Language Disorders of Speech

Joshua Christy- 4th Year Medical Student

Windsor University School of Medicine

Objectives and Topics

- Aphasia
  - Etiology, Neuroanatomy
  - Wernicke's
  - Transcortical Motor
  - Conduction Aphasia
  - Anomic Aphasia
  - Broca's Aphasia
  - Transcortical Sensory
  - Global Aphasia
  - Diagnosis
  - Management
- Dysarthria
  - Factors in Speech Process
    - Respiration, Phonation, Resonance, Articulation
  - Unilateral UMN Dysarthria
  - Flaccid
  - Spastic
  - Hypokinetic and Hyperkinetic
  - Diagnosis
  - Management

Aphasia

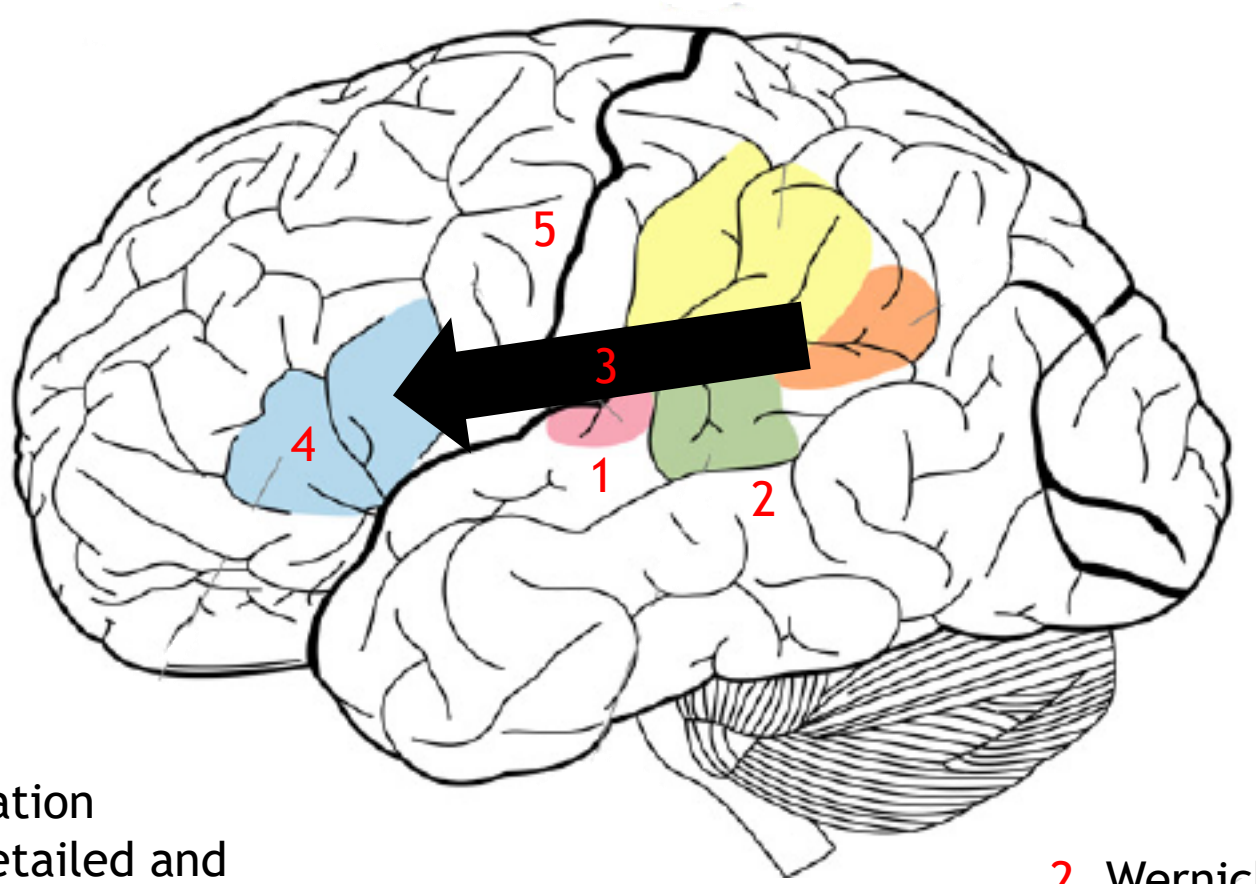
- Inability to comprehend and formulate language because of damage in the brain.

