Dysphagia in Head and Neck Cancer
Optimizing outcomes through standard pathways and evaluation protocols
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- NCI R01CA220260
- NIDCR R01DE025248
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- NCI CTSA NCORP Seed Monies Research Program
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- American Board Swallowing & Swallowing Disorders: non-financial

Dysphagia is common in HNC
Two-year prevalence of dysphagia and related outcomes in head and neck cancer survivors: An updated SEER-Medicare analysis
Hutcheson KA, Lewis, CM, et al.
Head Neck (e-pub 2019)
Impact of dysphagia

Health

QOL

Quality of life

Dysphagia is top symptom associated with decisional regret
Aspiration pneumonia

Image showing the incidence of aspiration pneumonia in hospital and non-cancer patients.

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


Aspiration as source of late non-cancer deaths

Image showing the mortality breakdown of non-cancer mortality.

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


Dysphagia in HNC is complex....

Diagram illustrating factors affecting dysphagia in HNC:
- Tumor: Site, Size
- Radiation: Dose, Fields, Fractionation, Technique
- Surgery: Approach, Size, Reconstruction
- Patient: Age, Comorbidities, Psychosocial, Support, Function

MD Anderson Aspiration as source of late non-cancer deaths

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

- Respiration
- Speech
- Swallowing

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

V • Sensory: hard/soft palate (V2), anterior tongue (V3)
  • Motor (V3): suprahyoid (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, cricopharyngeus

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
HPV epidemic: impact on HNC incidence

Human Papillomavirus and Rising Oropharyngeal Cancer Incidence in the United States

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

HPV associated disease is different

<table>
<thead>
<tr>
<th>Risk Factor</th>
<th>HPV-positive</th>
<th>HPV-negative</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td>Male</td>
<td>Female</td>
</tr>
<tr>
<td>Smoking</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Alcohol</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Head and neck cancer</td>
<td>High</td>
<td>Low</td>
</tr>
<tr>
<td>Oral cavity cancer</td>
<td>High</td>
<td>Low</td>
</tr>
<tr>
<td>Esophageal cancer</td>
<td>High</td>
<td>Low</td>
</tr>
<tr>
<td>Dysphagia</td>
<td>Increasing</td>
<td>Decreasing</td>
</tr>
</tbody>
</table>

Primary site

Regional

TNM Classification

<table>
<thead>
<tr>
<th>T</th>
<th>(tumor)</th>
<th><em>Tumor size or extent of involvement</em></th>
<th><em>Varies some by site of primary tumor</em></th>
</tr>
</thead>
<tbody>
<tr>
<td>TX</td>
<td>Primary tumor cannot be assessed</td>
<td>T0: No evidence of primary tumor</td>
<td></td>
</tr>
<tr>
<td>T0</td>
<td>No evidence of primary tumor</td>
<td>T1*: varies by site</td>
<td></td>
</tr>
<tr>
<td>T1</td>
<td>Primary tumor by site</td>
<td>T2*: varies by site</td>
<td></td>
</tr>
<tr>
<td>T2</td>
<td>Primary tumor by site</td>
<td>T3*: varies by site, invades adjacent structures</td>
<td></td>
</tr>
<tr>
<td>T3</td>
<td>Primary tumor by site, invades adjacent structures</td>
<td></td>
<td></td>
</tr>
<tr>
<td>T4</td>
<td>Primary tumor by site, invades adjacent structures</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>N</th>
<th>(nodal status)</th>
<th><em>Important predictor of survival</em></th>
</tr>
</thead>
<tbody>
<tr>
<td>NX</td>
<td>Regional lymph nodes cannot be assessed</td>
<td></td>
</tr>
<tr>
<td>N0</td>
<td>No regional lymph nodes</td>
<td></td>
</tr>
<tr>
<td>N1</td>
<td>Single ipsilateral node, ≤ 3 cm</td>
<td></td>
</tr>
<tr>
<td>N2a</td>
<td>Single ipsilateral node, 3-6 cm, or multiple nodes ≤ 6 cm</td>
<td></td>
</tr>
<tr>
<td>N2b</td>
<td>Single ipsilateral node, 3-6 cm, or multiple nodes ≤ 6 cm</td>
<td></td>
</tr>
<tr>
<td>N2c</td>
<td>Single ipsilateral node, 3-6 cm, or multiple nodes ≤ 6 cm</td>
<td></td>
</tr>
<tr>
<td>N3</td>
<td>&gt;6 cm, single or multiple nodes</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>M</th>
<th>(metastases)</th>
<th><em>Rare at presentation (typically late)</em></th>
</tr>
</thead>
<tbody>
<tr>
<td>MX</td>
<td>Distant metastases cannot be assessed</td>
<td></td>
</tr>
<tr>
<td>M0</td>
<td>No distant metastases</td>
<td></td>
</tr>
<tr>
<td>M1</td>
<td>Distant metastases</td>
<td></td>
</tr>
</tbody>
</table>

