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## Dysarthrias: Differential Diagnosis

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## The Dysarthrias

- “A collective name for a group of *neurologic* speech disorders resulting from abnormalities in the strength, speed, range, steadiness, tone, or accuracy of movements required for control of the respiratory, phonatory, resonatory, articulatory, and prosodic aspects of speech production. The responsible pathophysiologic disturbances are due to central or peripheral nervous system abnormalities and most often reflect weakness; spasticity; incoordination; involuntary movements; or excessive, reduced, or variable muscle tone.”

(Duffy, 2020 p. 3)

### Differential diagnosis

- Evolution of a discipline
  - A need to better understand and define clinical populations.
  - Evaluation
    - ✦ *More accurate diagnosis*
  - Treatment
    - ✦ *Guide our treatment decisions*
- Darley, Aronson, & Brown
  - Pivotal articles (1969)
  - “Motor Speech Disorders” text (1975)
  - Defined and identified the dysarthrias
    - ✦ *Initial sample = 212 patients*
      - Lesion site
      - Perceptual characteristics
      - Motor characteristics

### Benefits & Drawbacks

- Assists with confirmation of lesion site
  - Can rule out other potential diagnoses
- Clinical “shorthand”
  - Across facilities, disciplines
- Guides treatment decisions
  - Understanding the underlying pathology informs treatment directions
- Reliability has been questioned
- Corresponding lesion data
  - Clinical knowledge adds to the picture
  - Not confirmed empirically

### Take home message...

- Clinically useful
  - Evolution of our understanding continues
- Our understanding of neuropathology will never be static
  - New discoveries
  - New procedures
- For now, the system is a useful one that will continue to be refined
  - Example: Hyperkinetic
    - ✦ *Myriad of movement disorders*

### Prevalence of MSD

Based on a sample > 14, 000 people referred for a speech/language evaluation at Mayo Clinic from 1993-2008

Other neurologic speech disorders - 0.4%

Apraxia of Speech – 3.9%

Nonaphasic cognitive-communication disorders – 16.8 %

Aphasia – 25.8%

Dysarthria – 53%

### Definition revisited:

Key features of the dysarthrias

Neurologic basis

Disorder of speech execution/movement

Categorized based on

Site of lesion

Physical characteristics (OME findings)

Perceptual Speech characteristics

### Components of the Evaluation

Perceptual features

Spontaneous speech

Background and history

Review of symptoms

Standard Reading Passage

Repetition

Physical features

Systematic review of physical characteristics

Symmetry

Range of movement  
 Direction of movement  
 Velocity of movement  
 Strength

Confirmatory signs

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## **Flaccid Dysarthria**

- Results from injury/damage to cranial and/or spinal nerves
  - Final common pathway
  - Lower motor neuron
- Reflexive, automatic, and voluntary activities are ALL affected when the lesion resides in the FCP.
- Can impact all subsystems of speech
  - Primary characteristics can be traced to weakness
  - Which of the Cranial and/or spinal nerves might be implicated?

## **Etiologies**

- Surgical
- Nonsurgical
- Neuropathies
- Tumor/Neoplasm
- Myasthenia gravis
- Degenerative
- Vascular
- Anatomic malformation
- Demyelinating
- Other

## **Lesion analysis**

## Trigeminal

### Innervation properties

- Three branches (sensory)
- Motor component
- Signs
  - Sensory loss
  - Jaw deviation (unilateral)
  - Jaw may hang open (bilateral)
- How do you test?
- Speech signs
  - Imprecision in connected speech
  - Most affected with bilateral lesions

## Facial

### Innervation properties

- Sensory
- Motor
- Signs
  - Facial droop
  - Drooling (possibly)
  - Pocketing
- Testing
- Speech signs
  - Imprecision in connected speech
    - Related to facial weakness
    - What sounds would be most affected?

## Glossopharyngeal

- Innervation properties
  - Sensory
  - Motor
- Signs
- Testing
- Speech signs

## Vagus

- Innervation properties
  - Sensory
  - Motor
- Signs

- Velar signs
- Testing
- Speech signs
  - Phonation
  - Respiration
  - Resonance

### **Spinal Accessory**

- Innervation properties
  - Motor
- Signs
  - Shoulder weakness
- Testing
- Speech signs

### **Hypoglossal**

- Innervation properties
  - Motor
- Signs
  - Tongue deviation
  - Atrophy
- Testing
- Speech signs
  - Imprecision with articulation
  - Compensation with the mandible

### **Spinal nerve lesions**

- Damage to spinal nerves C-1 through C-5
- Primary damage to respiration
  - How does that interfere with speech?
- Signs
  - Rapid/shallow breathing
  - Exaggerated thoracic expansion
- Flaccid dysarthria related to isolated damage to spinal nerve lesions is rare