- Etiology includes:
- Ischemic stroke
- Hemorrhagic stroke
- Malignancy
- Cerebral Abscess
- Transient Episodes
  - TIA- high risk of stroke in next couple of days to weeks.
  - Migraine
  - Seizure

Speech Language Pathway

5 Primary Motor Cortex

Speech articulation center to initiate appropriate movements to lips, tongue, and larynx to produce speech.



4 Broca's Area

Processed information received into a detailed and coordinated pattern for vocalization

1

Primary Auditory Cortex

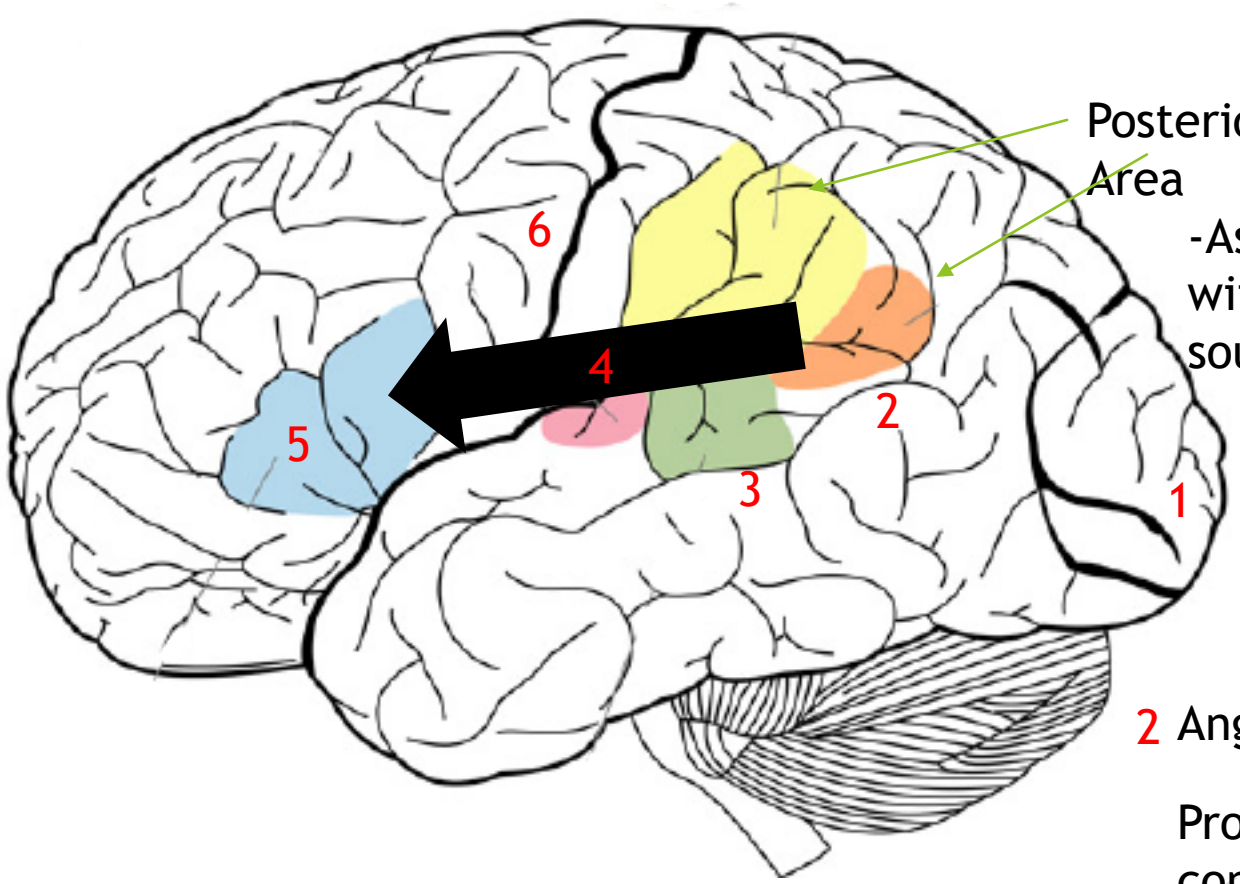
2 Wernicke's Area

Comprehension of Auditory Information

Speech Language Pathway

6 Primary Motor Cortex

Speech articulation center to initiate appropriate movements to lips, tongue, and larynx to produce speech.



Posterior Language Area

-Associates memories with thoughts and sounds

1 Primary Visual Cortex

2 Angular Gyrus

Processes information that converts visual information into auditory information.

5 Broca's Area

Process information received into a detailed and coordinated pattern for vocalization