AJCC Staging (non-NPC, non-OPC)

<table>
<thead>
<tr>
<th>Anatomic Stage</th>
<th>Prognostic Groups</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stage 0</td>
<td>T1a N0 M0</td>
</tr>
<tr>
<td>Stage I</td>
<td>T1 N0 M0</td>
</tr>
<tr>
<td>Stage II</td>
<td>T2 N0 M0</td>
</tr>
<tr>
<td>Stage III</td>
<td>T3 N0 M0</td>
</tr>
<tr>
<td>Stage IV</td>
<td>T4a N0 M0</td>
</tr>
<tr>
<td>Stage IVA</td>
<td>T4b N1 M0</td>
</tr>
<tr>
<td>Stage IVB</td>
<td>T4b Any N M0</td>
</tr>
<tr>
<td>Stage IV C</td>
<td>Any T Any N M1</td>
</tr>
</tbody>
</table>

Dysphagia in HNC (Hutcheson, Vanderbilt Medical SLP Course | 2019)
AJCC Staging, 8th edition (update)
Oropharynx cancer

<table>
<thead>
<tr>
<th>T CATEGORY</th>
<th>N CATEGORY</th>
<th>p16 (HPV) positive</th>
<th>p16 (HPV) negative</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1</td>
<td>N0</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>T2</td>
<td>N0</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>T3</td>
<td>N0</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>T4</td>
<td>N0</td>
<td>NA</td>
<td>NA</td>
</tr>
</tbody>
</table>

*pN1 is stage IV
*pN2 is stage IV

Evolution of HNC treatment

---|---|---|---|---|---|---|---
Surgery | | | | | | | 
Radiation Therapy | | | | | | | 
Chemotherapy | | | | | | | 
Biological Therapy (targeted therapy) | | | | | | | 
Integrative care | | | | | | | 

Courtesy of Dr. F. Christopher Holsinger

Single versus Multi-modality

Single modality

Combined modality
Treatment options for oral cancers

Definitive
- Surgery

Adjuvant
- Induction chemotherapy (preop)
- Postoperative radiation (± chemo)

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)
- HPVs and advanced T stage
- Transoral surgery
- Chemoradiation (~70 Gy)
- 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
  - ChemoRT (US standard)
  - Partial laryngectomy + PORT
- Total laryngectomy + PORT

Treatment options for **hypopharyngeal cancers**

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

- **Advanced stage**
  - Total laryngopharyngectomy
  - Postoperative RT ± chemo

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

Dysphagia in HNC is complex...

- **Tumor**
  - Site
  - Size

- **Radiation**
  - Dose
  - Fields
  - Fractionation
  - Technique

- **Surgery**
  - Approach
  - Site/side
  - Reconstruction

- **Patient**
  - Age
  - Comorbidities
  - Psychosocial
  - Support
  - Function

**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 Considerations</th>
<th>Details that impact swallowing outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location of resection</td>
<td>Normal function of structure(s)</td>
</tr>
<tr>
<td></td>
<td>Size defect (t-stage)</td>
</tr>
<tr>
<td></td>
<td>Adjacent structures</td>
</tr>
<tr>
<td>Approach</td>
<td>Open approach (transoral, mandibulotomy)</td>
</tr>
<tr>
<td></td>
<td>Minimally invasive/transoral/endoscopic approaches</td>
</tr>
<tr>
<td></td>
<td>Transoral robotic surgery (TORS)</td>
</tr>
<tr>
<td>Closure</td>
<td>Healing by secondary intention</td>
</tr>
<tr>
<td></td>
<td>Primary closure (local suture)</td>
</tr>
<tr>
<td></td>
<td>Reconstruction</td>
</tr>
<tr>
<td></td>
<td>Regional flap</td>
</tr>
<tr>
<td></td>
<td>Free flap (plastic surgeon)</td>
</tr>
<tr>
<td>Neck dissection</td>
<td>Extent of ND</td>
</tr>
<tr>
<td></td>
<td>Levels (I-V)</td>
</tr>
<tr>
<td></td>
<td>Selective vs. radical</td>
</tr>
<tr>
<td></td>
<td>Laterality (unilateral/bilateral)</td>
</tr>
</tbody>
</table>

