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Objectives for Dementia Assessment

1) Identify basic structures for functional neuroanatomy.

2) What are the essential questions during a consultation for possible dementia/Cognitive Decline.

3) When is the best time to refer for further evaluation.

Try to identify some neuroanatomical location that will usually deteriorate during the disease process.

Underpinnings

- When assessing degenerative declines/diseases
- Structure is related to function
  - When cortical pathways decline, the structural integrity is compromised
  - This is the potential risk when function declines
- There is a “invisible gap” between present behavioral symptoms with no abnormalities seen in MRI/CT scans.

5 Cortical Pathways

- Motor Circuit
- Oculomotor Circuit
- Dorsolateral Prefrontal Circuit
- Orbitofrontal Circuit
- Anterior Cingulate Circuit

These pathways work independently as well as in parallel, dependent on what type of thought/processing is occurring.

Chow & Cummings, 2001; Malloy & Richardson, 2001
Frontal-Subcortical Loops

- All anterior circuits originate in the frontal lobes.
- Frontal lobe origins project sequentially to the striatum.
- To the globus pallidus and substantia nigra.
- To specific thalamic nuclei.
- And with a final link back to the frontal lobes.
- As previously viewed, there are five prototypical prefrontal-subcortical circuits.

Posterior Circuitries

- Parietal Loop
- Inferior-temporal Loop

- Some literature defines a third loop which consists of Motion
- These pathways work independently as well as in parallel, dependent on what type of thought/processing is occurring.
White Matter

- Fasciculus Tracks connects the pathways from cerebrum to the subcortical regions.
- There are 5 main tracks from Anterior, Subcortical, to Posterior
  - Superior Occipital Frontal
  - Superior Longitudinal Track
  - Inferior Occipital Frontal Track
  - Uncinate Track
  - Inferior Longitudinal Track

White Matter

- Two Tracks which connect Left and right hemispheres
  - Corpus Collosum
  - Anterior Commissure
Dementia – Simple Definition

- Dementia represents a loss of cognitive functioning from a level that was significantly higher in the past.
- This loss of functioning affects social and/or occupational functioning.
- Dementia is not “normally distributed.”
- There are many different types of dementia; most common is Alzheimer’s Type.
  - This type will not be specifically covered because it is the most common.

The Frontal Cortex, Behavior, Decline

- It is a mistake to talk about a single “frontal lobe syndrome.”
- The frontal lobes subsume a wide range of disparate functions.
- The deficits attributable to frontal lobe lesions are quite diverse.

The Frontal Cortex and Behavior

- The issue is not “what the frontal lobes do” or what specific “functions” find their seat within the frontal lobes.
- The issue is how frontal lobe structures participate in an anatomy of integrated systems that include the brainstem, the subcortical nuclei, the cerebellum, and other cortical areas – and how the operation of such functional systems relates to the psychology of the individual.
  - Referring back to dependent and independent regions.
  - So, there are cortical regions that are specific to its function and regions that assist with the function.
The anatomical segregation of each circuit supports the concept of circuit-specific behaviors.

While each circuit has a closed loop, there are open elements in each circuit.

Reciprocal connections between the cortical source of each circuit and regions outside the circuit modulate the circuit's activity.

These circuits share common structures and are parallel and contiguous.

These circuits remain segregated anatomically, even as succeeding projections are focused progressively unto smaller numbers of neurons.

Open elements of each circuit allow for regions outside the circuit to introduce new information into the circuit and therefore influence its activity.
Cortical Pathways of Behaviors

- The orbitofrontal circuit – Plays a role in response inhibition, “Phineas Gage” syndrome that are related to personality changes.
- Lesions in this region result in disinhibition, irritability, impulsivity, distractibility, and in environmental dependency.
- Temporal ordering of behavior in determining proper time and place for expressing behaviors. (Filtering)

Cortical Pathways of Behaviors

- The Medial circuit/Anterior Cingulate – Plays an important role in motivation and mood
- Lesions in this region result in apathy. Also, lack of motivation and drive-abulia. (This is sometimes referred to as pseudodepression.)
- Will have mood irregularities.
- Additionally, cognitive flexibility

Cortical Pathways of Behaviors

- Dorsal Lateral Prefrontal Cortex
  - Are deficits in a subset of attention
    - Element of maintenance/"updating" feature
    - Responsible for adaptive behavior automatically, without environmental support
    - Normal aging decline occurs here first, starting with forgetfulness
Cortical Pathways of Behaviors