3 Wernicke's Area

Comprehension of Auditory information

Aspects of Communication

- Sensory Aspect- Language input.
  - Tracts move from the ears and eyes to Wernicke's Area.
- Motor Aspect- Language output.
  - Tracts move from Broca's Area and to the muscles involving vocalization.

Clinical Examination

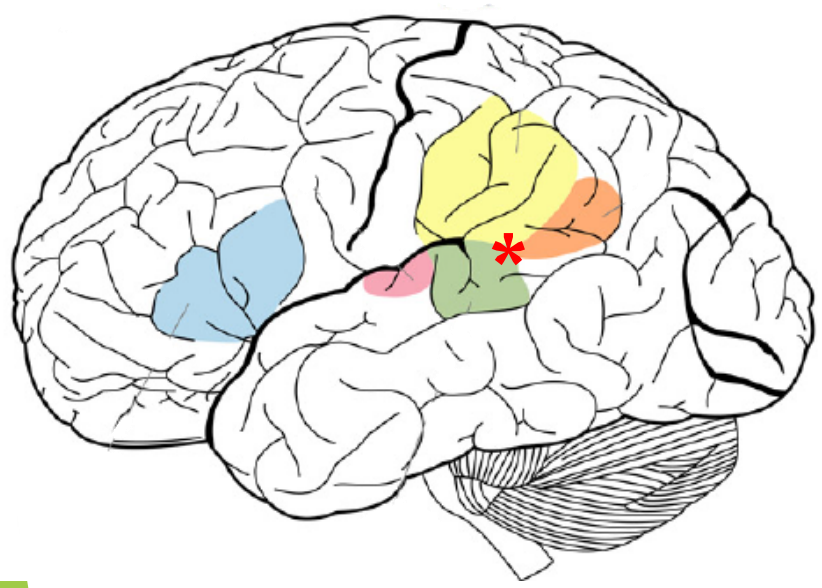
- Fluency- spontaneous speech. Measured by asking patient to saw a certain number of words in a restricted category. (E.g. say many words with letter F).
  - Inability to say more words than 12, means there is an impairment in verbal fluency.
- Repetition
- Naming- helps test retrieval

Clinical Examination

- Comprehension- evaluated by giving a series of commands. “Close your eyes”. Or asking patient to point at an object.
- Reading- Assess comprehension by asking patient to “Fold paper in half and put it on the table”.
  - Make sure to test reading comprehension by reading aloud.
- Writing

Wernicke's Aphasia

- Superior Temporal Lobe- Involves Wernicke's area and posterior language area
- Sensory Aphasia