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

- **Partial glossectomy** = RANGE OF MOTION
  - Healing by 2° intention: best ROM
  - partial glossectomies + 1° closure: better ROM

- **(sub)Total glossectomy** = bulk

---

**Day of surgery**

**5 mos. postop**
Protuberant
Semi-protuberant
Flat
Concave

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

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From: Risk Factors Predicting Aspiration After Free Flap Reconstruction of Oral Cavity and Oropharyngeal Defects

- Post-swallow aspiration residue
- Post-RT inefficiency
- BOT as "pump" (McConnel et al. Lscope 1988)

THE JAMA NETWORK

<table>
<thead>
<tr>
<th>Table 1: Outcomes of Aspiration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preoperative</td>
</tr>
<tr>
<td>Residue Free</td>
</tr>
<tr>
<td>Residue Present</td>
</tr>
<tr>
<td>Residue Present</td>
</tr>
</tbody>
</table>

ABBREVIATIONS: RT, radiotherapy.

- Post-swallow aspiration residue
- BOT as "pump" (McConnel et al. Lscope 1988)

Partial laryngectomy

- Post-laryngectomy
- Post-vertial partial
- Post-conflaccy

- Post-supraglottic
- Post-supraorbital

15
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

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

expect (and address) post-surgical edema

Lymphedema
Functional impact?
H&N Lymphedema Therapy Program

**Intensive Phase + home program**

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

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

- n=733
- 60% CDT responders
- Improvement (p<0.05)
Radiation-Associated Dysphagia “RAD”

Safety  Efficiency

“Organ preservation”

VA Laryngeal Cancer Study

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**

![Graph showing patient-reported symptoms during RT](image1)

**Chest X-ray of oropharyngeal cancer adding to reduced dysphagia:**

**Reduced dose radiation and its impact on dysphagia.**

![Graph showing reduced dose radiation and dysphagia](image2)

**Floor of mouth (suprahyoid) muscle dose predicts RAD in OPC survivors (n=349)**

![Graph showing floor of mouth muscle dose and RAD prediction](image3)
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**

**RAD**

- **Mechanics**
  - Laryngeal closure
  - Bolus push
  - Esophageal opening

- **Structure**
  - Edema
  - Defect
  - Stricture

- Aspiration
- Residue
Dysphagia is not always stricture after RT

Collaborative management: the esophagus

Management of stricture

Gastroenterology (GI) or ENT/HNS

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

- 4-41 HNC survivors
- ≥12M post RT NED
- Sham controlled RCT
  (EGD +/- dilation)

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

Stricture: common symptoms

“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?)
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

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

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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)

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Lower cranial neuropathy (LCNP) as rare late effect of RT – 5% incidence
IX, X, XII nerves, median latency 8 years (n=59 IMRT OPC survivors)


overall survival
97% at 10 years

incidence LCNP
5% (median FU 6 years)
Denervation source?

Chemotoxicity

Compressive (peripheral axonal)

Brainstem nuclei

Late Dysphagia

“Late-RAD”

- Significant inefficiency
- Refractory aspiration
- Progressive dysfunction
- Secondary pneumonia

