SWALLOWING AND DYSPHAGIA

- Swallowing is a complex process that involves multiple brain centers and coordination of multiple oral and throat muscles.
- The primary control of this process is the brainstem.
- Dysphagia, difficulty swallowing food, can significantly affect the quality of life in certain patients.
- Includes patients with neurological disorders (e.g., Parkinson’s disease, ALS)
- Patients who undergo neck surgery (e.g., anterior cervical discectomy and fusion procedures)
- Head and neck cancer patients (surgery and/or radiation therapy)

UES DYSFUNCTION AND TREATMENTS: OBJECTIVES

- Define the anatomy and physiology of the UES
- Describe types of UES dysfunction
- Discuss the assessment of swallowing function and UES dysfunctions
- Describe treatments of UES dysfunction
- Understand a special case of UES dysfunction

UPPER ESOPHAGEAL SPHINCTER DYSFUNCTION AND TREATMENTS

Kimberly N. Vinson, M.D.
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February 22, 2019
### Slide 4

**ESOPHAGEAL ANATOMY AND CONSIDERATIONS**

- The esophagus is the narrowest tube in the GI tract.
- Roughly 8 in (25 cm) in length
- 3 typical areas of constriction
  - Upper esophageal sphincter
  - Lower esophageal sphincter

### Slide 5

**UPPER ESOPHAGEAL SPHINCTER (UES)**

- C-shaped against CP muscle
- A deep muscle band between the aorta and the trachea
- Above this level, food passes into the windpipe
- Below this level, food passes into the stomach
- Innervated by the pharyngeal (X) and vagal (XII) cranial nerves
- Failure
  - Primary failure (CP weakness or pharyngeal dysfunction)
  - Secondary failure (neurological disease)
  - Localized (CVA)
  - Generalized (PD, ALS, PBP)

### Slide 6

**TYPES OF UES DYSFUNCTION**

- Failure of the CP to allow passage of a bolus in the absence of pharyngeal weakness or other esophageal diseases
- CP weakness
- Hypothyroid
- Failure to relax

- Primary dysfunction is a problem with the muscle itself
- Muscular dystrophy
- Localized gastric reflux
- Secondary dysfunction is due to neurological disease
- Localized (CVA)
- Generalized (MD, ALS, PBP)
ASSESSMENT OF SWALLOWING

- Complete history including pulmonary status
- Comprehension of instructions
- Evaluation of eating habits
- Physical examination
  - Trauma
  - Age
  - Dysphagia questionnaire
  - FE E S / FEEST
  - VF S S  (MBS)
  - CT or MRI
  - Esophageal Manometry
  - Esophagoscopy (TNE vs. traditional EGD)
ASSESSMENT OF SWALLOWING–
PHYSICAL EXAM

- Complete history (including pulmonary status)
- Dysphagia questionnaire (part of new patient evaluation)
- Physical examination
- Voice and swallow disorders
- Diagnostic studies:
  - VFSS
  - FEES
  - FEEST
  - CT/MRI
  - Esophageal manometry
  - Endoscopy (TNE vs. traditional EGD)

ASSESSMENT OF SWALLOWING–
DIAGNOSTIC STUDIES

- Retention observed in the pyriforms and at the level of FFL/FEES
- Characteristic bar seen on VFSS, C4-C6
TREATMENT OF UES DYSFUNCTION

- Medical
  - Conservative
  - Treatment of GERD, if applicable
- Therapeutic
  - Swallow therapy
- Surgical
  - Mechanical widening with dilation
  - Decrease resting tone
  - Botox
  - Myotomy

TREATMENT OF UES DYSFUNCTION - DILATION

- EGD
  - Endoscopy
  - Gastroenterologist or gen surgeon
  - Requires conscious sedation
  - Rigid esophagoscopy
  - Otolaryngologist
  - Requires general anesthesia

Case report:
- 77 year old female presents with a 13 mo history of dysphagia with aspiration following treatment
- No improvement in swallowing following 5 dilations by GI
- Ordered VFSS
Slide 16

TREATMENT OFUES DYSFUNCTION - DILATION

- Chemically denervates (weakens) the CP
- Injection performed under direct visualization during high-resolution manometry
- Takes 12-18 hours to take effect
- May last 3-6 months or longer in some cases

TREATMENT OFUES DYSFUNCTION - BOTOX

- Case Report
- 57 yo male reports solid foods sticking in his throat
- 30-40 lb weight loss in 9-12 mo
- Underwent dilation with endomiroscopy
- Underwent Botox injection during barium swallow
- Presented with dysphagia with normal esophageal manometry
- Failed endoscopic dilation with endo laryngoscope
- Botox done every 3-6 months

TREATMENT OF UES DYSFUNCTION - MYOTOMY

- Cut the fibers of the CP muscle under direct visualization
- Can be done via open approach or endoscopically
- Concern for increased GERD, regurgitation after procedure

TREATMENT OF UES DYSFUNCTION - ZENKER'S DIVERTICULUM

- Zenker's diverticulum
- Pouch of the pharyngeal mucosa just below the cricopharyngeus (CP) muscle
- Usually arises in a triangle established by the oblique and transverse segments of the inferior constrictor muscle
- Can be diagnosed with fundoplication or undigested food after eating
- Thermoregistration with manometry and/or barium swallow exam

[Verma, S. www.throatdisorder.com]
TREATMENT OF UES DYSFUNCTION - ZENKER'S DIVERTICULUM

- Treatment MUST involve division of the CP muscle to be effective.
- Endoscopic
- Open
- Zenker's will tend to recur if only the diverticular sac is addressed and the CP is not treated.

TREATMENT OF UES DYSFUNCTION - ZENKER'S DIVERTICULUM

- Endoscopic approach
- Suction tubing is placed in the esophagus cephalad and the diverticulum
- CP muscle is exposed
- Division of the CP muscle fibers with either carbon dioxide laser or stapler
**TREATMENT OF UES DYSFUNCTION - ZENKER’S DIVERTICULUM**

- The diverticulum is not removed but the lip is made more shallow so that normal swallowing will not become impaired in the diverticulum.
- Slightly a small remnant of the lip is left to prevent disruption of mucosa.

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**TREATMENT OF UES DYSFUNCTION - ZENKER’S DIVERTICULUM**

- Open approach
  - Incision is made 2-3cm medial to the cricoid cartilage and along the border of the SCM
  - Cricoid and SCM retracted
  - Diverticulum exposed
  - Diverticulum and all of its mesentery excised and sent to pathology
  - CP angle should be trimmed

---

**TREATMENT OF UES DYSFUNCTION - ZENKER’S DIVERTICULUM**

- Figure A: Lateral epiglottal view and conventional incision of a pharyngoesophageal diverticulum.

A. After excision of the diverticulum, the esophageopexy is performed in order to
   approximate the pharynx and esophagus over a distance as described in figure 1.

B. After the esophageopexy is completed, the base of the diverticulum is crissed with a
   0.5 cc syringe and cauterized.

(Finn Ommegang WJ (1986) Extended cervical esophageopexy for recurrent
TREATMENT OF UES DYSFUNCTION - ZENKER’S DIVERTICULUM

- Endoscopic approach
- No external incision required
- Shorter hospital stay and recovery time
- May not be able to expose diverticulum
- Open approach
- Randomized incision
- Longer operation time
- Longer hospital stay and recovery time
- Improved exposure of diverticulum

Case report:
- 79 year old female presented with persistent dysphagia followed by repair of a Zenker’s diverticulum 1 year prior.
- Normalized vocal cords without “ticking” in her upper trachea, but decrement negative.
- No external incision needed.
- Why would this patient still have dysphagia following open diverticulotomy?

VFSS revealed normal oral and pharyngeal phases of the swallow.
- Suction lid on view, suction tube in the pharynx, extraglottic space, and diverticulum.
- Suction tube was used to lodge in the diverticulum and took several sips of carbonated beverage in case.
- Patient DF had extraglottic diverticulotomy.
TREATMENT OF UES DYSFUNCTION -
ZENKER'S DIVERTICULUM

• Post-operative VFSS revealed

• Normal oral and pharyngeal phases of swallowing

• Patient was extremely happy with improved swallowing

• Must treat the CP muscle to get a good, lasting result!
UES DYSFUNCTION AND TREATMENTS

- Define the anatomy and physiology of the UES
- Describe types of UES dysfunction
- Discuss the assessment of swallowing function and UES dysfunction
- Describe treatments of UES dysfunction
- Understand a special case of UES dysfunction
Intubation and Voice: Assessment and Management
Barbara Jacobson, Ph.D. CCC-SLP
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Department of Hearing & Speech
Vanderbilt Bill Wilkerson Center

Disclosures
• Financial
  • Salary from VUMC
• Non-Financial
  • Author, Voice Handicap Index
  • Co-editor, Medical Speech-Language Pathology: A Practitioner’s Guide

Outline
• Landscape of intubation and the ICU
• How does laryngeal injury occur?
• What are potential sequelae?
• How can we assess laryngeal function?
• What are surgical & medical treatment options?
• How can the speech-language pathologist intervene?
Do you need to be a voice specialist to evaluate & treat post-intubation voice disorders?

NO!!!!!

The Landscape

• On average, >55,000 patients are hospitalized in the ICU every day in the U.S.
• Greater than a third of these are mechanically ventilated.
• This places a significant number of people at risk for airway injury and fibrosis.


