Forensic Neuropsychiatry Committee Course

Review of Clinical Neuroscience for Forensic Psychiatry

Forensic Neuropsychiatric Assessment of Cognition

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Neuropsychiatry is...

- Predicated on the notion that all behavior, emotion and cognition is dependent on brain function
- Realize that the boundaries between these constructs are blurred; for instance, apathy may have behavioral, emotional and cognitive components
- Neuropsychiatric examination mandates attention to all three
- Most psychiatrists are relatively adapt at the first two, but many still look to others (neuropsychologists, OT, Speech, etc.) to assess cognition
- But cognition is a vital domain, implicated in most neuropsychiatric conditions
Much of the same neuroanatomy serves cognition, behavior, and emotion

Frontal-Subcortical Circuits

Figure 4.3 General outline of frontal-subcortical circuitry.
Or medial temporal lobe structures...
Cognition is central to many forensic neuropsychiatric questions

- Central to issues of competency, civil and criminal
- Most insanity statutes include, if not solely predicated, on cognitive prong
- Disability and life care planning heavily influenced by cognitive impairment

**Forensic neuropsychiatric assessment mandates**

*the ability to carefully assess and cogently articulate cognitive status, independent of external assistance*
A Model of Cognition

Get more out of the MMSE, FAB, and cognitive exam!
Reticulothalamic, Reticulocortical, and Thalamocortical Pathways

- Cortex
- Brainstem reticular formation
  - Reticulothalamic (cholinergic)
  - Reticulocortical (DA, NE, 5-HT, ACh)
- Thalamus
  - Reticular
  - Sensory relay
- Thalamocortical (glutamate)
- GABA

Excitatory
Inhibitory
Arousal

- Level of consciousness
- Reticular activating system
- Levels of arousal described with terms such as: alert, somnolent, lethargic, obtunded, coma
- Such terms may be less useful than a brief description denoting: 1) level of stimulus needed to arouse patient; 2) patient’s behavioral response to stimulus
- Keep in mind disorders of hyperarousal, such as mania, anxiety states, some forms of delirium (EtOH withdrawal)
Attention

- the entire family of processes that mediate the choice of suitable mental or external events for consciousness and action
- simultaneously the most fundamental cognitive process but also an intrinsic component of our most complex cognitive functions
- Several components: selective, sustained, and divided attention
Attention

- Selective attention: focus upon single selected environmental or cognitive target
- Sustained attention: concentration, maintain that focus on a target despite competing stimuli. Impairments yield distractibility
- Divided attention: simultaneous tracking of multiple targets
Attention

• Bedside attentional tasks
  – “A” test
  – Trails A or B
  – Digit Span
  – Months of year in reverse

• Boundaries between cognitive processes are indistinct and there is overlap.

• Bottom-up impact of attentional deficits on other domains of cognition
Memory is not a unitary function... The term memory generally refers to the ability to learn, store, and retrieve information.
Categorizing Memory

• Several different and somewhat overlapping ways to categorize memory function

• Type of information: explicit (declarative) and implicit (procedural)

• Temporal, i.e. the duration between learning or recall: registration/immediate, working memory, short-term memory, long-term memory
Declarative Memory

• Ability to learn, encode, and retrieve factual (semantic) information, information about events (episodic), and information about self (autobiographical)

• Pertains to who, what, when, and where

• Declarative memory is highly associative and subject to representational flexibility, and hence to post hoc modification or error
Encoding Declarative Memory

- Requires intact sensory-cortical pathway for acquisition
- Processed multimodal information from parietal heteromodal association cortices transmitted to entorhinal-hippocampal complex
- Amygdala assigns emotional/motivational valence and interacts with hippocampus
- Sufficiently robust signaling to hippocampus initiates long-term potentiation (LTP)
Declarative Memory

- LTP is neural basis for encoding, forming stable synaptic connections within network
- LTP is a glutamatergically and cholinergically dependant process
- Because hippocampus is essential for encoding, new learning of declarative information is described as hippocampally dependant
Retrieval of Declarative Memory

- Hippocampus projects via hippocampal-forniceal-mamillo-thalamic path to frontal areas involved in consolidation of new memories
- Volitional retrieval (recall) of declarative information requires prefrontal activation of selective networks in which information was encoded
- Retrieval of previously learned information is not hippocampally-dependent, but is frontally-dependent
- Retrieval of previously learned information is highly associative: reactivation of nearly any part of network involved in the original encoding will result in retrieval
Procedural Memory

- Procedural memory permits us to remember “how”
- Dependent on attention and recognition but is not particularly dependent on language
- Praxis is more important to this type of memory than to declarative memory
- Procedural memory is not hippocampally dependent
Defining Amnesia

- Amnesia denotes an impairment of memory.

- Amnesia may be:
  - A problem of encoding/new learning or one of recall/retrieval of previously learned information.
  - Anterograde, retrograde, or both (global).

- Impaired encoding is associated with dysfunction of hippocampal-forniceal-mamillo-thalamic paths.

- Impaired retrieval suggests dysfunction in frontal-subcortical systems.