### **Primary Characteristics**

- Weakness
- Hypotonia and reduced reflexes
- Fasciculations and fibrillations

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## Spastic Dysarthria

Secondary to damage of the direct and indirect pathways of the CNS (UMN system)

- Direct pathway
  - Pyramidal tract
  - Corticobulbar tracts
    - Interacts with cranial nerves
  - Corticospinal tracts
    - Interacts with spinal nerves
  - Facilitatory action
    - Leads to skilled discrete movements
  
- Indirect pathway
  - Extrapyrarnidal
  - Regulates reflexes, maintains posture, tone
  - Inhibitory nature

### Clinical Characteristics

- Difficulty with fine, discrete movements
  - Initially decreased tone
  - Weakness
  - Develops into increased tone, spasticity
    - Those muscles utilized in fine movements most affected
  - Decreased reflexes initially, then more pronounced
  - Babinski sign
  - Oral motor reflexes
    - Suck
    - Snout
    - Jaw jerk

### Etiologies

- Vascular
  - Brainstem stroke
    - Bilateral effects
    - Cerebral stroke can't have the same impact, unless there is previous damage, or perhaps midline shift/compression from a hemorrhagic stroke
  - Lacunar infarcts
  - Multi-infarct dementia
    - Not a common problem with DAT
- Inflammatory
  - Leukoencephalitis
- Degenerative disease
  - Primary lateral sclerosis
- Traumatic Brain Injury
- Multiple Sclerosis
- Neoplasm

### **Oral Mechanism**

- Dysphagia
- Drooling
- Pseudobulbar affect
- Normal jaw strength
- Facial movements may be slow then move into excess/extreme
- Hyperactive reflexes

### **Speech Characteristics**

- Impairments noticed most by looking at muscle movement rather than isolated muscles
- reduced speed
- reduced range
- reduced force
- increased muscle tone

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### **Ataxic Dysarthria**



- Cerebellum
  - Two cerebellar hemispheres
  - Vermis
  - Ipsilateral contribution
    - Unlike the cerebral hemispheres which have contralateral contributions
    - With median lesions, effects may be bilateral

How does the “circuit” function?

- The “circuit”
  - Notice of movement-cerebral hemispheres
  - Monitors the movement via feedback from the muscles/joints that conduct the movement.

Regulates movement in an ongoing fashion based on both ends of this circuit.

### **Clinical Characteristics**

- Ataxic dysarthria typically manifests with diffuse cerebellar damage
  - Any signs/symptoms from unilateral lesions tend to improve rapidly
- Disordered gait
- Truncal instability, titubation
- Rotated head postures
- Ocular motor abnormalities
- Ataxic dysarthria

### **Etiologies**

## Degenerative Diseases

- Hereditary Ataxias
- Multiple Sclerosis
  - Paroxysmal Ataxic Dysarthria
- Vascular Disorders
  - Aneurysms
  - AVMs
  - Occlusion in the vertebrobasilar system
- Neoplasm
- Trauma
- Toxic/metabolic conditions
  - Alcoholic cerebellar degeneration
  - Severe malnutrition
    - Vitamin deficiencies
  - Pharmacological
    - Antiseizure drugs
    - Lithium
    - Valium
  - Hypothyroidism
  - Normal Pressure Hydrocephalus

## Oral Mechanism

Most aspects of the OME can be entirely normal

- Size
- Strength
- Symmetry
- Face, jaw, tongue, palate
- Rest, and during sustained postures
- Gag
- Reflexive swallow

## OME abnormalities

- Irregular AMRs
  - Observe the regularity of movement of the tongue, lips, and jaw
  - AMRs and connected speech
- Systemic problem
  - Affects the entire system rather than isolated impairment from muscles/muscle groups

## Speech

- Imprecision with artic
- Irregular artic breakdown
- Distorted vowels
- Excess and/or equal stress
- Prolonged phonemes/pauses
- Slow rate
- Harshness
- Monopitch
- Monoloudness
- Reduced/irregular breath groups

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## Hypokinetic Dysarthria

- Basal Ganglia Control Circuit
  - Functions
    - Regulate muscle tone
    - Movements that support goal directed activity
    - Postural adjustments
    - Adjust movements to the environment
    - Assists in learning new movements
- Damage results in reduced movement a/o a failure to inhibit involuntary movement
- Hypokinetic dysarthria most reflects reduced movement