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

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

n = 889 OPC survivors

Median 7 year survival time

4% incidence of LCNP

MD Anderson Symptom Inventory-Head and Neck Module (MDASI-HN) survey responses

Late-RAD

Pre-RT  1 year  7 years

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

MD Anderson

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

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

**Pharyngeal dose**
- >50 Gy
- 20-30 Gy

**Laryngeal dose**
- >50 Gy
- 20-30 Gy

**Dose-response varies over time**

**Late-RAD**
Dose-dependent

**Dose-response varies over time**

**Late-RAD**
Dose-dependent

**Dose-response varies over time**

**Late-RAD**
Dose-dependent
### 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>


### Evaluating 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 Dysphagia Evaluation Protocol

**MBE**
- Efficiency
- Penetration-aspiration
- Pathophysiology

**Functional status scale**
- **Dysphagia**
- **Eating in Public**

**Patient-reported outcomes (PROs)**
- **MDADI**
- **MD Anderson Functional Status Scale**
- **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 (occasional repetition)
  - 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

** clinician-rated**
- Semi-structured interview
- 3 items
- NCCN recommended
- Best = 100, Worst = 0
- Don’t average the score

**MD Anderson Dysphagia Inventory**

- 20-item PRO

- **Scores**: 100 = Best, 0 = Worst

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


**MD Anderson Dysphagia Inventory**

- 20-item PRO

- **Scores**: 100 = Best, 0 = Worst

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

Quantifying MBS?

Function
- Safety
- Efficiency

Pathophysiology
- Kinematics
- Timing

- Penetration/Aspiration
- Residue
- DIGEST

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

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

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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
Dynamic Imaging Grade of Swallowing Toxicity (DIGEST)

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- 5-point severity staging, CTCAE benchmarks
- Safety (Pen-Asp) vs Efficiency (residue) interaction
- For therapy profiling! (see: S1 E4 D3)

Hutcheson KA, et al. (2017) Cancer

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>0</td>
<td>Tube dependent</td>
</tr>
<tr>
<td>1</td>
<td>Tube dependent with minimal attempts of food or liquid</td>
</tr>
<tr>
<td>2</td>
<td>Tube dependent with consistent void of food or liquid</td>
</tr>
<tr>
<td>3</td>
<td>Tube dependent with minimal attempts of food or liquid</td>
</tr>
<tr>
<td>4</td>
<td>Tube dependent with consistent void of food or liquid</td>
</tr>
<tr>
<td>5</td>
<td>Oral diet of single consistencies</td>
</tr>
<tr>
<td>6</td>
<td>Oral diet of multiple consistencies, but special preparation or compensation</td>
</tr>
<tr>
<td>7</td>
<td>Oral diet of multiple consistencies, without special preparation or compensation, but with specific food limitations</td>
</tr>
<tr>
<td>8</td>
<td>Oral diet with no restrictions</td>
</tr>
</tbody>
</table>


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

<table>
<thead>
<tr>
<th>Level</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Tube dependent</td>
</tr>
<tr>
<td>2</td>
<td>Tube dependent with minimal attempts of food or liquid</td>
</tr>
<tr>
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</table>


Other swallowing questionnaire options

EAT-10

Sydney Swallow Questionnaire (SSQ)

SWAL-QOL
Adjunctive functional measures

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

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

- Mucositis, odynophagia, mucus
- ↓ oral intake
- Disuse atrophy?

Preventive swallowing therapy

- Eat

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

<table>
<thead>
<tr>
<th>Study</th>
<th>Setting</th>
<th>Outcomes</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>Shorter duration PEG (OPC &amp; HP)</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>Uspa</td>
<td>Retrospective</td>
<td>Superior diet feeds (5-6M after CRT)</td>
</tr>
</tbody>
</table>

**Cochrane review** (Perry, 2016) → inconclusive

**Meta-Analysis** (Grecco, Martino, 2018) → benefit

Cochrane review (Perry, 2015) → inconclusive

**Use it or lose it:**

**Eat and Exercise during Radiation**

(Hutcheson, Bhayani, Beadle, Gold, Shinn Lai, Lewin. *JAMA‐OtoHNS* (2013))

Exercise

Eat

(Hutcheson, Bhayani, Beadle, Gold, Shinn Lai, Lewin. *JAMA‐OtoHNS* (2013))
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%


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

Use it or lose it: 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)
H&N cancer patients with cancers of oral cavity, larynx*, pharynx (OPC, NPC, or HP), or_UPC dispositioned to receive bilateral neck RT ± chemo.

