


Slide 1

Swallowing 101:
Back to Basics

PRESENTED BY: ERIN MILFORD, MS, CCC-SLP




Slide 2

Objectives


By the end of this session, we will:

- Recognize swallowing musculature and cranial nerve involvement in swallowing
- Describe a cranial nerve exam and its importance in dysphagia intervention
- Apply swallowing physiology for appropriate treatment plans



Slide 3

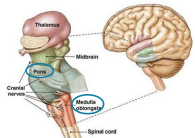
Neurology



Slide 4

Swallowing Innervation

- Medulla oblongata and pons play a significant role in swallowing
- Cranial Nerves are 12 paired nerves, originating in the brain and brainstem



The diagram shows a lateral view of the brainstem. Labels include: Thalamus (top), Midbrain (middle), Pons (bulging part), Medulla oblongata (lower part), and Spinal cord (bottom). A blue circle highlights the Pons and Medulla oblongata, with a line pointing to the text 'Cranial nerves'.

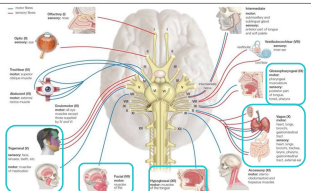
Slide 5

Cranial Nerves

MNEMONICS:
ON OLD OLYMPUS'S TOWERING TOP A FINN AND GERMAN VIEWED SOME HOPS
OOH, OOH, OOH TO TOUCH AND FEEL VERY GOOD VELVET SUCH HEAVEN!

Slide 6

Cranial Nerves



The diagram shows the brainstem with 12 pairs of cranial nerves emerging. Each nerve is color-coded and labeled with its name and number. Small inset boxes provide details for several nerves: CN I (Olfactory), CN II (Optic), CN III (Oculomotor), CN IV (Trochlear), CN V (Trigeminal), CN VI (Abducens), CN VII (Facial), CN VIII (Vestibulocochlear), CN IX (Glossopharyngeal), CN X (Vagus), CN XI (Accessory), and CN XII (Hypoglossal). The diagram also shows the distribution of these nerves to various organs and structures in the head, neck, and torso.

Slide 7

Cranial Nerves and Swallowing

V. **Trigeminal**
VII. **Facial**
IX. **Glossopharyngeal**
X. **Vagus**
XII. **Hypoglossal**

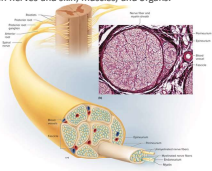
Slide 8

Cranial Nerve Fibers

Fibers are the lines that carry the signal between nerves and skin, muscles, and organs.

2 main functions or groupings for fibers:

- Motor (Efferent) fibers
 - When stimulated creates a muscle contraction
- Sensory (Afferent) fibers
 - Carries impulses toward CNS



Slide 9

V. Trigeminal

• Motor, Sensory

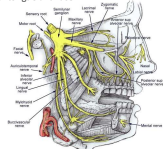
• General sensation (pain, temperature, touch) to anterior 2/3 of tongue and face

• Motor innervation:

- Suprahyoid (above the hyoid)
 - Mylohyoid
 - Anterior belly of digastric
- Muscles of mastication
 - Masseter
 - Temporalis
 - Medial and lateral pterygoids
 - Tensor veli palatine

• Can be assessed via:

- Laryngeal excursion palpation
- Masseter palpation



Slide 16

XII. Hypoglossal

- Motor innervation for the intrinsic and extrinsic muscles of the tongue

Intrinsic muscles:

- Superior longitudinal
- Inferior longitudinal
- Transverse
- Vertical

Extrinsic muscles:

- Genioglossus
- Hyoglossus
- Styloglossus

• Can be assessed via protrusion, lateralization of tongue

© Teachmeanatomy

Slide 17

Other abnormal oral motor findings

- **Lingual fasciculation:** visible, spontaneous and intermittent contractions of the tongue
 - Concerning for motor neuron disease (i.e. ALS)

- **Dyskinesia:** involuntary muscle movements, tremors
 - Tardive dyskinesia

Slide 18

Abnormal findings cont.

