subject must tap with his hand at each letter A. No points if ≥ 2 errors [ ] FBACMNAAJKLBFAKDEAAAJAAMOFAAB | 1/1 |
| Serial 7 subtraction starting at 100 [ ] 93 [ ] 86 [ ] 79 [ ] 72 [ ] 65 | 3/3 |
| 4 or 5 correct subtractions: 3 pts, 2 or 3 correct: 2 pts, 1 correct: 1 pt, 0 correct: 0 pt |
| LANGUAGE | Repeat: I only know that John is the one to help today. [ ] The cat always hid under the couch when dogs were in the room. [ ] | 2/2 |
| Fluency / Name maximum number of words in one minute that begin with the letter F [ ] ____ (N ≥ 11 words) | 1/1 |
| ABSTRACTION | Similarity between e.g. banana - orange = fruit [ ] train – bicycle [ ] watch - ruler | 2/2 |
| DELAYED RECALL | Has to recall words WITH NO CUE FACE [ ] VELVET [ ] CHURCH [ ] DAISY [ ] RED [ ] Points for UNCUED recall only | 5/5 |
| Optional | Category cue | |
| | Multiple choice cue | |
| ORIENTATION | Date [ ] Month [ ] Year [ ] Day [ ] Place [ ] City | 6/6 |
| © Z.Nasreddine MD www.mocatest.org Normal ≥ 26 / 30 TOTAL | 30/30 |
| Administered by: ____________________________ | Add 1 point if ≤ 12 yr edu |
These tests were developed to assess dementia.

They are language-laden, not designed for stroke patients (with high prevalence of aphasia, neglect). There is no assessment of neglect, limb praxis or everyday action.
MOCA is almost totally LANGUAGE dependent

Also affected by neglect
- The test provides an overall score. What does this mean?

- Tests not designed to separate cognitive processes (executive function, verbal memory, language processing).

- How does the score feed into rehabilitation?
- Need for a screen that is ‘broad but shallow’
- That covers a range of cognitive ‘domains’ AND that can be delivered efficiently, incl. at the bedside (time efficient test design)
- That is aphasia and neglect friendly – to maximise inclusion
- Test family – cognitive screens covering 5 ‘domains’ of cognition
  - attention and executive function
  - language
  - memory
  - numerical skills
  - praxis (action)

- BCoS full - delivered within 1 hour, at sub-acute stages of the incident - gives relatively detailed breakdown of cognitive function and provides pointers to rehabilitation

- BCoS 2 allows an in-depth assessment of the 5 cognitive domains

- OCS – delivered in 15/20 mins aimed at giving a brief snapshot, targeted at stroke

- OCS-d – delivered in 15/20 mins for dementia
Test philosophy:

- use short high frequency words
- use vertical layouts and multi-modal presentations
- design tests to incorporate several measures (to maximise time efficiency)
- use tests that are sensitive (will detect a problem if one is present) and indicate general domain deficits (e.g., problem in naming, but not exact problem)
- The measures provide a cognitive profile for an individual patient
- Web-based data entry to generate a normed profile
- Plus a visual snapshot of the patient’s profile for entry into case notes and use in case management
Oxford Cognitive Screen

Stroke sensitive

Aphasia Friendly

Neglect Friendly
STROKE SENSITIVE APRAXIA
STROKE SENSITIVE APRAXIA

Hand sequences:

<table>
<thead>
<tr>
<th>1st presentation</th>
<th>2nd presentation</th>
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<tbody>
<tr>
<td>1st presentation</td>
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<tr>
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Finger positions:

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Aphasia friendly
Instruction Comprehension / semantics
Which picture did you see before?

What did you cross out?

- Heart
- Star
- Cross
- Smiley face
Tests measure multiple factors
Reading / writing (not in MOCA)

Have any of the islands got a quay, thought the colonel sitting on his yacht.

Please write the following numbers: 708 15,200 400
- Measures executive functions using timed measures and baseline conditions to extract effects of slow motor speed and neglect
ATTENTION
Controlled / Executive

1. Connect circles – largest to smallest (max 30seconds) (practice first) /6
2. Connect triangles – largest to smallest (max 30seconds) (practice first) /6
3. Alternate triangles to circles – largest to smallest (time) (practice first) /13

Executive score = (circles + triangles) – mixed score

Final score reflects the relative cognitive load
Measurement of *relative* performance speed provides a highly sensitive measure of the *added* effect of cognitive load on processing speed.

Antoniades et al. (2014) – only executive task sensitive to difference between non-medicated early PD patients and controls.
Neglect Friendly:
INCLUSIVE

Aphasia Friendly:
- All tests validated against other standard tests in the literature
- All tests with 100+ norms at different age and education levels
How does the OCS perform against the MOCA?

OCS vs. MOCA

data from 150 patients
## OCS Impairment incidences

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- LANGUAGE AND MEMORY: 12% of patients had sufficiently severe expressive aphasia to preclude testing on the MOCA. Only 2% of patients were unable to respond to the multiple choice questions in the OCS (receptive aphasia).