Intubation and the ICU

• Complications at time of intubation
  • Dysphonia
  • Arytenoid dislocation
  • Cervical spine and spinal cord injuries
  • Traumatic dental injury

• Post-extubation complications
  • Vocal cord paralysis
  • Tracheomalacia
  • Laryngotracheal stenosis
Intubation & Swallowing Function

- 59 patients evaluation with FEES within 72 hours of extubation
  - 44 patients were evaluated ≤ 24 hours post-extubation – 57% penetrated/aspirated
  - 15 patient were evaluated ≥ 24 hours post-extubation – 60% penetrated/aspirated
- Heterogenous patient population

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**Axial cross section through the glottis demonstrating airflow.** (Image courtesy of Professor Haoxing Luo, Vanderbilt Dept of Engineering)

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ETT size selection
(Karmakar, et al., 2015)

- Evidence that height in males should be taken into consideration
- Women, in general, require a smaller size
  - Height is not a factor
ETT size distribution in 100 VUMC MICU Patients (compared with historic controls)

Role of Provider Choice in ETT size Selection

ETT size distribution in 100 VUMC MICU Patients (grouped by intubating provider type)

70% of LTS patients obtained their injury from an ETT

Laryngeal Pathology Incidence (N=61)  
(House, et al., 2011)

<table>
<thead>
<tr>
<th>Pathology</th>
<th>%</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arytenoid edema</td>
<td>95</td>
<td>58</td>
</tr>
<tr>
<td>Arytenoid erythema</td>
<td>96.7</td>
<td>59</td>
</tr>
<tr>
<td>Vocal fold edema</td>
<td>65.6</td>
<td>40</td>
</tr>
<tr>
<td>Vocal fold erythema</td>
<td>88.5</td>
<td>54</td>
</tr>
<tr>
<td>Interarytenoid edema</td>
<td>95</td>
<td>58</td>
</tr>
<tr>
<td>Subglottic edema/narrowing</td>
<td>13.1</td>
<td>8</td>
</tr>
<tr>
<td>Vocal process ulceration, any</td>
<td>34</td>
<td>21</td>
</tr>
<tr>
<td>Vocal process granulation tissue, any</td>
<td>52.5</td>
<td>32</td>
</tr>
<tr>
<td>Vocal fold immobility, any</td>
<td>39</td>
<td>24</td>
</tr>
</tbody>
</table>

Results

- ALgI occurred in 57% of intubated patients.
- Patients who develop ALgI report significantly worse phonation and breathing at 10 weeks post-intubation ($p = 0.002$, $p = 0.001$).
- ALgI significantly associated with:
  - **Patient-specific risk factors**
    i. Elevated BMI ($p<0.01$)
    ii. Diabetes ($p=0.02$)
  - **Provider-specific risk factors**
    i. Larger Endotracheal Tube Size (>7.0) ($p<0.001$)
    ii. Worse Grade of View ($p=0.01$)
    iii. Longer Intubation Duration ($p<0.01$)
ALgl: Pattern of Anatomic Injury

- Granulation Tissue (19%)
- Vocal Cord Edema (7%)
- Subglottic Ulceration (7%)

Incidence and Outcomes of Acute Laryngeal Injury After Prolonged Mechanical Ventilation. Submitted Lancet Respiratory Medicine. 2019
Relationship between ETT size and laryngeal injury

Normal exam
New Mobile Tools for Research

Video courtesy of Dr. Gelbard

Granuloma

Vocal fold paralysis - abduction
Vocal fold paralysis - adduction

Arytenoid Dislocation

Evaluation

• Goals —
  • Voice quality baseline
  • TVFP
  • Pain assessment

• Tasks
  • Sustained /i/
  • Pitch glide (ascending/descending)
    • Use ascending/descending count if no glide
  • Spontaneous conversation
  • Cough
  • Throat clear
Evaluation

• Sustained /i/
  • > 3 seconds
  • Normal = 18-20 seconds (no respiratory compromise)

• Glissando
  • Glide up into falsetto

• Voice quality
  • Clear, sex-appropriate, adequate prosody

• Good glottal coup

Other measures

• VHI, VHI 10
• VFI

Outcomes

• Reduced MPT
  • TVFP
  • Edematous TVFs, arytenoids

• Poor voice quality
  • Rough, breathy, inadequate loudness, pitch too high, absent high pitch
  • Edematous TVFs
  • Erythematous TVFs
  • Granuloma
  • RLN/SLN damage
  • Arytenoid dislocation
  • Arytenoid fixation (ankylosis)
FEES

- Your exam can be a screening instrument for TVF function
- Elicit these behaviors:
  - Sniff (TVF abduction)
  - Pitch glide/glissando
  - Maximum phonation
- MDs would ask you to get as close as possible to glottis, with emphasis on posterior commissure
- Sensory testing

Otolaryngology Consult

- May only be possible if:
  - TVFP on FEES
  - Aphonia
  - Dysphagia

- Often patients will be referred for OP evaluation

Physician Intervention

- TVF Immobility
  - Cymetra injection
  - Direct laryngoscopy to differentiate TVFP from fixation/dislocation
    - 7EMG
- Thyroplasty
  - After 1 year of documented paralysis
Physician Intervention

- Granuloma
  - Steroid injection
  - Excision
- Other disorders (e.g., laryngotracheal stenosis)
  - Course of medical/surgical management

Treatment and Prevention – Short Term

- Avoid excessive voice use
  - No voice rest (in most situations)
- Gentle coughing/throat clearing
- Hydration
- If voice is breathy, avoid straining to produce voice

⚠️ muscle tension dysphonia

Other Exercises – as indicated

- Semi-occluded vocal tract
  - Cup bubbles (with/without voice)
  - Straw phonation
- Resonance
  - Humming
  - Chanting
- Flow phonation (Stone-Casper)
Vocal hygiene

- Adequate hydration
- Gentle throat clear/cough
- Moist snacks
- Maintain conversational loudness
- Moderation in voice use
- Consider short term use of H2 blockers/PPIs
Patients with Tracheostomy and Ventilator Dependence: Importance of Communication

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Nashville, TN

Disclosures
• Financial: VUMC salary, Passy Muir Educational Consultant (no remuneration for this talk)
• Non-financial: none

Overview
• Impact of tracheostomy and ventilator dependence on communication, safety, patient rights, mental status, and quality of life
• Methods of communication
  – Focus on verbal communication
ASHA’s vision

Making effective communication a human right, accessible and achievable for all

Are we doing this for our patients with tracheostomy and ventilator dependence?

What are our obstacles?

• Time
• Resistance from RN
• Resistance from MD
• Resistance from RT
• Insufficient knowledge
• Our patients are too sick
• We just wait until they are off the vent

IMPACT OF TRACHEOSTOMY AND VENTILATOR DEPENDENCE
Impaired communication

Patient safety
• Poor communication can result in
  – Serious medical events (Cohen et al., 2005)
  – Sentinel events (The Joint Commission, 2007)

• “Patients with communication problems were three times more likely to experience preventable adverse events than patients without such problems” (Bartlett et al., 2008)

Patient rights
• The Joint Commission:
  – “The organization addresses the needs of those with vision, speech, hearing, language, and cognitive impairments” (Elements of Performance R1.2.100, No 4)
  – “The organization respects the patient’s right and need for communication” (Standard of Care R1.2.180)
  – New accreditation standards include the communication disability acquired as a result of tracheostomy as a condition requiring provider assessment and accommodation
Slide 10

Patient rights

• ADA
  - "The ADA applies to all hospital programs and services..."
  - It applies to your facility
  - Wherever patients...are interacting with hospital staff, the hospital is obligated to provide effective communication."
  - "Effective communication is particularly critical in health care settings where miscommunication may lead to misdiagnosis and improper or delayed medical treatment."


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Patient rights (VUMC document)

• Know what your problem is and what this might mean for you
• Share in decisions about your care
• Be told what you can expect from your treatment, its risks and benefits, other choices you may have, and what might happen if you are not treated at all
• Meet with an ethicist, chaplain, or advocate to talk about ethical issues and policies
• Refuse tests or treatment (as far as the law allows) and to be told what might happen if you do

Slide 12

Mental status

• 60 – 85% of critically ill mechanically ventilated patients experience delirium (www.icudelirum.org)
• Why?
  — Hypoxia
  — Medications
  — Poor sleep
  — Unfamiliar environment
  — Severe pain
  — Medical illness
  — Lack of communication?
Complications of delirium

- Delirium is associated with worse outcomes
  - Increased length of stay and ventilator-days
  - Cognitive dysfunction
  - Increased hospital costs
  - Mortality

Patient testimonial

"I actually seen body bags with my children’s names on them. I tried to help them and tried to communicate this but with the tracheostomy tube I was unable to do this. My wife told me later that I tried to pull my tracheostomy out one night and I believe that this is the same night that I recall the body bags. The next day I was strapped down to my bed for safety reasons and I had the same dream the next night and I was dreaming that I got caught trying to help my kids and was tied to a bed so I couldn’t help them."  (www.icudelirium.org)

Post-Intensive Care Syndrome (PICS)

- New or worsening impairments in physical, cognitive, or mental health status arising after critical illness and persisting beyond acute care hospitalization.
Growing interest in ICU Survivors

Efforts to reduce delirium and PICS

• ABCDEF Bundle
  – A – Assess, Prevent and Manage Pain
  – B – Both SATs (spontaneous awakening trials) and SBTs (spontaneous breathing trials)
  – C – Choice of Sedation
  – D – Delirium: Assess, Prevent and Manage
  – E – Early Mobility and Exercise
  – F – Family Engagement and Empowerment

Communication as part of the bundle of care?

• Communication-vulnerable patients have an increased diagnosis of psychopathology (JCAHO webinar, Call to Action: Improving Care to Communication Vulnerable Patients)
• Maybe the inverse is true
  – Patients with access to effective communication have a reduced diagnosis of psychopathology?
  – Enabling communication can improve well-being, increase compliance, and reduce length of stay (Batty, 2009)
Quality of life

• The inability to speak has been identified as “...the main instigator for feelings of insecurity, anxiety, fear, and even agony/panic” in mechanically ventilated individuals (Bergbom-Engberg & Haljamäe, 1989)
• Inability to communicate in the ICU patient can lead to frustration, anger, withdrawal from interaction with family and staff, and reduced participation in treatment (Magnus, V. & Turkington, L. 2006)
• Return of voice was associated with significant improvement in patient reported self-esteem, particularly in being understood by others (Freeman-Sanderson, 2016)

What is the common theme?

Establishing communication should be a standard of care for this patient population
HOW CAN WE IMPROVE COMMUNICATION?

Non-verbal communication options

- Writing
- AAC
- Communication board
- Phone or tablet (Trachtools app, text to speech apps)
- Gestures
- Mouthing
Problems with non-verbal options

- Unnatural
- Often difficult due to extremity weakness
- Limited choices
- Imprecise
- Some can be costly
- Time-consuming
- We are poor lip readers

What is the word recognition accuracy of the average person who is lip reading?