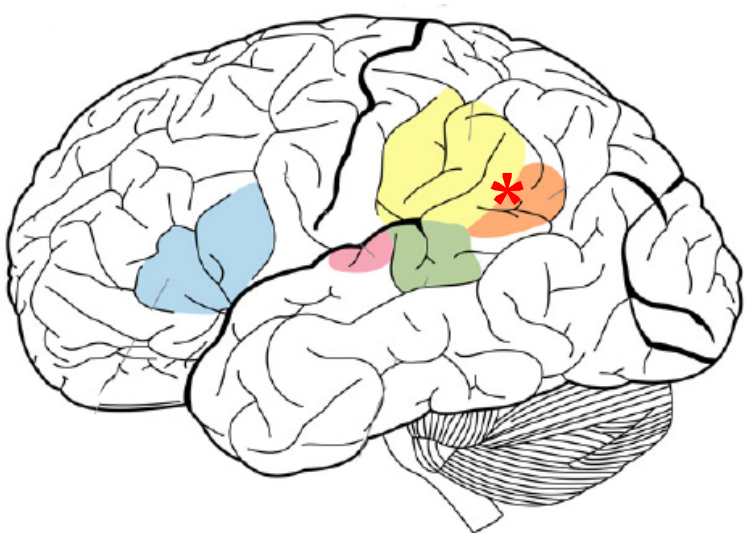
Feature	Characteristic
Spontaneous Speech	Fluent
Naming	Impaired
Auditory Comprehension	Impaired
Repetition	Impaired
Reading	Impaired
Behavior	Inappropriately happy

Wernicke's Aphasia

- Comprehension is tested by asking patient to point to something.
  - Patients usually will not be able to because they don't understand.
- Lack Awareness that speech is faulty, and lack ability to understand.
- Neologism- creating new words or meanings for previously learned words.

Transcortical Sensory Aphasia

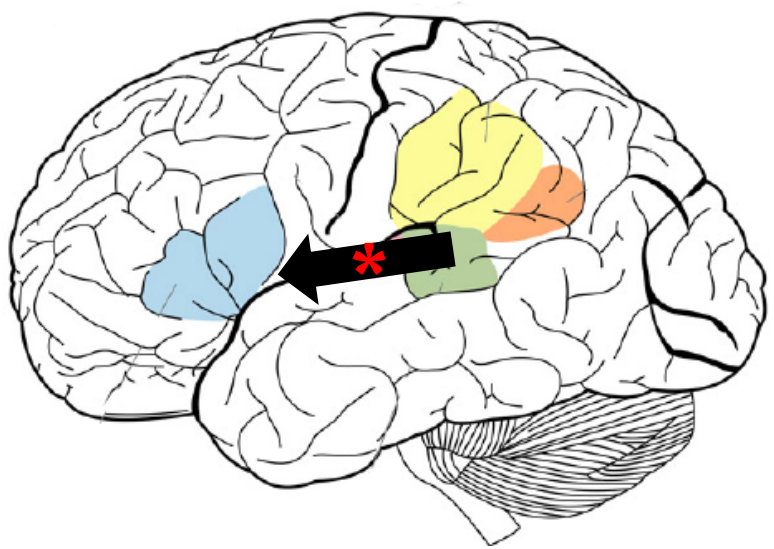
- Lesion of the posterior language center.
- Patients will often present similar to Wernicke's, however they retain the ability to repeat.



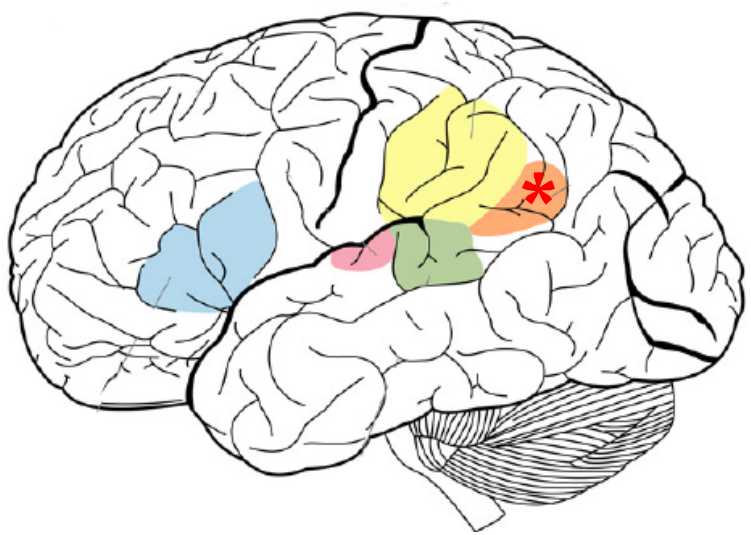
Feature	Characteristic
Spontaneous Speech	Fluent
Naming	Impaired
Auditory Comprehension	Impaired
Repetition	Intact
Reading	Impaired
Behavior	Inappropriately happy