1. **Xerostomia:** severe dry mouth
 - Causes: radiation, medications, autoimmune disease
2. **Black hairy tongue:** buildup of dead skin cells
 - Risk factors: antibiotics, poor oral hygiene, dry mouth, tobacco, excessive alcohol use
3. **Oral Candida "Thrush":** fungal infection
 - Risk factors: steroids/antibiotics usage, weakened immune system, poor oral hygiene, DM

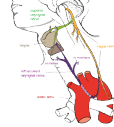
Slide 19

Recurrent Laryngeal Nerve

Slide 20

Recurrent Laryngeal Nerve (RLN)

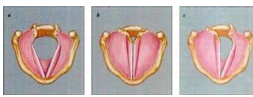
- A branch of the vagus (X) nerve which branches again into 2 pathways:
 - Left RLN: more complex path, from larynx to the thoracic cavity and is more susceptible to injury
 - Right RLN: shorter pathway, primarily innervates larynx and lower pharynx
- RLN innervates all intrinsic muscles of the larynx, sensation & motor to esophagus and trachea
- Damage can be caused by:
 - Trauma (both)
 - Esophageal Carcinoma (both)
 - Thyroid diseases and/or tumors (both)
 - Aortic aneurysm (L RLN)
 - Intrathoracic surgery (L RLN)



Slide 21

RLN Injury: Symptoms and Signs

- Dysphonia/Hoarseness/Breathy Voice
- Shortness of breath
- Stridor
- Vocal fatigue
- Limited pitch range
- Reduced vocal intensity
- Inefficient cough/throat clear
- Respiratory insufficiency
- Airway obstruction



Slide 22

RLN Implications: Swallowing

- Damage of RLN can impair mechanisms of airway protection
 - TVC closure
 - Sensation to larynx
 - Weak cough, unable to clear aspirated material
- Postoperative dysphagia is reportedly 44-87% in cardiac patients
 - 16% of cardiac surgery patients were diagnosed with aspiration pneumonia postop
- Patients with diagnosed TVC paralysis were twice as likely to aspirate as those without

Slide 23

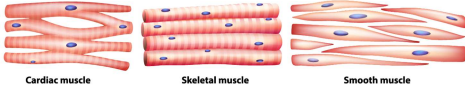
Muscles

Slide 24

Muscle Types

Muscles are broken down into 3 groups:

- Skeletal (or striated): Muscles responsible for moving the skeleton.
 - Most muscles of swallowing are skeletal
- Smooth: Found in tubular/hollow organs (i.e., intestines, lower 1/3 esophagus)
 - Involves involuntary contractions and movements (i.e., peristalsis)
- Cardiac: tissue of the heart chambers



Cardiac muscle Skeletal muscle Smooth muscle

Slide 25

Oral Musculature

- Obicularis Oris
- Buccinator
- Muscles of the Tongue

Lateral view labels: Genioglossus, Hyoglossus, Lingual tonsil.

Frontal view labels: Levator Anguli Oris Muscle, Levator Labii Superiori Alaeque Nasi Muscle, Zygomaticus Major Muscle, Zygomaticus Minor Muscle, Risorius Muscle, Modiolus, Depressor Anguli Oris Muscle, Depressor Labii Inferior Muscle, Orbicularis Oris Muscle, Mentalis Muscle.

Slide 26

Pharyngeal Musculature

- Superior constrictor: drive bolus down and create pressure
- Medial constrictor: continues constriction
- Inferior constrictor: drives bolus, also forms UES with CP which relaxes during swallow to allow bolus to pass
- Stylopharyngeus: Elevates pharynx and larynx
- Palatopharyngeus: Elevates pharynx superiorly, anteriorly and medially (shortening it to swallow)
- Salpingopharyngeus: Elevates pharynx, opens auditory tube during swallowing

Labels: Superior constrictor muscle, Medial constrictor muscle, Inferior constrictor muscle, Stylopharyngeus muscle, Palatopharyngeus muscle, Salpingopharyngeus muscle, Larynx, Thyroid cartilage.