Lip reading

- Average person lip reading:
  - "word-recognition accuracy scores were barely greater than 10%"
  - Alteri et al. (2011)
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Goal should be verbal communication

Slide 29

Speaking during mechanical ventilation is not new

- Cuff deflation to facilitate communication in vent-dependent patients was reported in the 1960s polio epidemic

Slide 30

- In the early 1960s, Dr. RML Whitlock described a simple tracheostomy tube attachment to facilitate communication for patients with cuff inflated
- "The speaking aid not only makes communication easier but also relieves the patient from the frustration and fear of not being able to make his requirements known."
The Passy Muir Speaking Valve was developed in 1985 to be used in-line with the ventilator. Inventor David Muir.

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Verbal communication options for patients with tracheostomy and ventilator dependence

- Leak speech
- In-line Passy Muir Speaking Valve
- Talking tracheostomy tube

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LEAK SPEECH
Leak speech

• What is it?
  – Leaking air around the tracheostomy tube into the upper airway for the purpose of phonation

• How?
  – Slowly deflate cuff
  – May not need to fully deflate the cuff
  – Listen for upper airway sounds / phonation
  – Watch for drop in expiratory volumes

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Leak speech

• Ventilator adjustments by respiratory therapist (FI02, tidal volume, alarms)
• Encourage vocalization
• Troubleshooting
  – Consider size of trach tube
  – May need downsise
  – Partial vs. full cuff deflation
• Monitor vital signs throughout trial
• Establish plan of care for continued or intermittent leak speech
Pros / cons of leak speech

Pros
• Verbal
• May be able to have a continual leak for longer periods of voicing

Cons
• Expiratory alarms may sound
• Short length of utterance (run out of air)
• Weak, breathy voice

Passy-Muir Valve in-line with vent

• Patient criteria
  – Medically stable
  – Able to tolerate complete cuff deflation
• Vent criteria (guidelines only)
  – FIO2 <50%
  – PEEP < 10
  – Pressure Support <12
  – PIP < 35
Passy-Muir valve in-line with vent

- How?
  - SLP / RT teamwork
  - Obtain baseline measurements
  - Educate

Passy Muir in-line with vent

- Slow cuff deflation

Listen for exhalation or phonation during cuff deflation

Look at expiratory volumes to determine air leak
Passy-Muir valve in-line with vent
• Proceed with in-line valve placement
• Need appropriate adapters

Vent adjustments to consider
• Adjust alarms
• PEEP (turn off or decrease by 5)
• Humidification
• Volume compensation during cuff deflation determined by PIP
**Slide 46**

Peak Inspiratory Pressure – highest level of pressure applied to the lungs during inhalation.

**Slide 47**

**Troubleshooting**

- Decreased O2 with cuff deflation
  - May need to increase FiO2 (role of the RT)
- Anxiety
  - Provide reassurance
  - Go slow
- Inadequate exhalation/phonation
  - Check cuff
  - Teach to use non-breath-activated modes
  - Suctioning needs
  - Need for MD assessment
- Difficulty coordinating vent cycle with phonation
  - Teach to speak on expiration

**Slide 48**

**Pros / cons with in-line PMV**

**Pros**
- Louder voice and longer length of utterance than leak speech
- Restoration of positive airway pressure
- Additional benefits
  - Secretion management
  - Cough function
  - Swallowing
  - Improved lung recruitment

**Cons**
- May have short duration of PMV use in the ICU
- Some facilities do not allow in-line PMV without direct supervision
- Alarm issues
  - NIV mode may help
Slide 49

Improved lung recruitment with PMV

- Sutt et al (2016)
  - After introduction of a Passy-Muir protocol for vent dependent patients
    - Patients were speaking an average of 9 days earlier
      - "When a patient is awake and not talking, there is something wrong" quote from ICU intensivist
    - Increased lung recruitment was demonstrated during use of the Passy-Muir Valve
    - Patients weaned from ventilator sooner

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TALKING TRACHEOSTOMY TUBE

Slide 51

Talking Trach

- Cuffed trach tube with an additional tubing that connects to an air source.
  - Air travels through this tube and flows out of an opening above level of cuff to facilitate voicing
Slide 52

Talking Trach Tubes

Portex Trach Talk
Portex Suctionaid
Trach
Bivona Talking Trachs

Slide 53

Dual benefit tracheostomy tube
Blue Line Ultra Suctionaid (BLUSA) Tracheostomy Tube

Slide 54

Subglottic suction feature

- VAP is a serious complication for patients who require mechanical ventilation
  - Prevalence of VAP in ICU is as high as 64%
  - Cost of a single episode of VAP: $57,000
- Ledgerwood et al. (2013) reported significantly reduced rates of VAP in ICU patients with above the cuff suction tracheostomy tubes
Above cuff vocalization feature

- **How to use it**
  - Connect external tube to air source
  - Connect humidification
  - Turn on air source
  - Flow meter should be set initially at 3-5 LPM
  - Gas flow may be slowly increased to 10 LPM to produce the desired intensity of vocal quality.

Must occlude the port for phonation

Talking trach

**Pros**
- Verbal option
- Dual feature of voice and suction
- Can use with Passy-Muir Valve
- Patients/families can use the above the cuff vocalization feature independently

**Cons**
- Unnatural voice
- Airflow through stoma
- Patient comfort
- Single cannula trach
- Secretions can clog airflow openings
Slide 58

Blom Trach System

Electrolarynx

• Rose et al. (2018)
  – Reduced anxiety
  – Improved ease of communication

Slide 59

Effective communication can result in:

• Adherence to Joint Commission and ADA standards
• Improved safety
• Improved well-being and compliance
• Participation in decision-making
• Interaction with medical staff, family and friends
• Perhaps reduced delirium
• Improved quality of life

Slide 60

Overcoming our obstacles

• Time
  – We need to make time
  – Why have we considered the inability to communicate in the trach/vent patient less important than in the stroke patient or the TBI patient?
• Resistance from RN
• Resistance from MD
• Resistance from RT
• Insufficient knowledge
  – Learn, read, ask questions, go to courses
  [www.passymuir.com]
Overcoming our obstacles

• Our patients are too sick
  – Some are; many are not
  – How will you know unless you evaluate him / her?
• We just wait until they are off the vent
  – Noooooooo
  – Our patients are missing days, weeks, possibly a lifetime if we wait

Key points

• Impaired communication in the trach / vent patient is common
• Safety, patient rights, mental well-being, and quality of life can be in jeopardy due to insufficient communication
• Early referral to speech pathology is crucial to facilitate the most effective means of communication
• Our job – advocate and educate, get the consults and make a difference

Any questions?
Aphasia after stroke: Using clinical neuroimaging to predict speech-language deficits and recovery patterns

Sarah Schneck MS, CCC-SLP and Jillian Lucanie Entrup MS, CCC-SLP

Main aims of The Aphasia and Language Imaging Lab
1. Where is language function located in the brain?
2. What happens to the language network after stroke?
3. What are different neural patterns of recovery?
4. Can behavioral outcomes be predicted?

The recovery project
Investigate potential recovery patterns within the first year of stroke
Assess speech and language across first year
- within 5 days, 1 month post, 3 months post, 12 months post
Use fMRI to better understand what areas of the brain are being used for language after stroke... any reorganization?
Today’s outline

- Location in the brain
- Role of area
- What happens when disrupted?
- Using structure and function to help assess, treat and educate

Important anatomical landmarks
Slide 6

The language network

Slide 7

The posterior temporal area: Structure

Slide 8

The posterior temporal area: Function

The posterior temporal area is responsible for:
- The mapping of sounds onto meaning
- The mapping of meaning onto sounds

When the posterior temporal area is disrupted:
- Comprehension deficits
- Phonemic paraphasias
- Semantic paraphasias
- Empty speech
The posterior temporal area: Function

Lesion overlay of 12 subjects with comprehension deficits (Kertesz et al., 1977, Arch Neurol)

Sentence comprehension
Video removed

Picture naming
Video removed
Using sentence comprehension to parse apart comprehension deficits

Are you sitting?
Am I a man?
Do you brush your teeth with a comb?
Do you open your door with a key?
Are doctors treated by patients?
Are cats chased by mice?
If I was at the park when you arrived, did I get there first?
If I tell you I used to smoke, do you think I smoke now?

Wilson, Eriksson, Schneck & Lucanie, 2018, PLoSOne

The inferior parietal area: Structure

The inferior parietal area is responsible for:
- Selecting and sequencing sounds for words
- Phonemic paraphasias
- Comprehension likely to be intact
- Multiple attempts at correcting phonemic paraphasias
- Halting nature from self monitoring
- Number deficit
- Verbal working memory deficits
The inferior frontal area is responsible for:

- Verbal expression
- Creating syntactic structure
- Speech motor programming

When the inferior frontal area is disrupted:

- Limited output
- Agrammatism
- Apraxia of speech
- Verbal working memory deficits
- Comprehension likely intact
- Hemiparesis often co-occurs

Spontaneous speech

"No"
"Ma"
"Dad"

Broca's area lesion and Broca’s aphasia

Slide 21

Spontaneous speech and picture naming 3 months later...

Video removed

Slide 22

The occipitotemporal area: Structure

Slide 23

The occipitotemporal area: Function

The occipitotemporal area is responsible for:
- The mapping of a purely visual stimulus to a lexical entry
- Perceiving letters
- Mapping graphemes to phonemes

When the occipitotemporal area is disrupted:
- Reading deficits
- Can break down at different stages
- Reading comprehension impacted as a result
- Word finding deficits
- "Tends to be temporary"
- Visual defects often co-occur

Visual deficits often co-occur
Slide 24

Reading

<table>
<thead>
<tr>
<th>tin</th>
<th>dough</th>
<th>proposition</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>The baby cries in the night</td>
</tr>
</tbody>
</table>

---

Slide 25

Spontaneous speech

---

Slide 26

Total left hemisphere damage

Damage to all left hemisphere language areas

Expect global deficits

Outcome?

Lesion overlay of 12 subjects with deficits across domains (Kertesz et al., 1977, Arch Neurol)
Slide 27

Spontaneous speech

Video removed

---

Slide 28

Repetition

Video removed

---

Slide 29

Patients can make progress after a year

Holland et al., 2017, Aphasiology

26 participants with aphasia
All at least 6 months post stroke (mean 5.5 years post)
Tested twice; at least 1 year apart (WAB-R)
Take home messages
Anatomy can inform and impact clinical practice
Outcomes are variable
Recovery can continue past a year
Research is ongoing...