Conduction Aphasia

- Lesion in the arcuate fasiculus connecting Wernicke's and Broca's areas
- Speak and write well.
- Understand words
- Repetition is Poor
- Unable to put parts of words together or create words.



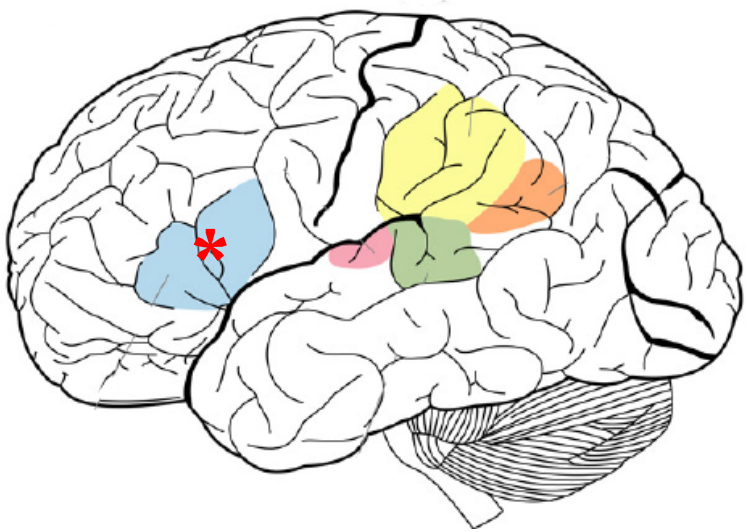
Anomic Aphasia



- Angular gyrus lesion
- Difficulty understanding written language or pictures
- Unable to process visual images and not sent to Wernicke’s area.

Broca's Aphasia

- Inferior Frontal Lobe
- Motor Aphasia



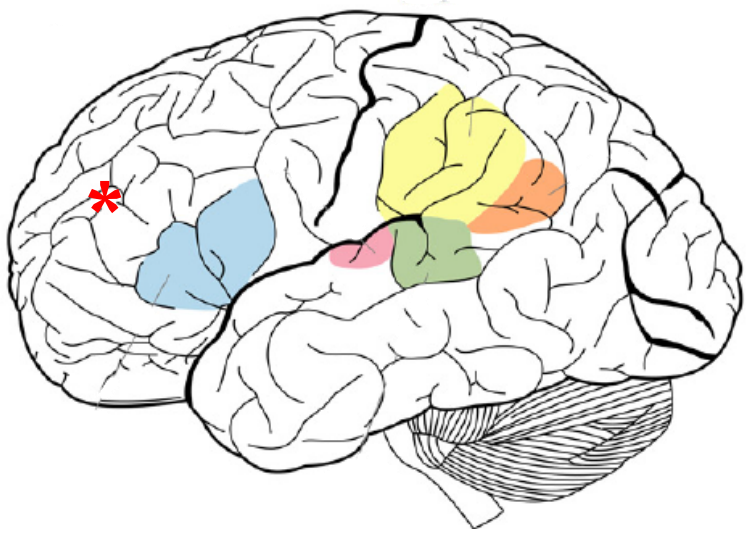
Feature	Characteristic
Spontaneous Speech	Nonfluent
Naming	Impaired
Auditory Comprehension	Intact
Repetition	Impaired
Reading	Impaired
Behavior	Angry and depressed

Broca's Area- Speech Deficits

- Agrammatism- difficulty in comprehending or using proper grammar with verb endings and word order (Don't use "ed" for past events, don't use –ing and don't use functors like "is".)
- Anomia- difficulty in finding (remembering) the appropriate word to describe an object or action.
- Difficulty with articulation- mispronounce word.