- OCS – more inclusive

- OCS less contaminated
74% failure

61% failure
MOCA Score /30

‘normal’

>26/30

OCS

[Diagram showing various cognitive functions and their abbreviations: Attention (ATTENTION), task switching, orientation, memory (MEMORY), recall, recognition, episodic, number (NUMBER), calculation, imitation sequencing, praxis, language (LANGUAGE), picture pointing, picture naming, reading.
OCS more sensitive to the cognitive problems after stroke
OCS less contaminated by co-occurring cognitive problems
OCS better able to provide rehabilitation-related information
Full BCoS
Attention
Controlled attention: auditory

**Auditory attention test** [words presented at uneven times on MP3 player, respond to *goodbye, please, no* but not to *hello, yes and thanks* across 3 trial blocks]

measures:

- selective attention/response inhibition
- sustained attention (across blocks)
- working memory (learning & recall of words)
Controlled attention: rule finding and switching
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Gains measures of: **rule finding** (how many rules are found) and **set shifting** across dimensions (rows to colour) **within** dimensions (colour 1 to colour 2)
Patient is given parts of a torch plus distractor objects – task is to assemble the torch and to show how to use it.

Provides a measure of **perseveration** along with implementation of individual actions and action sequence.
BCoS

- Data on ~950 patients within 3 months (& depression/anxiety, apathy, ADL)
- ~600 at follow-up (9 months)
- Analysed CT scans on ~600
- All tests validated against other standard tests designed to assess similar abilities, test-retest reliability
- All tests normed (100+ control)
- At least 1 impairment present in 79% of cases (50%+ of patients in some tests)

- No overall difference in impairment (e.g., number of failed tests) for right and left hemisphere cases
### Profile by hemisphere

<table>
<thead>
<tr>
<th>Different areas</th>
<th><strong>Left lesion group</strong></th>
<th><strong>Right lesion group</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Verbal memory– encoding</td>
<td>Cancellation</td>
</tr>
<tr>
<td></td>
<td>Working memory</td>
<td>Left tactile extinction</td>
</tr>
<tr>
<td></td>
<td>Picture naming</td>
<td>Left visual extinction</td>
</tr>
<tr>
<td></td>
<td>Writing</td>
<td>Orientation- time and space</td>
</tr>
<tr>
<td></td>
<td>Nonword reading</td>
<td>Sentence construction</td>
</tr>
<tr>
<td></td>
<td><strong>Language based</strong></td>
<td><strong>Spatial, memory</strong></td>
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<th>Common areas</th>
<th>Selective attention</th>
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<tr>
<td></td>
<td>Rule finding and switching</td>
</tr>
<tr>
<td></td>
<td>Sentence reading</td>
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<tr>
<td></td>
<td>Gesture imitation</td>
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<td></td>
<td>Figure copy</td>
</tr>
</tbody>
</table>
### Functional correlates

#### Outcome measure at 9 months

<table>
<thead>
<tr>
<th>Measure</th>
<th>B</th>
<th>SE</th>
<th>β</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial Barthel</td>
<td>0.45</td>
<td>0.06</td>
<td>0.40**</td>
</tr>
<tr>
<td>% BCoS tasks impaired</td>
<td>-2.82</td>
<td>1.30</td>
<td>-0.11*</td>
</tr>
<tr>
<td>Apathy at follow up</td>
<td>-0.16</td>
<td>0.03</td>
<td>-0.27**</td>
</tr>
<tr>
<td>HADS at follow up</td>
<td>-0.16</td>
<td>0.05</td>
<td>-0.19**</td>
</tr>
<tr>
<td>Hemiplegia at follow up</td>
<td>2.34</td>
<td>0.98</td>
<td>0.13*</td>
</tr>
</tbody>
</table>
- Role of co-occurring deficits?

- Predicting NEADL from Apple cancellation
  - apple alone (16% variance)
  - apple & WM (28% variance)
  - apple & Bham rule/executive function (30% variance)

Co-occurring deficits are important for predicting outcome
In sum, the BCoS provides a useful overview of cognitive abilities that predicts outcome.

- It is inclusive.
- It provides measures of attentional & executive deficits & their co-occurrence with other impairments.
- It can be scored remotely and used in clinical case management.
- It is also useful scientifically – e.g., extraction of incidental deficits, lesion analyses.
Considerable advantages

High sensitivity
Standardised administration
Automated scoring
Automated recording
Extra data for free
Patient with systematic performance
Patient with non-systematic performance
Systematicity captured in a simple nearest-neighbour scoring scheme
Correlates with scorers’ measures of systematicity
Correlates also with measures of executive function

R = .517
P = .002
N = 29
- Tea/coffee break!!!!

http://www.isis-innovation.com/outcomes/cns/ocs.html

http://www.cognitionmatters.org.uk/