Thank you!
VUMC Acute Speech Pathology Department
Dr. Stephen Wilson and the Aphasia and Language Imaging Lab
Dr. Howard Kirshner and the VUMC Neurology Department
All of our wonderful participants and families
Cranial Nerves—Beyond the Mnemonics

The Inferior Aspect of the Brain

- 12 pairs, numbered with Roman numerals
- Large, easily seen
- Notice circle of Willis
- CN I and II emerge directly from brain
- CN III-XII from brainstem
Exits for CN III-XII

Introduction To CNs

• I-II-III-IV at midbrain level
• (I and II just above midbrain)
• V-VI-VII-VIII at pons level
• IX-X-XI-XII at medulla level
• They may have motor (afferent) components
  – Motor tracts leave cranium
• They may have sensory (afferent) components
  – Bring information to cranium
To learn CNs, spare your memory!

- Get some mnemonics in place:
- We all know the CN acronyms
  – OODTAF(A/V)VGVAM
- Learn the CN functions
  – SSMMBMBSBBMM
  – S=sensory, M=motor, B=Both

And now without further ado...

THE 12 PAIRS OF CRANIAL NERVES

CN-I: Olfactory

- This CN is SUPER SPECIAL:
- It does only one thing--smells!
- It also has the distinction of going directly into brain regions with connections to the limbic cortex (emotional cortex)
- AND it is rarely tested (chart reviews typically stated CN II-XII)
Slide 9

CN-I: Olfactory

Where olfactory fibers emerge. Olfactory fibers start in the nasal mucosa.

Slide 10

Damage to CN-I: Olfactory

- Trauma to the nasal region may damage nasal fibers, cause loss of CSF and meningeal infections.
- Aging may result in loss of appetite and weight loss. This is thought to be secondary to anosmia (loss of sense of smell).
- Neurodegenerative diseases, such as AD, PD, and HD, may result in anosmia.

Slide 11

CN-II: Optic

- The nose is the organ of smell, the ear is the organ of hearing, but the organ of vision is...

- [Additional content not transcribed]

- [Additional content not transcribed]
Slide 12

CN-II: Optic

• You can compare the eye to a camera lens: it transduces light and this is what it sees:

• Your brain assembles the images sent in order to be truly representational.

Slide 13

CN-II: Optic

• The optic nerves are large and composed of 1.2 million axons
• The nerves converge onto the chiasm (decussation point)
• And then onto the thalamus

Slide 14

Damage to CN II—Field Defects

• The optic nerves...
Slide 18

**Damage to CN II—Field Defects**

- Besides damage to the optic nerve and chiasm, insult to the occipital lobe can produce cortical impairments
- Bilateral occipital lobe impairments may cause cortical blindness since the cortex may not be able to make sense of visual information

Slide 19

**CN III—Oculomotor**

**CN IV—Trochlear**

**CN VI—Abducens**

- Motor to the eye
- Light accommodation (pupil), elevate eyelid, move eyes (extra-ocular)
- But definitely must be aware of visual impairments so we know what the patient is going through
  - E.g. ptosis, double vision (diplopia), pupil accommodation difficulties, etc...

Slide 20

**CN IV—Trochlear**

- CN IV has an interesting characteristic:
  - It has the longest intracranial course, but is the smallest CN in terms of axons
  - While all other CNs exit from the anterior, this one exits from the posterior (cerebellum) and courses to the anterior aspect
  - This long pathway makes it vulnerable to damage from trauma
  - Vertical diplopia
CN V—Trigeminal

- Three branches, two sensory that cover the upper and middle face and one fabulous mixed branch that is very important as it innervates:
  - all muscles of mastication
  - Anterior 2/3 of tongue for general sensation
  - and some speech muscles.

Six week old embryo
Inferior aspect of adult brain

CN V—Trigeminal

Grows up to be this monster nerve!

Of special concern to dentists, from the ADA literature
Damage to CN V—Trigeminal

Motor damage is rare due to strong bilateral innervation. Sensory damage involves loss of sensation to the anterior 2/3 of the tongue, loss of blink and sensory disturbances to the face, etc.

Trigeminal Neuralgia (Tic Douloureux): severe, shooting pain along the course of the nerve branch...sometimes called the suicide disease.

CN VII—Facial

- A very descriptive name: this CN is important for all the muscles of facial expression
- Mixed motor and sensory
  - Sensory: Gustation to the anterior 2/3 of the tongue
  - Motor: Innervates the muscles of the face and scalp
  - Motor: Innervates the submandibular, sublingual, and lacrimal glands.

The relationship of CN V and VII.
Slide 27

CN VII-Facial

- Upper face has bilateral input, Lower face has contralateral input

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Damage to CN VII-Facial

- Can alter articulation
- UMN damage will not produce paralysis
- LMN damage may paralyze facial muscles
  - Bell's Palsy being the prime example
  - Viral infection, some tick bites, etc...
- Common, affecting 30,000+ in the US annually, mostly resolving spontaneously

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Damage to CN VII-Facial

- Bell's Palsy
  - Flattened nasolabial fold, asymmetry
Slide 30

Famous People with Bell's

Slide 31

CN VIII - Vestibulocochlear

• Mediates auditory information and sense of movement
• Mostly sensory
• Dampens output of cilia

Damage to CN VIII - Vestibulocochlear

• Ipsilateral hearing loss, trauma, tinnitus, vertigo, etc.
Slide 33

**CN IX-Glossopharyngeal**
- Both sensory and motor
- Sensory: gustation and general sensation from posterior 1/3 of the tongue. Also sensory to soft palate, pharynx and Eustachian tube
- Motor: salivation, constrictor muscles of pharynx

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**Damage to CN IX-Glossopharyngeal**
- CN IX, X, and XI are close and damage to one may imply damage to all 3
- IX: loss of taste and sensation from posterior tongue, absent gag reflex, dysarthria, etc...

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**CN X-Vagus**
- Vagus (vagabond, vagrant) is the wandering nerve. It is the longest by far of all the CNs.
- It is a mixed nerve
- And captain of the parasympathetic nervous system
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CN X - Vagus

- Unique to mammals
- Known as "the caretaking nerve"
- Activated when we get that 'fuzzy, warm' feeling
- Activated in empathy or compassion (seeing pictures of suffering)
- Theory: the stronger the emotional profile (exercise, volunteer, socialize, etc.) the stronger response of Vagus

Some Facts about Vagus

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CN X-Vagus

- Stimulated in depression and in epilepsy

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CN X-Vagus: Phonation

- Innervates all the intrinsic laryngeal muscles
- In Larynx, one branch, the recurrent laryngeal innervates all muscles of the larynx except for the cricothyroid which is innervated by the superior laryngeal nerve
Damage to CN X - Vagus
Parasympathetic Nervous System
• Just what you would expect from perturbations to the parasympathetic nervous system:
  – palpitation (forcible pulsation of the heart), tachycardia (rapid beating of the heart), vomiting, slowing of respiration, and a sensation of suffocating, paralysis of the vocal cords and other laryngeal disorders, etc….

Damage to CN X - Vagus
SLP concerns
• Damage to pharyngeal branch:
  – swallowing deficit, loss of gag reflex, hypernasality etc…
• Damage to superior laryngeal branch:
  – Laryngeal sensory deficit, paralysis of cricothyroid
• Unilateral damage to recurrent laryngeal:
  – flaccid dysarthria
• If bilateral damage to recurrent laryngeal:
  – harsh (spastic) dysarthria

Testing CN X - Vagus
• Test IX and X together
• Say “aaaah”
• Watch for symmetrical palatal lifting
• The uvula is an indicator; deviation indicates intact side
Slide 42

CN XI - Spinal Accessory
- Both Cranial and Spinal components
- Innervates portions of the larynx, pharynx and velum
- Innervates the SCM and the trapezius

Slide 43

CN XII - Hypoglossal
- This one is easy!
- It is MOTOR TO THE TONGUE (of course!)
- It innervates almost all of the tongue muscles

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Mnemonic Art for CNs
So now that we have looked at the CNs in order…. Let us make some educated guesses about CN supply to structures we speechies care about.

Let us start with innervation to the tongue:

• How many total CNs innervate the tongue? 5
• How many CNs provide sensory innervation to the tongue? 5

Sensory innervation to the tongue:

• To the anterior 2/3 of the tongue:
  – CN V provide general sensory innervation
  – and CN VII provides gustatory innervation.
• To the posterior 1/3 of the tongue, CN IX provides all sensory innervation.
How many CNs provide motor innervation to the tongue?

• This is easier...
• Almost all tongue muscles are innervated by the hypoglossal (XII) except for one, palatoglossus, innervated by Vagus

How about sensory innervation to the face?

• The main CN is the ginormous Trigeminal (V) with its 3 branches, 2 of which are purely sensory.
• Additionally, Facial (VII) contributes: gustation to the anterior 2/3 tongue and other parts of the face, such as the ears.

What CNs are motor to the face?