Transcortical Motor Aphasia

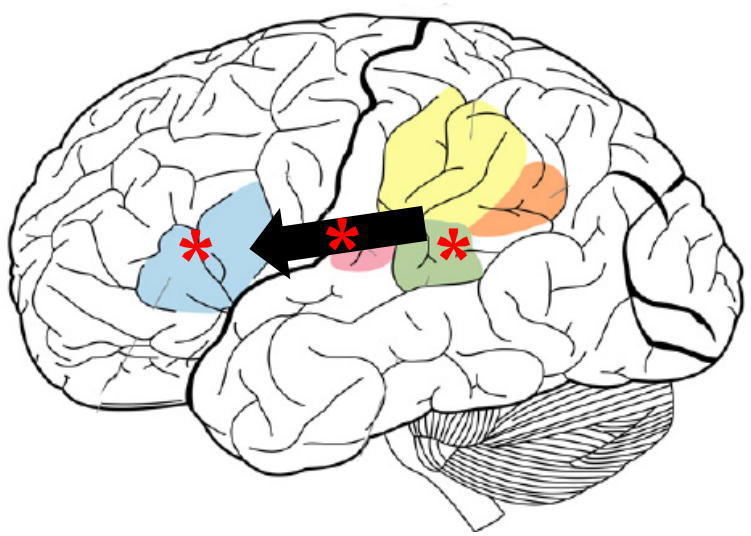
- Damage to the frontal lobe, typically to the superior and anterior portions.
- Characteristics are similar to Broca's aphasia



Feature	Characteristic
Spontaneous Speech	Nonfluent
Naming	Impaired
Auditory Comprehension	Intact
Repetition	Intact
Reading	Impaired
Behavior	Angry and depressed

Global Aphasia

- Both Wernicke's, Arcuate Fasiculus, and Broca's areas are damaged.



Feature	Characteristic
Spontaneous Speech	Nonfluent
Naming	Impaired
Auditory Comprehension	Impaired
Repetition	Impaired
Reading	Impaired
Behavior	Angry and depressed

Aphasias. Characteristic responses of patients with lesions in various areas when shown a picture of a chair

Type of Aphasia and Site of Lesion	Characteristic Naming Errors
Nonfluent (Broca's area)	"Tssair"
Fluent (Wernicke's area)	"Stool" or "choss" (neologism)invented word
Fluent (areas 40, 41 and 42; conduction aphasia)	"Flair . . . no, swair . . . tair"
Anomic (angular gyrus)	"I know what it is . . . I have a lot of them"

Diagnosis

- MRI of the brain
- Transient aphasia → EEG or CVA imaging
- Aphasia with an insidious onset and gradual progression → Neurodegenerative Disease

Management

- Treat the Underlying cause
- Speech Language Therapy
  - Help to train the patient and family members.
  - Constraint Induced Aphasia Therapy
- Pharmacologic approach
  - Replace depleted neurotransmitters
  - Bromocriptine, Amphetamine, Donepezil, and Memantine
- Transcranial Magnetic Stimulation

Aphasia Summaries

Feature	Wernicke's Aphasia	Transcortical Sensory	Broca's Aphasia	Transcortical Motor	Global Aphasia
Spontaneous Speech	Fluent	Fluent	Nonfluent	Nonfluent	Nonfluent
Naming	Impaired	Impaired	Impaired	Impaired	Impaired
Auditory Comprehension	Impaired	Impaired	Intact	Intact	Impaired
Repetition	Impaired	Intact	Impaired	Intact	Impaired
Reading	Impaired	Impaired	Impaired	Impaired	Impaired
Behavior	Inappropriately happy	Inappropriately happy	Angry and depressed	Angry and depressed	Angry and depressed

Factors Involved in Speech Process

- Respiration
- Phonation
- Resonance
- Articulation

Respiration

- Breathing serves as the energy source for the production of sound.
- Exhalation phase is longer in speech, however inhalation and exhalation are the same length.
- C3-C5 segments of spinal cord innervate the diaphragm through the phrenic nerve
- Intercostal and abdominal muscles innervated by the intercostal nerves.

