Aphasias and Other Cortical Syndromes

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Aphasias and Other Cortical Syndromes

• Cognition and Hemisphere Dominance
• Normal Language
• Aphasias
  • Broca’s (Non-Fluent)
  • Wernicke’s (Fluent)
  • Transcortical Motor and Sensory
  • Conduction
• Disorders Related to Aphasias
• Parietal Syndromes
• Occipital Syndromes
Are you Left Brained? Or Right Brained?

- Right-handed people -> Left hemisphere dominance in >95%
- Left-handed people -> Left hemisphere dominance in >70%

[Image of a brain with logical and verbal functions on the left side, and artistic functions on the right side.]
Hemispheric Specialization

• **Left Hemisphere**
  • Language (linguistic content)
    • Reading/writing
  • Skilled motor functions (Praxis)
  • Arithmetic: sequential and analytical calculating skills
  • Verbal memory (vocabulary)
  • Processing detail
  • Music: sequential and analytical skills in trained musicians

• **Right Hemisphere**
  • Language (Emotion/prosody)
  • Visual-spatial analysis and spatial attention
  • Arithmetic: ability to estimate quantities and line up columns on a page
  • Self-awareness
  • Nonverbal memory
  • Processing “gestalt”
  • Music: in untrained musicians and for complex pieces in trained musicians
Left vs Right

• Left Hemisphere: “Classic” Clinical Presentation
  • Right hemiparesis/sensory deficits
  • Aphasia
  • Apraxia
Left vs Right

- Right Hemisphere: “Classic” Clinical Presentation
  - Left hemiparesis/sensory deficits
  - Neglect of the left hemibody
  - Unawareness of deficits
Normal Language

● Controlled by *dominant hemisphere*
  ○ Left hemisphere dominant in most (95%) people, including the majority of left-handed
  ○ Dominant *planum temporale* (superior surface of temporal lobe) is only exception to symmetry of brain
    ■ Asymmetry missing in schizophrenia, autism, dyslexia

● Association areas integrate language with visual recognition (naming) and verbal memory
Normal Language

- Perisylvian Language Arc
  - Comprised of Wernicke’s (reception) → Arcuate fasciculus (transmittal) → Broca’s (production)
  - Processes all forms of language (written, spoken, sign language, etc)
  - Exception is obscenities, languages learned as adults
  - All in MCA territory
Language
Language
Normal Language

- Non-dominant hemisphere controls prosody (inflection, rhythm), gestures, singing/music in a similar way to the dominant hemisphere
  - temporal areas involved in receptive prosody
  - frontal areas involved in expressive prosody
Disorders Related to Aphasias

● Aprosodia
  ○ Non-dominant (right) hemispheric lesion
  ○ Loss of normal inflection/emotional content of speech
  ○ If lesion is to R hemispheric correlate to Broca’s, will lose production of prosody
  ○ If lesion is to R hemispheric correlate to Wernicke’s, will lose understanding of tone/prosody
Normal Language

• Dominant hemisphere for language established by age 5
• After puberty, very difficult to learn new language with no trace of primary language and non-dominant hemisphere can no longer assume language control
• There is a critical period of time during which language must be acquired. Pathological “feral children” situations result in no ability to acquire language.
Aphasias

• Test by assessing basic language functions
  • Spontaneous speech production
  • Comprehension
  • Naming
  • Repetition
• Pure Broca’s and Wernicke’s are rare
• Preferred terms are non-fluent and fluent aphasias
### Aphasias

#### Wernicke-Geschwind Model of Language

<table>
<thead>
<tr>
<th>Lesion</th>
<th>Comprehension</th>
<th>Fluency of speech</th>
<th>Repetition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Werinke’s area</td>
<td>Bad</td>
<td>Good</td>
<td>Bad</td>
</tr>
<tr>
<td>Broca’s area</td>
<td>Good</td>
<td>Bad</td>
<td>Bad</td>
</tr>
<tr>
<td>Arcuate Fasciculus</td>
<td>Good</td>
<td>Good</td>
<td>Bad</td>
</tr>
<tr>
<td>Middle cerebral artery occlusion (Global aphasia)</td>
<td>Bad</td>
<td>Bad</td>
<td>Bad</td>
</tr>
<tr>
<td>Transcortical sensory aphasia</td>
<td>Bad</td>
<td>Good</td>
<td>Good</td>
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<tr>
<td>Transcortical motor aphasia</td>
<td>Good</td>
<td>Bad</td>
<td>Good</td>
</tr>
<tr>
<td>Transcortical mixed aphasia</td>
<td>Bad</td>
<td>Bad</td>
<td>Good</td>
</tr>
</tbody>
</table>
Aphasias