• The facial nerve (VII) innervates all muscles of facial expression.
• Trigeminal (V) innervates all muscles of mastication.
CNs of Chewing and Swallowing

1. The Oral Stage
   1a. The oral prep stage: this includes smelling and tasting the food
   ▪ CN7
   ▪ Sealing the lips
   ▪ CN
   ▪ Moving the tongue
   ▪ CN
   ▪ Mastication
   ▪ CN

1b. The oral transport stage: the bolus is ready to swallow
   ▪ Elevate the mandible
   ▪ CN9
   ▪ Tongue cups and grooves
   ▪ CN 12
   ▪ Posterior tongue elevates
   ▪ CN? (hint...exception to the rule CN)
### Slide 54

<table>
<thead>
<tr>
<th>CNs of Chewing and Swallowing</th>
</tr>
</thead>
<tbody>
<tr>
<td>• 2. The Pharyngeal Stage</td>
</tr>
<tr>
<td>• A complex sequence of reflexive events involving multiple muscles and nerves</td>
</tr>
<tr>
<td>• a. hyolaryngeal elevation — Hypoglossal XII</td>
</tr>
<tr>
<td>• b. pharyngeal timing — X and XI</td>
</tr>
<tr>
<td>• c. airway protection — V, X, XI</td>
</tr>
<tr>
<td>• d. UES — X</td>
</tr>
</tbody>
</table>

### Slide 55

<table>
<thead>
<tr>
<th>CNs of Chewing and Swallowing</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Total tally of CN for this complicated action:</td>
</tr>
<tr>
<td>• 7 CNs working in consort</td>
</tr>
<tr>
<td>• Olfactory</td>
</tr>
<tr>
<td>• Trigeminal</td>
</tr>
<tr>
<td>• Facial</td>
</tr>
<tr>
<td>• Glossopharyngeal (taste to posterior tongue)</td>
</tr>
<tr>
<td>• Vagus</td>
</tr>
<tr>
<td>• Accessory</td>
</tr>
<tr>
<td>• Hypoglossal</td>
</tr>
</tbody>
</table>

### Slide 56

![WELL DONE!](image)
Dysphagia in Head and Neck Cancer
Optimizing outcomes through standard pathways and evaluation protocols
Kate A. Hutchison, PhD
Associate Professor
Department of Head and Neck Surgery
karnold@mdanderson.org

Disclosures
• PCORI 16-10-36195
• NCI R01CA215148
• NCI R01CA188162
• NCI R01CA214625
• NCI R01CA228206
• NIDCR R01DE025248
• MD Anderson Institutional Research Grant Program
• MD Anderson Survivorship Seed Monies Research Grant Program
• NCI Q2014 NCIORC Seed Monies Research Grant Program
• Barry & Damien Stiefel MD Anderson Oropharynx Program Fund (PRO/function core)
• American Board Swallowing & Swallowing Disorders: non-financial

Dysphagia is common in HNC
Ten-year prevalence of dysphagia and related outcomes in head and neck cancer survivors: An updated SEER-Medicare analysis
(Yates et al, 2015 - 2017)
Impact of dysphagia

Health

QOL

Quality of life

Dysphagia is top symptom associated with decisional regret

Recall: patients with hoarseness or a sore throat in the early stages of head and neck cancer are more likely to have dysphagia. Dysphagia is a common symptom of head and neck cancer and can significantly impact the patient's quality of life. Dysphagia is also a top symptom associated with decisional regret. Dysphagia is one of the most common symptoms in patients with head and neck cancer, and it can significantly affect the patient's quality of life.
Aspiration pneumonia

SEER-Medicare 2000-2009, n=3,513 chemoradiation for HNC

Aspiration as source of late non-cancer deaths

n=116, 56% OPC, mean 33 mos FU

Dysphagia in HNC is complex....

Tumor
- Site
- Size

Radiation
- Dose
- Fields
- Fractionation
- Technique

Surgery
- Approach
- Size
- Reconstruction

Patient
- Age
- Comorbidities
- Psychosocial
- Support
- Function
Head and neck cancer

Distinct subsites
TNM staging
Different treatment modalities

What is the “Head & Neck”?

H&N
- “Upper aerodigestive tract”
- Borders of the H&N:
  - Superiorly: skull base
  - Inferiorly: trachea
  - Anteriorly: nose
  - Posteriorly: pharyngeal wall

NOT H&N
- Esophagus
- Cervical spine
- Lungs
- Trachea
- Brain

Anatomic regions of H&N
Visualization of H&N Regions

Key functions of the H&N region

H&N structures: What are the functional correlates?
Review of CN functions

- **V**
  - Sensory: hard/soft palate (V2), anterior tongue (V3)
  - Motor (V3): supralaryngeal (anterior excursion), palate (VP closure), masticatory muscles

- **VII**
  - Sensory: anterior tongue (taste)
  - Motor: labial, facial, posterior digastric (laryngeal elevation)

- **IX**
  - Sensory: posterior tongue, faucial arches, oropharynx
  - Motor: stylopharynx

- **X**
  - Sensory: SLN → BOT, hypopharynx, supraglottis, glottis, RLN → subglottis
  - Motor: pharynx, palate, intrinsic larynx, cricopharynx

- **XII**
  - Motor: intrinsic & extrinsic tongue, hyolaryngeal excursion

---

**Head and neck cancer**

- 12th most common malignancy (U.S.)
- 49,260 new cases 2010
- 11,000 deaths/year
- Prevalence ~350K
- >90% SCCA
- Survival: 5-year ~60%

---

**Shifting epidemiology of HNC**

- Earlier diagnosis, more surgical organ preservation
- NCI SEER (2011)
2/19/2019

HPV epidemic: impact on HNC incidence

Human Papillomavirus and Rising Oropharyngeal Cancer Incidence in the United States


HPV associated disease is different

<table>
<thead>
<tr>
<th>Variable</th>
<th>HPV-positive</th>
<th>HPV-negative</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Site</td>
<td>Head and neck</td>
<td>Neck or oropharynx</td>
<td>0.0001</td>
</tr>
<tr>
<td>Age</td>
<td>Younger</td>
<td>Older</td>
<td>0.002</td>
</tr>
<tr>
<td>Gender</td>
<td>Male</td>
<td>Female</td>
<td>0.001</td>
</tr>
<tr>
<td>Social economic status</td>
<td>High</td>
<td>Low</td>
<td>0.003</td>
</tr>
<tr>
<td>Alcohol</td>
<td>Heavy</td>
<td>None</td>
<td>0.004</td>
</tr>
<tr>
<td>Tobacco</td>
<td>High</td>
<td>Low</td>
<td>0.005</td>
</tr>
<tr>
<td>Head and neck</td>
<td>Increasing</td>
<td>Decreasing</td>
<td></td>
</tr>
</tbody>
</table>

Dysphagia in HNC (Hutcheson, Vanderbilt Medical SLP Course | 2019)

Primary site

**TNM Classification**

<table>
<thead>
<tr>
<th>T (tumor)</th>
<th>N (nodal status)</th>
<th>M (metastases)</th>
</tr>
</thead>
</table>
| • Tumor size or extent of involvement  
  • Varies some by site of primary tumor | • Important predictor of survival | • Rare at presentation (typically late) |
| T0: Primary tumor cannot be assessed  
  T1: Variability of primary tumor  
  T2: Tumor by site  
  T3: Tumor by site, involves adjacent structures (ts, de, en)  
  T4: Tumor by site, involves adjacent structures (ts, de, en), invades adjacent structure (ts, de, en) | N0: No regional lymph nodes  
  N1a: Single ipsilateral node ≤ 3 cm  
  N1b: Single ipsilateral node > 3 cm, or multiple nodes  
  N2a-c: Multiple ipsilateral nodes  
  N3: >6 cm (single or multiple)  
  *Varies by site* | M0: No distant metastases  
  M1: Distant metastases |

**AJCC Staging** (non-NPC, non-OPC)

<table>
<thead>
<tr>
<th>Anatomic Stage</th>
<th>Prognostic Groups</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stage I</td>
<td>T1a N0 M0</td>
</tr>
<tr>
<td>Stage II</td>
<td>T1b N0 M0</td>
</tr>
<tr>
<td>Stage III</td>
<td>T2a N0 M0</td>
</tr>
<tr>
<td>Stage IV</td>
<td>T2b N0 M0</td>
</tr>
<tr>
<td>Stage IVA</td>
<td>T3a N0 M0</td>
</tr>
<tr>
<td>Stage IVB</td>
<td>T4a N1 M0</td>
</tr>
<tr>
<td>Stage IVC</td>
<td>T4b Any N M0</td>
</tr>
<tr>
<td></td>
<td>Any T Any N M0</td>
</tr>
</tbody>
</table>
### AJCC Staging, 8th edition (update)

**Oropharynx cancer**

#### p16 (HPV) positive

<table>
<thead>
<tr>
<th>AJCC stage</th>
<th>N1</th>
<th>N2</th>
<th>M0</th>
<th>M1</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>N0</td>
<td>N0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>N0</td>
<td>N0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>N0</td>
<td>N0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>N0</td>
<td>N0</td>
<td></td>
<td></td>
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#### p16 (HPV) negative

<table>
<thead>
<tr>
<th>AJCC stage</th>
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<th>N2</th>
<th>M0</th>
<th>M1</th>
</tr>
</thead>
<tbody>
<tr>
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<td>N0</td>
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<td>N0</td>
<td>N0</td>
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</tr>
<tr>
<td>4</td>
<td>N0</td>
<td>N0</td>
<td></td>
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</tbody>
</table>

*Note: M1 is stage IV.


### Evolution of HNC treatment

- **Before 1950**: Surgery
- **1950-1960**: Radiation Therapy
- **1960-1970**: Chemotherapy
- **1970-1980**: Combined Through Intensity Therapy
- **1980-2010**: Immunotherapy

*Courtesy of Dr. F. Christopher Holsinger*

### Single versus Multi-modality

- **Single modality**: Cure vs. toxicity
- **Combined modality**:
Treatment options for oral cancers

- **Definitive**
  - Surgery
- **Adjuvant**
  - Induction chemotherapy (preop)
  - Postoperative radiation (+ chemotherapy)

Treatment options for oropharyngeal cancers

- **Historically**
  - Radical surgery
- **1990's**
  - Organ preservation (radiation/chemoradiation)
- **2000's**
  - Transoral surgery
- **2010's**
  - De-intensified RT (low-intermediate risk)
  - Immunotherapy
  - Transoral surgery

Current

- Low-intermediate risk (HPV+) and low T stage
  - Transoral surgery
  - Chemoradiation (~70 Gy)
- HPV+ and advanced T stage
  - IRT +/- systemic
Treatment options for **early laryngeal cancer**

- Single modality therapy
  - RT alone (narrow field)
  - Surgery TLMS (laser)

Treatment options for **advanced laryngeal cancer**

- Multi-modality therapy
  - Laryngeal preservation
    - Partial RT ± chemo
    - Partial laryngectomy + PORT
  - Total laryngectomy + PORT

Treatment options for **hypopharyngeal cancers**

- Early stage “larynx preservation”
  - RT ± chemo
  - eHNS – laser or robot

- Advanced stage
  - Total laryngopharyngectomy
  - Postoperative RT ± chemo

Dysphagia in HNC (Hutcheson, Vanderbilt Medical SLP Course | 2019)
Sources of dysphagia in HNC

- Tumor
  - Site
  - Size

- Patient
  - Age
  - Comorbidities
  - Psychosocial
  - Function

- Surgery
  - Approach
  - Site/size
  - Reconstruction

- Radiation
  - Dose
  - Fields
  - Fractionation
  - Technique

Dysphagia in HNC is complex...