Phonation

- The sounds that are created when air passes through the vocal folds.
- The opening in between is the glottis.
- This determines the pitch (frequency), loudness (intensity), and quality of the sound.
- Laryngeal muscles innervated by phrenic nerve.
- Speed of vocal folds vibrating, determines the if pitch is high or low.

Resonance

- The process by which phonation is enhanced in quality and/or intensity by the air-filled cavities (pharynx, nasopharynx, nasal cavity and oral cavity), which passes to outside air.

- These vibrations will cause another “body” to vibrate in tune with it.
  - Either through physical contact (conductive resonance) or receives vibrations from the air (sympathetic resonance).
  - Chest, head, nose.

Articulation

- Shaping of the phonated voice into certain sounds, and then are made into words that are understandable.
  - Pterygoid, masseter, and temporalis innervated by trigeminal nerve
  - Facial expression- orbicularis oris by the facial nerve
  - Tongue Muscles- innervated by the hypoglossal nerve.

Dysarthria

- Paralysis or decreased coordination of the muscles involved with articulation.
- Can be caused by a single stroke → Unilateral UMN Dysarthria.
- LMN, ALS, Myasthenia Gravis → Flaccid Dysarthria
- Multiple strokes/Bilateral → Spastic Dysarthria.
- Basal Ganglia→ Hypokinetic or Hyperkinetic Dysarthria

Unilateral UMN Dysarthria

- Most cranial nerves receive bilateral innervation from UMNs.
- Cranial nerves to lips and tongue are innervated primarily by UMN from contralateral brain.
- Unilateral UMN lesion have a reduced ROM and the tongue will deviate to affected side.
- Hemi-lower facial drop

Unilateral UMN Dysarthria

- Etiology is due to stroke, tumors, and traumatic brain injury.
- Phonation: Mild harsh vocal quality
- Resonance: Mild hypernasality
- Articulation: Imprecise consonant production.

Flaccid Dysarthria

- Damage to LMN that innervate respiratory musculature or to the cranial nerves that innervate speech musculature
- Etiologies include ALS, Myasthenia Gravis, GBS, and damage to CN nuclei.
- Presents with Weakness, Hypotonia, Decreased reflexes, atrophy, fasiculations.

Flaccid Dysarthria

- Trigeminal Nerve- Jaw deviation to weaker side. Decreased masseter or temporalis contraction. Unable to adjust for vowels.
- Facial Nerve- at rest, affected side sags and is hypotonic. Forehead may be unwrinkled, eyebrow drooped, during smiling, face retracts more toward the intact sign. Will have vowel distortion.
- Vagus Nerve- soft palate hangs lower on side of lesion. Pulls toward the nonparalyzed side on phonation. Hypernasality.
- Spinal Accessory Nerve- Affects posture → respiration and phonation.
- Hypoglossal nerve- tongue deviates to weak side on protrusion. Affects vowel sounds.

Flaccid Dysarthria Voice Presentation

- Phonation: Presents with a breathy voice (sighing voice)
- Resonance: Hypernasality, and nasal emission (air escapes and effects production of consonant).
- Will also have trouble with producing vowels.

Spastic Dysarthria

- Due to the combination of damage to the pyramidal and extrapyramidal tracts.
- Can affect all or one of respiratory, phonatory, resonatory, or articular components of speech.
- Most common causes are vascular, degenerative, traumatic.
- Excessive muscle tone.

Spastic Dysarthria Voice Presentation

- Phonation stenosis due to spasticity of laryngeal muscle: low pitch, strained voice.

- Resonance/Articulation- imprecise consonants and distorted vowels. (not as severe as flaccid).

Hypokinetic Dysarthria

- Etiology mostly due to Parkinson's disease.
- Respiration- Faster breathing rates.
- Phonation- Harsh, breathy voice. Reduced loudness.
- Articulation- Imprecise consonants.