## Clinical Characteristics

- Resting tremor
  - 4-7 Hz
  - Limbs
  - Pill-rolling
  - Jaw, lips, and tongue
- Rigidity
  - Resistance to passive stretch
  - Decreased movement
- Bradykinesia/Akinesia
  - Slow movement
  - Freezing
  - Shuffling gait
  - Micrographia
  - Masked facies
  - Reduction in:
    - Arm movement while walking
    - Gestures
    - Blinking
    - Head movement
    - Swallowing frequency
- Loss of postural reflexes
  - Reduced “righting” response
  - Stooped posture
  - Difficulty initiating movement
    - While lying down
    - Sitting to standing

## **Etiologies**

Damage to the basal ganglia

- Degenerative
- Vascular
- Traumatic
- Inflammatory
- Neoplastic
- Toxic
- Metabolic diseases

### **Oral Mechanism**

- Immediate revealing features
  - Masked facies
    - Flat affect
  - Respiratory signs
  - Infrequent swallowing
    - May result in drooling
  - Size, strength, and symmetry may be normal
  - AMRs may be slowly initiated a/o rapid and restricted in range

### **Speech Characteristics**

- Monopitch
- Monoloudness
  - Reduced intensity
  - Breathy quality
- Reduced stress
- Short phrases
- Variable rate
- Short rushes of speech
- Imprecise consonants

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## Hyperkinetic Dysarthria

- Another dysarthria type that manifests secondary to damage to the basal ganglia control circuit
- May effect all or isolated speech subsystems.
- Involuntary movement is the hallmark feature
  - Rhythmic
  - Irregular
  - Fast
  - slow

### Abnormal

- What constitutes abnormal?
- Involuntary movements when steadiness is expected
- Hyper-in this case does not mean fast
  - Excessive, extra
- Many forms
- Classified based on speed and periodicity

### Classification

- Dyskinesia
- Myoclonus
- Tics
- Chorea
- Ballism
- Athetosis
- Dystonia
- Spasm
- Tremor

## Etiologies

- Degenerative
- Vascular
- Traumatic
- Inflammatory
- Toxic
- Metabolic disease

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## Unilateral Upper Motor Neuron Dysarthria

- Unilateral lesions of the upper motor neuron system
  - UMN system
  - Direct and indirect pathways
    - ✦ Direct signs
      - Hemiplegia-paresis
      - Lower facial weakness
        - Contralateral
      - Possible unilateral weakness of the tongue, palate, larynx
    - ✦ Indirect signs
      - Increased muscle tone
      - Spasticity
        - Occurs over time
- Etiologies

### Unilateral effects

- Stroke
- Tumors
- Focal trauma
- Lacunar infarcts
- Severity
- Often improves rapidly
  - ✦ Dependent upon lesion characteristics
  - ✦ Left side lesions can co-occur with language deficits
  - ✦ OME findings
- Contralateral facial weakness
  - ✦ UMN pattern, or “central” to differentiate from LMN pattern.

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## Mixed Dysarthrias

- Mixed dysarthrias
  - Combination of dysarthrias
    - Two or more
    - Diffuse damage
- Etiologies
  - Degenerative
    - ALS
    - MS
    - PSP
  - Toxic metabolic
    - Wilson's disease
    - Hepatocerebral degeneration
    - Hypoxic encephalopathy
  - Vascular Disorders
  - Trauma
  - Neoplasm
  - Infectious diseases

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## Cranial Nerve Screening

Cranial Nerve	Function	Screening Task
I – Olfactory	<b>Sensory</b> - Smell	odors
II – Optic	<b>Sensory</b> - Vision	vision chart/acuity
III- Oculomotor	<b>Motor</b> – Eye movement	"follow the moving finger"
IV - Trochlear	<b>Motor</b> – Eye movement (superior oblique)	look at the nose



V - Trigeminal	<b>Sensory</b> - facial sensation/anterior tongue	Have the individual close their eyes: touch the face
	<b>Motor</b> - muscles of mastication	Palpate muscles that clench the teeth
VI - Abducens	<b>Motor</b> - lateral rectus	look to the side
VII - Facial	<b>Sensory</b> - taste	sweet, sour, bitter, salt
	<b>Motor</b> - facial expression	smile, raise the eyebrows
VIII - Vestibulocochlear	<b>Sensory</b> - hearing	a tuning fork
	balance	look for vertigo
IX - Glossopharyngeal	<b>Sensory</b> - pharynx sensation	gag reflex
	<b>Motor</b> – pharyngeal muscles	gag reflex
X - Vagus	<b>Sensory</b> –pharynx, larynx, esophagus <b>Motor</b> - muscles of palate, pharynx, and larynx	Check phonation Assess vocal quality
XI- Spinal Accessory	<b>Motor</b> – Shoulder, head movement	shoulder shrug and/or turning the head to resistance
XII - Hypoglossal	<b>Motor</b> - tongue movement	Assess tongue movement

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