- Non-fluent (Broca’s)
  - Lesion around Broca’s area
    - Impaired speech production and repeats
    - Preserved comprehension except for syntax heavy meaning e.g. “The lion was killed by the tiger”
    - Reduced, halting, laborious, limited, telegraphic, agrammatic, stereotyped utterances
    - Very very bothered by their deficits
  - Testing:
    - Naming difficulties (how many animals can you think of in one minute?)
    - Short phrases (listen for the syntax. Are they using only fragments? or whole sentences?)
    - Content words (nouns) exceeds function words (prepositions, conjunctions, modifiers)
Aphasias

● Fluent (Wernicke’s)
  ○ Lesion around Wernicke’s area
    ■ Impaired comprehension and repeats
    ■ Preserved speech production
    ■ Flowing easy production of speech, grammatic, but doesn’t make sense, vague, word substitutions, jargon
    ■ Less bothered by their deficits, possibly unaware of them
  ○ Testing:
    ■ Give simple commands. From least grammatically complicated to most:
      ● Stick out your tongue, close your eyes, show me a thumbs up, touch your left ear with your right thumb, etc
    ■ Listen
      ● Semantic paraphrasic error: “ink” instead of “pen”
      ● Phonemic paraphrasic error: “pish” instead of “fish”
      ● neologisms or non words
Aphasias

● Global
  ○ Lesion entire Perisylvian language arc
  ○ Impaired speech production, comprehension, and repeats
Aphasias

● Transcortical motor
  ○ Lesion disconnecting Broca’s area
  ○ Impaired speech production
  ○ Preserved comprehension and repeats

● Transcortical sensory
  ○ Lesion disconnecting Wernicke’s area
  ○ Impaired comprehension
  ○ Preserved speech production and repeats

● Conduction
  ○ Lesion to arcuate fasciculus
  ○ Impaired repeats and paraphrastic errors
  ○ Preserved speech production and comprehension
Aphasias

• Psychogenic aphasia
  • Most common is a psychogenic variant of Broca’s fluent)
  • Adult onset stuttering is usually psychogenic
  • Clues are if writing preserved (especially if R-handed), as this is anatomically difficult
  • In true Broca’s, frustration often leads to profanities (usually preserved) and will try to express self with L hand gestures/shoulder shrugs
Disorders Related to Aphasias

- Alexia without Agraphia
  - LEFT occipital plus posterior corpus callosum lesion (usually PCA stroke)
  - Usually has associated R homonymous hemianopsia

- Anosognosia
  - Seen with R parietal lesion
  - Denial of a neurologic deficit
  - Frequently some degree of neglect
Disorders Related to Aphasias

- **Echolalia**
  - Involuntary repetition of examiner’s words
  - Seen in autism, transcortical aphasias, dementia, Tourette’s

- **Echopraxia**
  - Involuntary mimicry of examiner’s movements
Disorders Related to Aphasias

● Apraxia
  ○ Inability to execute learned actions despite normal strength, sensation, coordination
  ○ Disconnection of motor centers from other areas
  ○ **Ideomotor apraxia** – cannot pantomime
    ■ Cannot pretend to brush teeth, etc
    ■ Cortical process but can be from many different cortical areas (usually parietal or frontal)
  ○ **Ideational apraxia** – cannot conceive/perform sequential steps in a task
    ■ Cannot pretend to fold letter, place in envelope, address letter, seal envelope, etc.
    ■ Hallmark of dementias, especially FTD
What kind of aphasia was that?