Hyperkinetic Dysarthria

- Mostly seen with Huntington's disease, due to the chorea. Rapid, involuntary movements cause distortion of speech.
- Phonation- Harsh vocal quality. Excess loudness.
- Articulation- imprecise consonants and vowels.

Diagnosis

- MRI of the Brain
- EMG
- Anti-acetylcholinesterase antibody
- DAT Scan
- Genetic Testing

Management of Dysarthria

- Correct the underlying causes

- Speech Language Therapists work on subtypes:
  - Respiration- producing enough pressures, controlled exhalation
  - Phonation- head realaxation techniques, focusing voice and load on the layrnx.
  - Resonance- repetition of plosive sounds (those that close the airways completely and include: t,d,k,g,p,b)
  - Articulators: Work on strengthening or relaxing muscles.

Dysarthria Summaries

Dysarthria	Phonation	Resonance	Articulation
Unilateral UMN	Mild Harsh Voice	Mild hypernasality	Imprecise consonants
Flaccid	Breathy Voice	Hypernasality and Nasal emission	Imprecise consonants
Spastic	Low Pitch, Strained	Mild hypernaslity	Imprecise consonants
Hypokinetic	Harsh, Breathy Voice. Decreased loudness	Hypernasality	Imprecise consonants
Hyperkinetic	Harsh vocal quality. Excess Loudness	Hypernasality	Imprecise consonants

Dysarthria vs Aphasia

- Dysarthria
  - Any lesion in the UMN to the muscles in the articulation.
  - Speech will be slurred or sound drunk.
  - If breath control effected, then may need to speak in short bursts vs complete sentences.

- Aphasia
  - Broca's Aphaia.
  - Difficulty with reading and writing.
  - May only say single words or short sentences, missing out crucial words.
  - Have frequent pauses and **unable to find word**.
  - Get stuck on a single word or sound and repeat it.

References

- Clark D., Mendez M., Wilterdink. J., Approach to the patient with aphasia. Jul 2018.
- Hustad, KC (2006). "Estimating the Intelligibility of Speakers with Dysarthria". *Folia Phoniatrica et Logopaedica*. **58** (3): 217–28.
- https://strokeanddysarthria.weebly.com/resulting-dysarthria.html
- Yang ZH, Zhao XQ, Wang CX, et al. Neuroanatomic correlation of the post-stroke aphasias studied with imaging. Neurol Res 2008; 30:356.
- https://uiowa.edu/voice-academy/three-parts-speech
- Alexander MP, Hiltbrunner B, Fischer RS. Distributed anatomy of transcortical sensory aphasia. Arch Neurol 1989; 46:885.
- Berthier ML. Poststroke aphasia : epidemiology, pathophysiology and treatment. Drugs Aging 2005; 22:163.
- Laska AC, Hellblom A, Murray V, et al. Aphasia in acute stroke and relation to outcome. J Intern Med 2001; 249:413.

References 2

- Goodglass H. Understanding Aphasia, Academic Press, San Diego 1993.
- Okuda B, Kawabata K, Tachibana H, et al. Postencephalitic pure anomic aphasia: 2-year follow-up. J Neurol Sci 2001; 187:99.
- Devere TR, Trotter JL, Cross AH. Acute aphasia in multiple sclerosis. Arch Neurol 2000; 57:1207.
- http://caferacersjpg.com/lower-motor-neuron-dysarthria/
- Hanlon RE, Lux WE, Dromerick AW. Global aphasia without hemiparesis: language profiles and lesion distribution. J Neurol Neurosurg Psychiatry 1999; 66:365.
- Boatman D, Gordon B, Hart J, et al. Transcortical sensory aphasia: revisited and revised. Brain 2000; 123 (Pt 8):1634.
- http://www.stroke.org.uk/sites/default/files/Communication%20problems%20after%20stroke.pdf
- Ericson EJ, Gerard EE, Macken MP, Schuele SU. Aphasic status epilepticus: electroclinical correlation. Epilepsia 2011; 52:1452.