Patient factors

- Age
  - Sarcopenia
  - Frailty

- Comorbidity

Functional reserve

Psychosocial factors: motivation, ability, adherence
Tumor-associated dysphagia

Primary site

Lymph nodes


Post‐surgical dysphagia

Site

Volume

Approach

Closure

Neck

Managing postsurgical dysphagia

know what to look for
Surgical factors to consider

<table>
<thead>
<tr>
<th>Surgical factor</th>
<th>Surgical considerations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resection (resection)</td>
<td>Normal function of structure(s)</td>
</tr>
<tr>
<td>Approach</td>
<td>Open approach (transoral, endoscopic)</td>
</tr>
<tr>
<td>Closure</td>
<td>Healing by secondary intention</td>
</tr>
</tbody>
</table>

Healing by secondary intention:
- Primary closure (local suture)
- Regional flap
- Free flap (plastic surgeon)

Neck dissection:
- Extent of ND
  - Levels (I-V)
  - Selective vs. radical
- Laterality (unilateral/bilateral)

---

**Partial glossectomy = RANGE OF MOTION**

Healing by 2° intention: best ROM

Partial glossectomies + 1° closure: better ROM

(sub)Total glossectomy = bulk

Dysphagia in HNC: Hardman, Vanderbilt Medical SLP Course (2019)
Postop swallowing rehabilitation – a practical hierarchy

1. Saliva management
2. Re-introduce PO (safest, most efficient)
   - MBS: rule out leak/assess safety (advanced-stage)
3. Increase volume of PO
   - mass practice
4. Increase complexity of PO

Postsurgical dysphagia

expect (and address) post-surgical edema

Lymphedema

Functional impact?
Dysphagia in HNC (Hutcheson, Vanderbilt Medical SLP Course | 2019)

H&N Lymphedema Therapy Program

**COMPLETE DECONGESTIVE TX**
1. Manual lymphatic drainage
2. Compression therapy
3. Remedial exercise
4. Skin care

---

**Lymphedema Outcomes in Patients with Head and Neck Cancer**

- n=733
- 66% CDT responders
- Adherence (p<0.001)
Radiation-Associated Dysphagia “RAD”

Safety  Efficiency

“Organ preservation”

Induction Chemotherapy Plus Radiation Compared with Surgery Plus Radiation in Patients With Advanced Laryngeal Cancer

VA Laryngeal Cancer Study

Larynx preservation  Estimated 2-year survival
PF induction → RT (n=166)  Surgery + RT (n=166)

Median follow-up = 2 years  Median follow-up = 33 months

Laryngeal Preservation: RTOG 91-11

% P R E S E R V E D

0 25 50 75 100

YEARS FROM RANDOMIZATION

Induction vs Concurrent: p = 0.0048
Induction vs RT alone: p = 0.27
Concurrent vs RT alone: p = 0.00012

ConcurrentInduction RT alone
88%
75%
69%

Induction vs Concurrent p = 0.0048
Induction vs RT alone p = 0.27
Concurrent vs RT alone p = 0.00012

Organ Preservation: Oropharynx
Definitive surgery v. RT?

51 studies
6,400 pooled patients
Compared 2 approaches:
• Surgery + PORT
• RT +/- chemotherapy
Equivalent survival and LRC
Complications in surgical group

Squamous Cell Carcinoma of the Oropharynx
Surgery, Radiation Therapy, or Both

The standard of care for organ preservation?

Chemoradiation
66-72 Gy
Organ preservation ≠ functional preservation

Radiation injury/toxicities

**Early**
- Acute (<3M)
- Subacute (3-6M)
- Mucosal
- Cell death
- Inflammation

**Late**
- >3-6M
- Deeper tissue
- Vascular
- Connective tissue
- Salivary/oral

Toxicity Grading
Common Toxicity Criteria for Adverse Events (CTCAE)

Grades
Grade refers to the severity of the AE. The CTCAE v3.0 displays Grades 1 through 5 with unique clinical descriptions of severity for each AE based on this general guideline:

- Grade 1: Mild AE
- Grade 2: Moderate AE
- Grade 3: Severe AE
- Grade 4: Life-threatening or disabling AE
- Grade 5: Death related to AE
Patterns of Acute Toxicities: 
MD Anderson Symptom Inventory (MDASI-HN) 

**Patient-reported symptoms during RT**

- Pharyngeal constrictor dose > 50 Gy
- Laryngeal dose > 20-30 Gy

**Floor of mouth (suprahyoid) muscle dose predicts RAD in OPC survivors (n=349)**
Older patients tolerate less radiation dose to swallowing muscles before developing dysphagia

Pathophysiology RAD

Acute (edema) | Chronic (fibrosis) | Late (denervation)

Dysphagia-Aspiration Related Structures: DARS, mobility

Mechanics
- Laryngeal closure
- Bolus push
- Esophageal opening

Structure
- Edema
- Defect
- Stricture

✓ Aspiration
✓ Residue

Abbreviations: NTCP, normal tissue complication probability; ROIs, regions of interest; ADM, anterior digastric muscle; GGM, genioglossus muscle; IPC, inferior pharyngeal constrictor; ITM, intrinsic tongue muscle; PDM, posterior digastric muscle; PCM, palatoglossal constrictor; PSM, palatopharyngeus muscle; MGM, mylohyoid muscle; MPC, middle pharyngeal constrictor; SPC, superior pharyngeal constrictor.


Eisbruch et al. (2004)
Hutcheson et al. Cancer (2012)
Dysphagia is not always stricture after RT

Management of stricture

Gastroenterology (GI) or ENT/HNS

- EGD w/ esophageal dilation:
  - Bougie ("paddi")
  - Balloon dilation
  - Rendevous
Esophageal dilation improves symptomatic stricture

- n = 41 HNC survivors
- ≥12M post RT NED
- Sham controlled RCT (EGD +/- dilation)

Dysphagia in HNC (Hutcheson, Vanderbilt Medical SLP Course | 2019)


75% 76% 5%

Note: short term response rate in red
Stricture relapse rate = 50%

When to suspect stricture

“Spit cup”
Can’t belch or vomit
High risk site + prolonged NPO
Solid-food dysphagia (sometimes)

Stricture: evaluating on fluoro

Large volume liquid
AP (high density barium)
Oblique?
Pharyngeal function
Hyolaryngeal kinematics (frozen larynx?)
MD Anderson

T2N1 SCCA Supraglottis 6M post chemoRT
Sternal recurrence 4M post re-RT

Pre-dilation
Post-dilation

Stock barium stricture
Thin liquid + Supraglottic

Lymphedema-Fibrosis continuum

n = 100 HNC with RT
Pre-RT to 18M post-RT
75% moderate-severe lymphedema
47% grade ≥2 fibrosis


Dysphagia in HNC (Hutcheson, Vanderbilt Medical SLP Course | 2019)

MD Anderson

Lower cranial neuropathy (LCNP) as rare late effect of RT – 5% incidence
IX, X, XII nerves, median latency 8 years (n=99 IMRT OPC survivors)


Overall survival
87% at 10 years
incidence LCNP
5% (median FU 6 years)
Denervation source?

LCNP associated significantly worse cancer-related symptoms
largest impact on swallow and voice/speech


Late Dysphagia After Radiotherapy-Based Treatment of Head
and Neck Cancer

“Late-RAD”

- Significant inefficiency
- Refractory aspiration
- Progressive dysfunction
- Secondary pneumonias
Late-RAD

Pre-RT 1 year 7 years

Dysphagia in HNC (Hutcheson, Vanderbilt Medical SLP Course | 2019)

Denervation (cranial neuropathy) common in late-RAD

Acute (edema) Chronic (fibrosis) Late (denervation)

Dysphagia-Aspiration Related Structures (DARS: mobility)

Denervation (cranial neuropathy) common in late-RAD

LCNP associated with late functional decline

Figure 3: Triplet of swallowing function among cases with lower cranial neuropathy (LCNP). Measures of swallowing function: logit-transformed for each LCNP case using modified barium swallow (MBS) outcomes (Dysphagia Imaging Grade of Swallowing, Tonsil Tidal Volume, and Transmitted Fooding per Performance Status Scale of Head and Neck Cancer [PS-HNC]). Defined LCNP as a drooping moro tone in the late dysphagia per fluoroscopy, diet, and self-reporting in all 3 such studies. (Data figure can be viewed at www.theadnkknows.com)
Evolution of RAD

<table>
<thead>
<tr>
<th>Acute &quot;transient&quot;</th>
<th>Chronic or persistent</th>
<th>Late-onset</th>
</tr>
</thead>
<tbody>
<tr>
<td>Edema</td>
<td>Edema-fibrosis</td>
<td>Fibrosis-neuropathy</td>
</tr>
<tr>
<td>High dose larynx</td>
<td>High RT dose larynx, pharynx</td>
<td>Moderate dose upper pharynx</td>
</tr>
</tbody>
</table>

Dysphagia in HNC

- Difficulty swallowing SOLIDS
  - Poor propulsion (pharyngeal)
  - Stricture
  - Prep: Mastication or saliva

- Difficulty swallowing LIQUIDS
  - Poor laryngeal (supraglottic) closure
  - Residue (propulsion vs. atresia)

What's the pathophysiology?
MD Anderson | Swallowing Evaluation Protocol

### MBS
- **Efficiency**
- **Penetration-aspiration**
- **Pathophysics**

**Functional status scale**
- Eating (PESI)
- Eating (PESI)

**Patient-reported outcomes (PROs)**
- MDADI
- PSS-HN (Diet, Eating in Public)

**MD Anderson Performance Status Scale – Head & Neck Cancer (PSS-HN)**

- **Understandability of Speech**
  - 100 = Always understandable
  - 75 = Usually understandable (repeated speech)
  - 50 = Sometimes understandable (slow to fast)
  - 25 = Difficult to understand
  - 0 = Never understandable

- **Normalcy of Diet**
  - 100 = Full diet (no restriction)
  - 90 = Full diet (liquid assist)
  - 80 = All meat
  - 70 = Semi-liquid
  - 60 = Dry toast, cracker
  - 50 = Soft, chewable
  - 40 = Soft, nonchewable
  - 30 = Pureed
  - 20 = Liquid (warm)
  - 10 = Liquid (cool)
  - 0 = NPO

- **Eating in Public**
  - 100 = No restriction (people, place, food)
  - 75 = Restrict food in public
  - 50 = Certain people, certain places
  - 25 = At home, certain people
  - 0 = Always eats alone

**MD Anderson Dysphagia Inventory**

- 20-item PRO
  - **Scores**
    - **Best = 100**
    - **Worst = 0**

- **3 subscales**
  - Emotional
  - Functional
  - Physical


Quantifying MBS?