- Knowledge of neuroanatomy facilitates identification and interpretation of amnesia in its various forms.
Defining Amnesia

• When significant memory impairment develops, anterograde amnesia is the rule

• Rare cases of pure retrograde amnesia from traumatic/vascular injury exist, but retrograde amnesia typically accompanied by anterograde amnesia

• With retrograde amnesia, info learned proximate to time of injury is more severely affected than remotely acquired info (Ribot’s law)
Defining Amnesia

- The term amnesia may refer to any type of memory impairment.
- Specific description of the type and severity of memory dysfunction is needed for proper comprehension and communication.
- When clarity is lacking, erroneous inferences and conclusions may result.
Language

• Means by which symbolic communication occurs

• Language is not...
  – speech - a motor capacity (dysfunction = dysarthria) or
  – voice - a laryngeal function (dysfunction = dysphonia)

• Explore reading and writing ability too
Language

• Four basic elements
  – Fluency
    • Consistent ability to generate phrase lengths of six or more words
    • Phrases without prominent word-finding pauses
    • Fairly normal syntax, even if semantic content is abnormal
  – Comprehension
  – Repetition
  – Naming
Praxis

- Ability to perform skilled purposeful movements on demand
- Apraxia is the inability to do such and not attributable to basic sensory, motor, or language deficits
- May involve buccofacial, limb, and/or axial movements (blow out a match, open a jar, swing a golf club)
Praxis

- Three major types of praxis:
  - limb-kinetic: simple, fine motor tasks (tap fingers)
  - ideomotor: single but more complex task, gestural (hammer a nail)
  - ideational (fold a letter, place in envelope, seal and stamp it)
Praxis

• **content errors:**
  – an incorrect movement is substituted for the requested movement (i.e., hammering when asked to saw)
  – postural (or internal configuration) errors: a body part is used in place of a proper pantomime for the object
  – *orientation errors: the pantomimed tool is not oriented towards a meaningful (real or imaginary) target*

• **production errors:**
  – *spatial: an element of the pantomime is missing or the task is performed in a place that does not conform to the task demands*
  – *temporal: there is a delay in task performance or the cadence of the task is impaired*
Gnosis/Agnosia

- Agnosia is the inability to recognize a perceived object; sensory input stripped of its meaning
- Sensory modality specific, such as visual agnosia or auditory agnosia
- Must distinguish this from anomia
- Apperceptive v. associative
Gnosis/Agnosia

Visual:
• Prosopagnosia: inability to recognize faces
• Simultagnosia: inability to synthesize parts of image into cohesive image

Auditory:
• Pure word deafness: looks like Wernicke’s but reading and writing intact
• Auditory sound agnosia: can’t recognize nonverbal sounds

Tactile:
• Astereognosis: unable to recognize by touch
Visuospatial Function

- Variety of abilities involving visual processing skills, spatial awareness, self-object spatial relationships, visuospatial memory, and navigation of extrapersonal space
- Overlaps with many other cognitive domains
- Common across many neuropsychiatric disorders, especially with right hemisphere involvement
Visuospatial Function

- Unilateral hemispace neglect: inability to attend to stimuli in one hemispace (typically left)
- Often multimodal, involving senses and/or motor exploration
- More subtle versions terms unilateral hemi-inattention
- Line bisection, target cancellation, searching tasks, bilateral simultaneous stimulation
Executive Function

- Executive dysfunction common to many neuropsychiatric conditions
- Cognitive exam absent specific attention to this domain is very incomplete
- This domain is *very forensically relevant*
- Common complaints and findings often attributed to other cognitive domains when actually reflective of executive impairments
  - Memory complaint
  - Constructional tasks (such as clock)
- Most common bedside test (MMSE) is weak on executive function
Executive Function

Refers to a collection of abilities integral to functional ability, including:

– categorization and abstraction
– systematic memory searching
– information retrieval
– problem solving
– self-direction
– independence from external environmental contingencies
– generating, maintaining, and shifting cognitive, emotional, and behavioral sets and patterns
A practical Broad-based Approach…

• Mini Mental Status Examination
  – Language, memory (retrieval and encoding), attention, construction

• Clock Drawing Task
  – Executive function, visuospatial function

• Frontal Assessment Battery
  – Executive Function

• Deploy specific tools to augment and explore
Take advantage of normative data...

- Age and education adjusted normative data exists for both the MMSE and the FAB
- To use the normative data, **DO THESE EXAMS BY THE BOOK, EVERYTIME**
  - MMSE per Folstein (1975) and normative data by Crum (1993)
  - FAB per Dubois (2000) and normative data by Appollonio (2005)
- Enhance your own ability to detect suspect performances
Validity!

- Must keep in mind the forensic context always
- Normative data and z-scores are useful only when effortful and honest performance is given
- Look for ecological validity and cogent clinical patterns
- Suspect effort is good reason to deploy specific validity measures (CARB, TOMM) or engage help from neuropsychology
The Cognitive Correlates of Functional Status: A Review From the Committee on Research of the ANPA, Royall DR (2007)

Relatively little attention paid to empirical study of specific cognitive correlates of functional outcomes, but available literature suggests:

• variance in functional status attributable cognition is “surprisingly modest”
• some cognitive domains more relevant to functional capacity than others
• measures of executive control function relatively strong correlates of functional capacities
• “general” cognitive screening tests are surprisingly strong correlates of functional status
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