- Fluent or Non-fluent?
- Paraphrasic errors: “fumb-fumb” instead of thumb, “what time is it?” instead of watch
- No complete sentences
- Also note the errors in completing tasks are not because she does not understand the command, but she does not seem to be able to make her hands do what she wants them to do (apraxia).
- There is a lot of dysarthria as well.
Left vs Right

• Neglect
  • Deficit in *attention to* and *awareness of* contralateral personal and extrapersonal space

• High level cognitive deficit. NOT the same as a visual field defect

• Can be evident in multiple sensory modalities and cognition
Left vs Right

Left Neglect

68 YOM, right basal ganglia hemorrhage
Left vs Right

Left Neglect is *not* a visual field defect!!!!!!
Occipital Syndromes

- Visual Field Defects
Parietal Syndromes

• **Balint’s Syndrome** – result of bilateral occipito-parietal junction lesions
  • Optic Ataxia
    • Misdirected movement under visual guidance
  • Simultanagnosia
    • Failure to scan and integrate an entire visual scene/picture
    • Can only see one object at a time
  • Ocular apraxia
    • Visual scanning deficit
    • Inability to voluntarily guide eye movements/change to a new location of visual fixation
Balint’s Syndrome – Simultanagnosia

Patients suffering from Simultanagnosia and Balint’s syndrome will only report the features they are presently looking at but will not be able to understand the contents of the scene.
Parietal Syndromes

- Gerstmann Syndrome – damage to left parietal lobe, specifically angular gyrus
  - Finger agnosia
  - Right-left confusion
  - Agraphia
  - Acalculia

- Neglect
  - Lesion to right parietal lobe, spec. area 39
  - Lesion can also produce topographagnosia (agnosia to landmarks)
Visual Processing

- **Dorsal Pathway (Occipito-parietal)**
  - “Where”

- **Ventral Pathway (Occipito-temporal)**
  - “What”

Remember: ‘What’ under ‘Where’
Occipital Syndromes

• Visual agnosia
  • Inability to combine individual parts of an object together to recognize the entire object
  • Damage to stream of visual information from primary visual cortex to association cortices

• Prosopagnosia
  • Inability to recognize faces including their own
  • Damage bilaterally beneath calcarine sulcus near occipital junction with temporal lobe
  • **A subtype of visual agnosia
Occipital Syndromes

• Achromatopsia
  • Another subtype of visual agnosia
  • Lesion to occipital cortex inferior to calcarine sulcus
  • Superior visual field deficit (upper quadrantanopsia)
  • Loss of color vision in the preserved inferior visual field
  • Causes total failure on Ishihara plates
Case 1

A 35 yo man with schizophrenia presents to Mbingo Hospital in Cameroon after suffering a blow to the head with LOC. He has been hospitalized for 5 days with steadily improving symptoms of concussion. His physicians are not sure if his current confusion is his baseline or if he has suffered a neurologic injury.

Which of the following examination findings is least consistent with schizophrenia and suggestive of a new injury?
A. He gets only 2/3 memory words on immediate recall.

B. He gets only 1/3 memory words on delayed recall.

C. He can write the sentence “My name is Emmanuel,” but he cannot read it back.

D. He cannot come up with abstract similarities between objects (train and bicycle = transportation) and instead comes up with concrete similarities (train and bicycle = both have wheels).
Alexia without Agraphia

- Diffuse axonal injury with shearing forces and white matter tract injuries
Case 2

A 75 year old man fell and hit his head and had a CT scan to rule out bleed. He was incidentally found to have a chronic stroke on CT as seen here. He is shocked that he had a stroke and does not remember any stroke symptoms.
When did this stroke happen?

A. When he stopped being able to see color.
B. When his wife started getting angry at him because he kept misunderstanding her and being “insensitive.”
C. When he began to hoard statues of saints.
D. When his handwriting changed – smaller, more cramped, and tremulous.
Loss of Receptive Prosody

• His wife thought he was being insensitive, but he had lost the ability to understand the intonations of language!
Case 3

Then Jesus left the vicinity of Tyre and went through Sidon, down to the Sea of Galilee and into the region of the Decapolis. There some people brought to him a man who was deaf and could hardly talk, and they begged Jesus to place his hand on him.

After he took him aside, away from the crowd, Jesus put his fingers into the man’s ears. Then he spit and touched the man’s tongue. He looked up to heaven and with a deep sigh said to him, “Ephphatha!” (which means “Be opened!”). At this, the man’s ears were opened, his tongue was loosened and he began to speak plainly. Jesus commanded them not to tell anyone. But the more he did so, the more they kept talking about it. People were overwhelmed with amazement. “He has done everything well,” they said. “He even makes the deaf hear and the mute speak.”