Slide 27

Suprahyoids

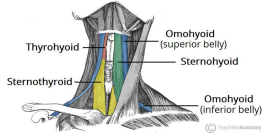
- Geniohyoid
 - Move hyoid forward and elevates
- Mylohyoid
 - Elevates hyoid
- Stylohyoid
 - Elevates hyoid
- Anterior & posterior belly of the digastric
 - Elevates hyoid

Labels: Geniohyoid, Mylohyoid, Stylohyoid, Digastric (anterior belly), Digastric (posterior belly).

Slide 28

Infrahyoids

- Sternohyoid
 - Depresses the hyoid bone
- Omohyoid
 - Depresses the hyoid bone
- Thyrohyoid
 - Depresses the hyoid
 - Elevates thyroid and larynx
- Sternothyroid
 - Depresses the thyroid cartilage and larynx

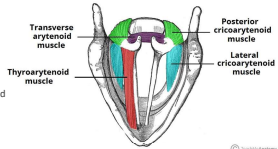


© 2013 Anatomical

Slide 29

Laryngeal Musculature

- Lateral cricoarytenoid
 - Adduct vocal cords
- Posterior cricoarytenoid:
 - Abducts vocal cords
- Thyroarytenoid
 - Relaxes vocal ligament
- Transverse and oblique arytenoid
 - Adduct the arytenoids
- Cricothyroid
 - Tenses the vocal cords




© 2013 Anatomical

Slide 30

Upper Esophageal Sphincter (UES)

There are 3 primary factors contributing to UES opening:

1. Relaxation of the cricopharyngeus muscle
 - relaxation *normally* precedes opening of the UES or arrival of the bolus
2. Hyolaryngeal excursion
 - contraction of the suprahyoid and thyrohyoid muscles pull the hyolaryngeal complex forward, pulling on the sphincter
3. Pressure of the descending bolus
 - Created by the pharyngeal constrictors



Slide 31

Clinical Implications

Slide 32

Cranial Nerve Exam

• A CNE is necessary to assess the motor and sensory function of the swallow and related systems
 • Helps identify areas of weakness or concern

• **CNE for the SLP:**

- **V. Trigeminal**
 - Sensation of skin of the face
 - Laryngeal excursion palpation
 - Masticator palpation
- **VII. Facial**
 - Raise eyebrows, show teeth, smile, and puff out cheeks
- **IX. Glossopharyngeal**
 - Can not be reliably tested at bedside
- **X. Vagus**
 - Soft palate movement
 - Vocal quality, endurance
- **XII. Hypoglossal**
 - Tongue strength:
 - Push against resistance (tongue blade, cheek)
 - Tongue ROM:
 - Protrusion
 - Lateralization of tongue

Slide 33

Full Cranial Nerve

Cranial Nerve	Motor Functions	Sensory Functions	Assessment
Cranial Nerve I	Olfaction	Smell	Identify odors, strong, pleasant odors
Cranial Nerve II	Optic	Vision	Visual acuity, visual field, color vision, pupillary reflexes
Cranial Nerve III	Motor and sensory	Eye and eyelid movement	Visual evoked potentials, pupillary reflexes, accommodation, convergence, strabismus
Cranial Nerve IV	Motor	Eye movement	Visual evoked potentials, pupillary reflexes, accommodation, convergence, strabismus
Cranial Nerve V	Motor and sensory	Facial sensation, corneal reflex	Visual evoked potentials, pupillary reflexes, accommodation, convergence, strabismus
Cranial Nerve VI	Motor	Eye movement	Visual evoked potentials, pupillary reflexes, accommodation, convergence, strabismus
Cranial Nerve VII	Motor and sensory	Facial sensation, corneal reflex	Visual evoked potentials, pupillary reflexes, accommodation, convergence, strabismus
Cranial Nerve VIII	Sensory	Hearing, equilibrium	Rinne, Weber, tuning fork, audiometry, caloric testing, Romberg, gait
Cranial Nerve IX	Sensory	Pharynx, larynx, epiglottis	Pharyngeal sensation, gag reflex, laryngeal excursion, epiglottic touch
Cranial Nerve X	Motor and sensory	Pharynx, larynx, epiglottis, soft palate, vocal cords	Pharyngeal sensation, gag reflex, laryngeal excursion, epiglottic touch, soft palate elevation, vocal quality, endurance
Cranial Nerve XI	Motor	Shoulder, neck, head rotation	Shoulder strength, neck strength, head rotation
Cranial Nerve XII	Motor	Tongue	Tongue strength, tongue protrusion, lateralization