Function
- Safety
- Efficiency

Pathophysiology
- Kinematics
- Timing

- Penetration/Aspiration
- Residue
- DIGEST

Leonard-Kendall
Logemann
Martin-Harris (MBSImP)
Reesink
Steele (ASPEKT)

Dysphagia in HNC (Hutcheson, Vanderbilt Medical SLP Course | 2019)

Dynamic Imaging Grade of Swallowing Toxicity (DIGEST)

- MBS tool: pharyngeal dysphagia severity (global)
- 5-point severity staging, CTCAE benchmarks
- Safety (Pen-Asp) x Efficiency (residue) interaction
- For therapy: profiling!

S3 E0 DIGEST3 versus S1 E3 DIGEST 3

Hutcheson KA, et al. (2017) Cancer
Dysphagia in HNC (Hutcheson, Vanderbilt Medical SLP Course | 2019)

MD Anderson Dynamic Imaging Grade of Swallowing Toxicity (DIGEST)

- MBS tool: pharyngeal dysphagia severity (global)
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Hutcheson KA, et al. (2017) Cancer
Dynamic Imaging Grade of Swallowing Toxicity (DIGEST)

- MBS tool: pharyngeal dysphagia severity (global)
- 5-point severity staging, CTCAE benchmarks
  - 0 = none, 1 = mild, 2 = moderate, 3 = severe, 4 = life threatening/profound
- Safety (Pen-Asp) x Efficiency (residue) interaction
- For therapy → profiling! (ex: S1 E4 D3)

Hutcheson KA, et al. (2017) Cancer
Dynamic Imaging Grade of Swallowing Toxicity (DIGEST)

- MBS tool: pharyngeal dysphagia severity (global)
- 5-point severity staging, CTCAE benchmarks
- Safety (Pen-Asp) x Efficiency (residue) interaction
- For therapy → profiling (e.g. S1 E4 D3)

Hutcheson KA, et al. (2017)

Other measures to consider: Oral Intake

**Functional Oral Intake Scale (FOIS)**

<table>
<thead>
<tr>
<th>Level</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>Fully oral</td>
</tr>
<tr>
<td>4</td>
<td>Total oral diet of single consistency</td>
</tr>
<tr>
<td>3</td>
<td>Total oral diet of multiple consistencies, but requiring special preparations or compensations</td>
</tr>
<tr>
<td>2</td>
<td>Total oral diet with multiple consistencies without special preparations, but with specific food limitations</td>
</tr>
<tr>
<td>1</td>
<td>Total oral diet with no restrictions</td>
</tr>
</tbody>
</table>

Crary M et al. Arch PMR 1995

**IDDSI Functional Diet Scale (IDDSI-FDS)**

Steele C, et al. Arch PMR 2018

Other swallowing questionnaire options

- EAT-10
- Sydney Swallow Questionnaire (SSQ)
- SWAL-QOL
Adjunctive functional measures

- Tongue strength (MILS)
- Mouth opening (MIO)
- Cough (PCT)
- Laryngoscopy

Mucositis, odynophagia, mucus ↓ oral intake Disuse atrophy?

Preventive swallowing therapy

Eat + Exercise → Use it or lose it!
Evidence for Proactive Swallowing Therapy: **Exercise**

<table>
<thead>
<tr>
<th>Study</th>
<th>Design</th>
<th>Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>UAB</td>
<td>Retrospective</td>
<td>Superior MDADI (swallow-related QOL)</td>
</tr>
<tr>
<td>MDACC</td>
<td>Retrospective</td>
<td>Superior MDADI (swallow-related QOL)</td>
</tr>
<tr>
<td>UF</td>
<td>RCT</td>
<td>Significant preservation muscle mass by MRI</td>
</tr>
<tr>
<td>NKI</td>
<td>RCT</td>
<td>Improved mouth opening</td>
</tr>
<tr>
<td>EPA</td>
<td>Retrospective</td>
<td>Superior distal feeds (1-6M after CRT)</td>
</tr>
<tr>
<td>UF RCT</td>
<td>Significant preservation muscle mass by MRI</td>
<td></td>
</tr>
<tr>
<td>NKI RCT</td>
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2. Carrol WR et al., Lscope (2008)
4. Shinn E et al., Head Neck (2013)
5. Carnaby-Mann G et al., IJROBP (2012)
6. Van der Molen L et al., Dysphagia (2011)
8. Ohba S et al., Head Neck (2014)

Evidence for Proactive Swallowing Therapy: **Eat**

1. Hutcheson BD, Vanderbilt Medical SLP Course | 2019
2. Cochrane review (Perry, 2016) → inconclusive
3. Meta-Analysis (Grecco, Martino, 2018) → benefit

Use it or lose it: **Eat and Exercise during Radiation**
(n=497, pharyngeal cancers 2002-2008)

1. Fully PO: 40%
2. Partial PO: 34%
3. NPO: 26%
4. Eating: 58%
5. Exercise: 58%

Use it or lose it study: EAT and Exercise are feasible during RT
MDACC retrospective review: Eat & Exercise during radiation
(n=497, pharyngeal cancers 2002-2008)

Adherent 58%
Non-adherent 42%
Fully PO 40%
Partially PO 34%
NPO 26%

EatExercise


Dysphagia in HNC (Hutcheson, Vanderbilt Medical SLP Course | 20 19)

Use it or lose it study: EAT and Exercise associated with greater chance of returning to regular diet long-term
MDACC retrospective review: Eat & Exercise during radiation
(n=497, pharyngeal cancers 2002-2008)

Use it or lose it: EAT and Exercise associated with shorter feeding tube dependence
MDACC retrospective review: Eat & Exercise during radiation
(n=497, pharyngeal cancers 2002-2008)
Dysphagia in HNC (Hutcheson, Vanderbilt Medical SLP Course | 2019)

Source: MD Anderson Cancer Center, Section Speech Pathology & Audiology
**Proactive exercise training**

Swallowing Exercises
A Program for Head and Neck Patients

- Mendelsohn
- Jaw/FOM stretch
- Supraglottic
- Mastic
- Effortful

3 sets, 10 reps

Source: International Radiation-Associated Dysphagia Working Group

---

**EAT – Eat All Through Radiation**

EAT Through Radiation Treatment
A Program for Head and Neck Patients

- EAT diet staircase (food hierarchy)
- Mealtime routine

Source: International Radiation-Associated Dysphagia Working Group
Tips for Eating

“You may feel solid foods stick abnormally in your throat while you eat. Although you may want to grab a drink to wash the food through the throat, try a hard, fast swallow instead to help clear the food. You may need to repeat this several times. It is good exercise for your throat when you swallow thick or heavy foods.”

Dysphagia in HNC (Hutcheson, Vanderbilt Medical SLP Course | 2019)

Source: MD Anderson Cancer Center, Section Speech Pathology & Audiology
Dysphagia Therapies

1980's
Compensations
Exercises

1990's
Biomechanics

2000's
Electrical stimulation

Electrical stimulation for RAD?

R01 funded multi-site RCT:
- Chronic RAD (≥3 months post RT or CRT)
- 2 arms:
  - Swallow exercise & stretching + NMES
  - Swallow exercise & stretching + sham NMES
- 3 months intensive home program
  - BID, 6 days/week

Primary aim: NS effect NMES

Efficacy of electrical stimulation and exercise for dysphagia in patients with head and neck cancer: A randomized clinical trial
Persistent RAD is DIFFICULT to fix!

Secondary analyses NMES trial

- Efficacy home exercise:
  - Significant (small) gains diet, QOL
  - NS effects MBS detected OPSE, PAS, hyoid excursion

- Time-dependent effects:
  - >10 yrs post
  - Worst pre-therapy swallows
  - Progressive deterioration despite therapy
  - Threshold @ 2 years?


Limitations of home program

- Static program (lack progression)
- Rely solely on patient adherence
- Low intensity

More **structured** and **progressive** swallowing therapy programs needed!

Dysphagia in HNC (Hutcheson, Vanderbilt Medical SLP Course | 2019)

More intensive options for persistent/chronic/late dysphagia

- Mobility
- Strength
- Skill

Dysphagia in HNC (Hutcheson, Vanderbilt Medical SLP Course | 2019)
More intensive swallowing therapies for persistent/chronic/late dysphagia

- Skill/strength training
  - "Boot Camp" McNeil
  - "RST" Resp Pattern SAFETY
  - "EMST" Exp. M. Strength SAFETY
  - Manual "MFR" Myofascial release

Swallowing BOOT CAMP

- "Mass practice"
  - Intensive, daily
  - QD or BID
  - 2-3 weeks
- FUNCTIONAL task = swallowing
- Intensive over time = progressive resistive swallowing (exercise) paradigm
- Home carry-over (1-2 X/week)

MDACC Boot Camp Experience

- sEMG and/or MDT (n=29)

MDADI scores pre-post boot camp swallow therapy. Global MDADI significantly improved (Δ+11.1, p=0.049)

Penetration Aspiration Scale scores pre-post boot camp (Δ=0, p=0.999)

QOL improves (efficiency) adaptation

Aspiration persists

Hutcheson, Kelly, Burton, Harrington, Fores, Kelle, Walker, Levine. COSM 2014

Dysphagia in HNC (Hutcheson, Vanderbilt Medical SLP Course | 2019)
Airway protection

Keep eating

Avoid pneumonia

Downstream targets > respiratory system?
＞Respiratory pattern training (Martin-Harris, 2014)
＞Expiratory muscle strength training - EMST (Sapienza, 2009)

Therapeutic target = airway protection
Adjustable spring-loaded expiratory valve
CLEARANCE: expiratory force
AIRWAY CLOSURE: hyolaryngeal lift
PUMP: velopharynx.