- Motor Circuit
- Originate in motor, premotor, and supplementary motor.
- You have classic symptoms of movement disorders
- At the cortical level, deficits in motor planning
  - Procedural learning/motor learning
- At the subcortical level, movement disorder will consist of intention programs

Cortical Pathways of Behaviors

- Oculomotor Circuit
- This contributes to voluntary fixational control
- May have abnormal saccades
- Disturbances in visual searching strategies

Cognitive Deficits Attributable to Prefrontal Dementia

- Conceptual ability
- Conceptual thinking comprises the ability to draw abstractions from perceptual experience and to manipulate abstract ideas in an organized and effective way.
- Deficits in conceptual ability can occur for many reasons.
- Frontal lobe lesions are sufficient to induce conceptual and this is frequently manifest in “concrete thinking.”
- For example, “what brought you here today?”
- “We came by car.”
Cognitive Flexibility

• This refers to the ability to shift sets, to move from one operating principle to another as circumstances require.

• Cognitive flexibility is essential to the ability to function effectively.

Cognitive Flexibility

• Two symptoms of frontal lobe injury are:

1. Perseveration – the tendency to maintain a cognitive set that is inappropriate to the situation.

2. The inability to maintain set – the inability to maintain set, when it is necessary to do so, in the face of distracting or competing stimuli.

• Deficits in initiative and motivation are not always apparent in the clinical setting.

• Frontal lobe patients hardly ever complain about it.

• The information is usually gathered from family members.
Attention and Arousal

- The frontal lobes participate in the functions of arousal and attention via the brainstem-frontal lobe axis that includes the thalamus and the ascending RAS.

Awareness and Empathy

- Insight is one of the cardinal functions of the frontal lobes.
- Anosognosia is the incapacity to appreciate the nature or degree of one's impairment.
- This can be a formidable problem in people with right frontal lesions.

The Frontal Lobes and Dementia

- Depending on your bias, a clinician can consider a pathology such as Pick's Disease as either a cortical dementia or as part of the frontal-subcortical dementia complex.
- A person with Pick's disease usually has a history that reflects the insidious onset of behavioral and cognitive abnormalities.
- Distractibility is often present but is not the single limiting factor on cognitive operations.
Brain Atrophy in Pick’s Disease


Underpinnings for Vascular Dementia

- Internal carotid artery (ICA) enters skull at base of brain branches into:
  - Anterior cerebral artery (ACA) and middle cerebral artery (MCA) which irrigates anterior-lateral and mesial cortex.
  - Basilar gives rise to posterior cerebral artery (PCA) which irrigates occipital lobe and mesial temporal cortex.

Blood Supply to Brain
Blood Supply to Brain

- Two major pairs of arteries supply the brain
  - Internal carotid arteries - anterior 2/3rds of brain (80%); predominantly cerebral in distribution.
    - Various estimates across literature says 58% – 62% of blood flow
    - This correlates with active thinking.
  - Vertebral arteries merge into basilar artery on ventral brainstem (pons) – posterior 1/3rd of brain; predominantly cerebellar & brainstem in distribution.

[Diagram of blood supply to brain]
Blood Supply to Brain

- Disruption of blood flow (ischemia) to the ACA, MCA or PCA will cause cognitive decline in these areas of entry.
- Ischemic necrosis to brain tissues in both cortical and subcortical regions.
- Stroke (hypoxic-ischemic cerebrovascular accident) that will result in

Subcortical Dementia

- Affects prefrontal cortex, white matter, basal ganglia, thalamus
- Recent memory often normal or only mildly affected
- Executive dysfunction is very common
- Loss of drive, disinhibition very common
- MSE of useless – normal or near normal

Risk Factors

- Chronic alcohol usage
  - Binge drinking is the worst case scenario
  - Risk to lead into Alcoholic Dementia and Korsacoff Syndrome
- Some STD's
  - Herpes
  - Syphilis
- Chronic Urinary Tract Infections
- Many other Viral encephalopathies
- Chronic virus that can lead to blood toxicity
Other Risk Factors Associated with various Pathologies

- Chronic Anxiety
- Chronic Depression
- Decline in Olfaction
  - Sometime correlates with decline in taste
- Hypoxia-limited oxygenated blood into these regions

Frontal-Temporal Dementia

- Personality changes
- Abulia – lack of motivation or initiative
- Disinhibition

AAA

- Be mindful of the Triple AAA
  - Alertness
  - Attention
  - Awareness

References


* Many more authors were utilized during this presentation. Upon request.