Slide 34

Do we look at swallowing in phases?

- Oral, pharyngeal, esophageal? Oropharyngeal, pharyngo-esophageal? What words do we use?
 - How often is dysphagia "purely" oral, pharyngeal, or esophageal?
 - What can be more helpful is to outline specific deficits (i.e., reduced tongue base retraction, oral residue, anterior spillage) rather than saying "oral dysphagia".
- For example:
- A patient aspirates because of premature spillage and is nonsensate, is this oral or pharyngeal dysphagia? Both?
 - A patient has severe pharyngeal residue above the UES (i.e., pyriform residue) resulting in sensate aspiration after the swallow, is this pharyngeal or esophageal dysphagia? Both?

Slide 35

What to do with an impaired swallow?

- SLPs have 3 major ways to help immediately improve a swallow's safety:
1. Compensatory strategies:
 1. Small/single sips/bites
 2. Alternating liquids/solids
 3. Digital or lingual sweep for oral pocketing
 2. Postural strategies
 1. Chin tuck
 2. Head tilt & turn
 3. Dump swallow
 3. Diet modifications:
 1. Thickened liquids
 2. Modified solids

Slide 36

EBP for Dysphagia Exercises

- | | |
|---|---|
| EFFORTFUL SWALLOW | LINGUAL PRESS |
| •Reduced hyolaryngeal elevation | •Reduced hyolaryngeal elevation |
| •Reduced tongue base retraction | SHAKER |
| •Stasis in valleculae | •Reduced hyolaryngeal elevation |
| •Stasis on posterior, left, right pharyngeal wall | MASAKO |
| CHIN TUCK AGAINST RESISTANCE | •Reduced hyolaryngeal elevation |
| •Reduced hyolaryngeal elevation | •Reduced tongue base retraction |
| MENDELSON MANEUVER | SUPRAGLOTTIC, SUPER-SUPRAGLOTTIC |
| •Reduced hyolaryngeal elevation | •Reduced hyolaryngeal elevation |
| •Stasis in lateral channels | •Reduced laryngeal closure |

Slide 37

Questions & Discussion

Slide 38

References

- Burkhead, L.M., Sapienza, C.M., & Rosenbek, J. C. (2007). Strength-Training Exercise in Dysphagia Rehabilitation: Principles, Procedures, and Directions for Future Research. *Dysphagia*, 22(3), 251-265. doi:10.1007/s00455-006-9074-z
- Cobin-Lewis, K, Liss, J.M., & Sciortino, K.L., 2005, *Clinical Anatomy & Physiology of the Swallow Mechanism*, Thompson Delmar Learning, Clifton Park, NY
- Murray, J., 1999, *Manual of Dysphagia Assessment in Adults*, Singular Publishing Group, Inc., San Diego
- Pusins, Jennifer M. "Recurrent Laryngeal Nerve Damage — Clinical Implications Following Cardiac Surgery." *www.todaygeriatricmedicine.com*, May 2019, www.todaygeriatricmedicine.com/archives/M119p20.shtml. Accessed 19 July 2021.
- "TeachMeAnatomy - Making Anatomy Simple." *Teachmeanatomy.info*, 2019, teachmeanatomy.info/.
