Cognitive Testing. Achilles Heel of Clinical Neurology

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Stroke and Cognition - a new era

• Vascular cognitive disorder
• Vascular cognitive impairment
• Vascular dementia
• Dementia: Vascular vs neurodegenerative
• Alert, orientated x 3
• MMSE
• Neuropsychological testing
• A treatable condition
Cerebrovascular disease and neuropsychiatric disorders are leading cause of disability worldwide. The frontal lobes comprise ~ 1/3 of the cerebrum and are supervisory to all other cortical and subcortical processes. The frontal lobes and their networks are damaged in over half of all ischemic stroke. No stroke measurement scale incorporates testing of frontal systems. This impacts decisions regarding treatment or management.
The importance of Metacognition

Frontal network syndromes (FNS)

- FNS are the most common cognitive disorders
- Confirmed by animal models
- FNS increasingly reported with discrete lesions outside anatomical boundary of the frontal lobe
- Include; subcortical grey matter, subcortical white matter, isolated lesions of the brainstem, cerebellum, temporal and parietal lobes
Spectrum of Frontal Network Disorders

- Structural (stroke, tumour)
- Frontal Lobe Epilepsies
- Schizophrenia
- Anxiety
- Depression
- Obsessive Compulsive
- Tourette’s syndrome
- ADHD
- Traumatic brain injury
- Autism
- Pervasive developmental disorders
Cognitive Testing.

- Mental Status
- Cranial Nerves
- Motor System
- Reflexes
- Sensation
- Coordination
- Gait
Hemispheric dominance

Left hemisphere
- Language
- Analytical/mathematical
- Temporal sequencing of stimuli

Right hemisphere
- Attention
- Prosody
- Spatial construction
- Body image
- Melody
- Emotion
QuickTime™ and a TIFF (LZW) decompressor are needed to see this picture.
Cognitive impairment and stroke. Pilot Data


QuickTime™ and a TIFF (LZW) decompressor are needed to see this picture.
Lhermitte F. Human Autonomy and The Frontal Lobes.
Metacognition

- Neural search engines
- Frontal network syndromes ubiquitous
- Analogy of fever to infections
Coconut Testing

• Neuropsychological metric examination
• Bedside behavioral neurological
• Neuropsychiatric
Neuropsychological Tests
Neuropsychological Tests

- Wisconsin Card Sorting Test (4.0)
- Frontal Systems Behavioral Test
- Tower of London
- Emotional Intelligence (Baron)
- Comprehensive Trail Making Test
Emotional Intelligence Scoring
Frontal Systems Behavioral Scale

- Lickert Scale
- 46 questions
- Executive dysfunction
- Apathy
- Disinhibition
- Before/After options
- T scores ≥65 impaired
- T scores 6-64 marginal
## Cognitive stroke registry n=2000

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Misery Perfusion Syndrome. Post stent deployment
Young woman 36 y. NIHSS = 3, FNS score = 16. Management: EC - IC bypass
A 24 year old man

- NIHSS = 1
- FNS = 32
- Frontal syndrome with disinhibition, perseverative responses, stimulus bound behavior and echopraxia.
- ICH
Dysexecutive syndrome

- Subcortical lesions
- Frontal subcortical circuits

Abulia - spectrum of disorders

- Athyhmhormia
- Abulia
- Apathy
- Akinetic mutism
32 year old woman

- Post partum
- Profound abulia
- Severe frontal syndrome
- Duration 5 days
Deep venous thrombosis
Accurate diagnosis and treatment

- Both the syndrome (simultanagnosia) and.....
- mechanism (eclampsia) required for firm diagnoses
- Call Fleming syndrome not unexpected
Posterior lesions and frontal syndromes
Mandarin Chinese – an example of a tone language

- Mandarin phoneme tone
  - Ma: mother
  - Ma: numbness
  - Ma: horse
  - Ma: curse
Transcortical Motor Aphasia

- Internal watershed infarction
- Misdiagnosed as multiple sclerosis
Denying blindness

- Cerebroappendicular syndrome
- Top of basilar syndrome
- Cortical blindness
- Anton’s syndrome
- Visual agnosia
FNS by stroke severity. F ratio 4.7, r=0.2, p=0.03
Lesion location vs FNS: ANOVA
Organicity: Structural/Chemical/Electrical

- Decrease in metabolism in depression relative to controls.
- Drevets et al. Nature 1997;386:824-827
Principle chemical projections to cerebral cortex

State dependent systems

1. Cholinergic - n. basalis of Meynert
2. Histaminergic - hypothalamus
3. Dopaminergic - ventral tegmental area
4. Serotonergic - brainstem raphe nuclei
5. Noradrenergic - locus ceruleus
Pharmacotherapy of cognitive disorders

- Aricept in aphasia
- Dopamine effective for working memory *
- Dopamine for akinetic mutism
- Dopamine in apathy
- Modafanil in apathy
- Bromocriptine in motor aphasia

Experimental trial

• **Primary aims:** To test the hypothesis that metacognitive deficits in young people with stroke are improved with dopaminergic medication by comparing pre and post treatment test scores following a 6 week randomized, double blinded placebo controlled trial using dopaminergic therapy.
Experimental Trial

• **Secondary Aim:** To test the hypothesis that different metacognitive components (attention, executive function, emotional intelligence, apathy, disinhibition) and their subtest scores are differentially affected by dopaminergic therapy.
Why the fuss?

• Health policy planners long needed an index of frontal dysfunction to determine eligibility for long-term care benefits.
• Improved imaging capability of MRI, SPECT and PET scanners delineated frontal impairment without gross frontal lesions.
• Strong link between impaired frontal function by testing and impaired performance in the goal directed behavior: careers and employment.
State dependent vs “hard wired” network systems

- Diagnosis of frontal systems impairment in patients, not imageable by surrogate markers such as MRI or PET scans?
- Schizophrenia, depression and frontal subcortical systems impairment attest to the severity of frontal dysfunction with normal neuroimaging.
- Improved clinical diagnostics will remain the directional beacon to follow
Quantitative Frontal Bedside Testing


Thank You
Affecting tone and color of behavior as opposed to content

- **NA** - Novelty seeking behavior and resistance to distraction
- **DA** - Encoding of reward and effort associated with cognition
- **5HT** - Sensory gating of environmentally behavioral clues
- **Ach** - Promotes arousal, motivational valence, learning
- **Hist** - Cortical arousal, energy metabolism, autonomic function


Adapted from Silber M. Neurology 2001