Expiratory Muscle Strength Training (EMST)

Maximum expiratory pressures significantly improve after EMST in post-RT HNC aspirators pre-post 8 weeks of EMST (5-5-5, 75% individualized MEP, n=23)

MBS results
DIGEST safety profiles significantly improve after 8 weeks EMST (n=23)

“no longer running to bathroom to regurgitate my food at restaurants”
“cough is stronger”
“less mucus in my throat”
“I bought the trainer for friends in my support group”
Integration of Manual Therapy into Speech and Swallow Rehabilitation Program for Head and Neck Cancer: A Case Series (n=15)

15 HNC survivors; 59 combined MT sessions
RT ±surgery or chemotherapy
Primary endpoint: cervical range of motion (CROM)
Secondary outcomes: functional status interview

Sex
<table>
<thead>
<tr>
<th></th>
<th>Female</th>
<th>Male</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2 (13%)</td>
<td>13 (87%)</td>
</tr>
</tbody>
</table>

Age, median (range)
67 (57-79)

Survival time, median (range)
98 (3-192)

Lewin JS, Woodall HE, Porsche CB, Barrow MP, Hutcheson KA (2017, MDACC unpublished)

Myofascial release
Massage
Passive and Active ROM

Manual Therapy for Fibrosis-Related Late Effect Dysphagia in Head and Neck Cancer Survivors: The Pilot MANTLE trial (2018-0052, NCI R21CA236200)

Manual therapy significantly improved after one session

"lift your head as high as you can"

CROM significantly improved after single session

CROM significantly improved >10º on avg after one session
80% pts improved 4 planes, 60% in 5 planes

Lewin JS, Woodall HE, Porsche CB, Barrow MP, Hutcheson KA (2017, MDACC unpublished)
**MD Anderson’s work flow for implementing “Boot Camp”**

**EVALUATION** → **CONSENSUS** → **Therapy phase I:** Optimize pre-boot camp → **Therapy Phase II:** “Boot Camp”

---

**Good therapy starts with comprehensive evaluation**

**MDACC Swallowing Evaluation Standard**

- **MBS**
  - Efficiency
  - Penetration-aspiration
  - Pathophysiology
- **Functional status scale**
  - PSIS-HN (Diet Eating in Public)
- **Patient-reported outcomes (PROs)**
  - MDADI

---

**DIGEST**

- MBS test (pharyngeal dysphagia)
- 5-point severity staging
- CTCAE benchmarks
- Safety (Pen-Asp) x Efficiency (residue) interaction
- FOR BOOT CAMP: 4-7 days (ex: S1 D4 D3)
### Evaluation...

**Other data you need to plan boot camp**

- Treatment history – time post treatment
- Disease status
- Pneumonia history
- Cranial nerve examination
- Trismus
- Wound issues/pain control (radiation, ulcers, mucositis)
- Prior therapy (and response)
- Goal (priority)

### Checklist for swallowing boot camp planning

#### Evaluation results:
- MBS date: __ / __ / __
- DIGEST grade: __ overall __ safety __ efficiency
- MBS pathophysiology:
  - PSS-HN diet:
  - Tube status:
  - MIO:
  - Cranial nerve function:

#### Optimization phase:
- Dilation
- Botox
- VC medialization
- Therabite/jaw ROM
- Manual therapy
- IOPI/lingual strengthening
- EMST
- Dental rehab (specify:_____) (check)

#### Functional therapy phase (boot camp):
- McNeil Dysphagia Therapy Program (start level:______)
- sEMG biofeedback swallows
- bioFEESback

#### History & evaluation
- Age:
- Comorbidity:
- HNC details:
- Pneumonia history:
- Prior swallowing therapy:
- Patient's goal:

#### Candidacy:
- Cancer free
- Free active tissue issue (mucositis, ulcer, untreated ORN)
- Minimal/no oropharyngeal pain
Checklist for swallowing boot camp planning

**Evaluation results:**
- **MBS date:** __ / __ / __
- **DIGEST grade:** __ overall __ safety __ efficiency
- **MBS pathophysiology:**
- **PSS-HN diet:**
- **Tube status:**
- **MIO:**
- **Cranial nerve function:**

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- Botox
- VC medialization
- Therabite/jaw ROM
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  - Dental rehab (specify:_____

**History & evaluation**

**Therapy plan:**
- Optimization phase:
  - Dilation
  - Botox
  - VC medialization
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  - Manual therapy
  - IOPI/lingual strengthening
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**Checklist for swallowing boot camp planning**

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- **MBS date:** __ / __ / __
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- **Patient’s goal:**

**Candidacy:**
- Cancer free
- Free active tissue issue (mucositis, ulcer, untreated ORN)
- Minimal/no oropharyngeal pain
Swallowing BOOT CAMP

- "Mass practice"
  - Intensive, daily
  - QD or BID
  - 2-3 weeks
- FUNCTIONAL task = swallowing
- Introduces new function paradigm; resists swallowing (exercise) paradigm
- Home carry-over (min 6-8 wks)

Progressive resistive functional exercise program

- sEMG Biofeedback
- MDTP

FUNCTIONAL task = swallowing

Introduces new function paradigm; resists swallowing (exercise) paradigm

Home carry-over (min 6-8 wks)

Biofeedback driven BOOT CAMP

Surface electromyography (sEMG)

- Reading amplitude of muscle activity (through skin)
- Not stimulating contractions
- Work at % of max, increase over time
- With or without bolus

Bolus-Driven Boot Camp

McNeil Dysphagia Therapy Program (MDTP)

- Mass practice
- Food hierarchy
- Strengthening & coordination


Dysphagia in HNC (Hutcheson, Vanderbilt Medical SLP Course | 2019)
Comparing functional therapy options for boot camp

N=24
Chronic dysphagia (>6M)
75% HNC
Short-term outcomes assessment (end therapy)

<table>
<thead>
<tr>
<th>Table 4: Dysphagia Outcomes Functional Therapy Options</th>
<th>Device-driven (sEMG biofeedback)</th>
<th>Bolus-driven (McNeill MDTP)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tube removal</td>
<td>27%</td>
<td>67%</td>
</tr>
<tr>
<td>Dysphagia recovery (per FOIS)</td>
<td>12%</td>
<td>75%</td>
</tr>
<tr>
<td>Continued aspiration</td>
<td>62%</td>
<td>35%</td>
</tr>
</tbody>
</table>

Comparing functional therapy options for boot camp

N=24
Chronic dysphagia (>6M)
75% HNC
Short-term outcomes assessment (end therapy)

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<thead>
<tr>
<th>Table 4: Dysphagia Outcomes Functional Therapy Options</th>
<th>Device-driven (sEMG biofeedback)</th>
<th>Bolus-driven (McNeill MDTP)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tube removal</td>
<td>27%</td>
<td>67%</td>
</tr>
<tr>
<td>Dysphagia recovery (per FOIS)</td>
<td>12%</td>
<td>75%</td>
</tr>
<tr>
<td>Continued aspiration</td>
<td>62%</td>
<td>35%</td>
</tr>
</tbody>
</table>
To my hero,

You make a difference! I came here 3 weeks ago with a life that was all but over. Yes, the cancer was gone but the inability to swallow/eat left me with a very shallow, empty life. All that is now changed. You didn't give me a silver bullet, but rather you gave me the courage to try to take baby steps, to believe in miracles, the impossible. No, eating is not the same, but it is manageable. Thank you so much for your training, wisdom, knowledge, dedication, kindness, compassion, but most importantly your passion for serving and helping to heal others. You are a good woman! I pray nothing but the best for you in the future.

You make a difference!

Interdisciplinary considerations

- Veteran's Affairs Interdisciplinary Clinical Demonstration Project
  - SLP therapy (device assisted tongue strengthening exercise)
  - Pulmonary monitoring (ID nurse practitioner)
  - Nutrition monitoring (RD)

↓ hospital admission (56%, 7.3 mean bed days, $2.1M)
↓ pneumonia diagnoses (67%, 0.43 HR)
Doing more for oral care?

A meta-analysis could only be done on 4 trials; this analysis showed a significant risk reduction in pneumonia through oral care interventions (RR fixed, 0.61; 95% CI, 0.40-0.91; P=.02).


What about late-RAD?

Late-RAD responds poorly to “traditional” rehab?
Traditional rehab = home program exercise ± dilation


Late-RAD: aspiration pneumonia

86%

aspiration pneumonia rate in late-RAD cases (25/29 cases)
✓ 32% hospitalized
✓ 14% intubated/trach

Late-RAD

“I cannot fix this”

Evaluation:
• Videofluoroscopy → MUST (>90% silent aspirations)
• Cranial nerve exam → prefer endoscopy
• Manometry

Management:
• Avoid pneumonia
• Avoid NPO
• Strategies, strategies, strategies → biofeedback (FEES)
• Myofascial release
• “Home exercise” = not enough

What else?

Figure 1. Interactions among indications for total laryngectomy.

Dysphagia in HNC (Hutcheson, Vanderbilt Medical SLP Course | 2019)

Yes, you eliminate aspiration, but how do they function?

| Table 5: Comparison of Swallowing Related Parameters between Total Laryngectomy and Partial Laryngectomy |
|-------------------------------------------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| Swallow | Voice (V) | 2.5 (2.2) | <0.01 | Partial Laryngectomy | 4.3 (4.3) | <0.01 |
| Voice (V) | 2.5 (2.2) | 4.3 (4.3) | <0.01 |
| Voice (V) | 4.3 (4.3) | <0.01 |

Considerations:
• Pre-TL function: CN exam, stricture, trismus
• Extent TL: flap? Yes, you eliminate aspiration, but how do they function?
Dysphagia in HNC is common and complex
Not all HNC impacts swallowing function similarly
Standardized evaluation protocol and pathways offer a framework to optimize care
Be pro-active → use it or lose it
Consider intensive, multi-disciplinary paradigms for persistent/chronic or late-onset dysphagia