- T1-2 N0 TVF receiving narrow field excluded (unless age > 80)

Pathways work!
Danse Head and Neck Pathway
Greater Baltimore Medical Center

Source: MD Anderson Cancer Center, Section Speech Pathology & Audiology
mid-RT 6-8 weeks
post end-RT

Clinic

Counsel

eXercise

Clinic

H2O screen

eXercise

Clinic

CSE

MD&A Anderson OPC and Radiation Swallowing Pathway

H&N cancer patients with cancers of head, neck, lung*, primary OPC, NPC, or HPV, or OPC obstruction to receive bilateral neck RT ± chemotherapy. Note: 2.5 MOF non-malignant head and neck condition (eg, SFT)

MD Anderson OPC and Radiation Swallowing Pathway

H&N cancer patients with cancers of head, neck, lung*, primary OPC, NPC, or HPV, or OPC obstruction to receive bilateral neck RT ± chemotherapy. Note: 2.5 MOF non-malignant head and neck condition (eg, SFT)

MD Anderson

Proactive exercise training

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

Mendelsohn

Jaw/FOM stretch

Supraglottic

Masako

Effortful

3 sets, 10 reps

Source: International Radiation Associated Dysphagia Working Group

MD Anderson

EAT – Eat All Through Radiation

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

EAT diet staircase (food hierarchy)

Mealtime routine

Source: International Radiation Associated Dysphagia Working Group
MD Anderson Radiation Swallowing Pathway

H&N cancer patients with cancers of oral cavity, larynx*, pharynx (OPC, NPC, or HP), or UPC dispositioned to receive bilateral neck RT ± chemo

PRE end-RT
Clinic
 Counsel
 exercise
Clinic
 H2O screen
 exercise
Clinic
 CSE
 exercise
Clinic
 MBS FU

MDADI
MBS

H&N cancer patients with cancers of oral cavity, larynx*, pharynx (OPC, NPC, or HP), or UPC dispositioned to receive bilateral neck RT ± chemo

mid-RT 6-8 weeks
post end-RT
3-6 months
post end-RT
18-24 months
post end-RT
5 years
post end RT

Dysphagia in HNC (Hutcheson, Vanderbilt Medical SLP Course | 2019)
Source: MD Anderson Cancer Center, Section Speech Pathology & Audiology

If functional swallow: "maintenance" education

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"
PSS-HN
Clinic

MBS FU
Clinic

MBS FU
Memorial Sloan Kettering Cancer Center, Annual Digest, December 2019

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

Electrical stimulation for RAD?

R01 funded multi-site RCT:
• Clinical: RAD (6-8 weeks post RT or CRT)
• 2 arms:
  – Swallow exercise & stretching + biofeedback
  – Swallow exercise & stretching + sham biofeedback
• 6 month intensive home program:
  – BID, 6 days/week

Primary aim: NS effect NMES

Table 2. Summary of randomized controlled trials

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

Electrical stimulation for RAD?
Efficacy of popular therapies for RAD
“home program therapies”

 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!

More intensive options for persistent/chronic/late dysphagia

<table>
<thead>
<tr>
<th>mobility</th>
<th>strength</th>
<th>skill</th>
</tr>
</thead>
<tbody>
<tr>
<td>ROM exercise</td>
<td>Biofeedback</td>
<td>Tongue press</td>
</tr>
<tr>
<td>Myofascial release</td>
<td>Biofeedback assisted skill training</td>
<td>&quot;e-stim&quot;</td>
</tr>
<tr>
<td>Electrical stimulation</td>
<td>&quot;NMES&quot;</td>
<td>&quot;Vital Stim&quot;</td>
</tr>
<tr>
<td>&quot;AmpCare&quot;</td>
<td>&quot;IOPI&quot;</td>
<td>&quot;iPRO – Swallow Strong&quot;</td>
</tr>
<tr>
<td>&quot;RST&quot;</td>
<td>&quot;bioFEESback&quot;</td>
<td>&quot;HRM&quot;</td>
</tr>
</tbody>
</table>
| "sEMG" | | }
More intensive swallowing therapies for persistent/chronic late dysphagia

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

Progressive resistive functional exercise program

- "Mass practice"
  - Intensive, daily
  - QD or BID
  - 2-3 weeks
- FUNCTIONAL task = swallowing
- Intensity over time = progressive, resistive swallowing (exercise) paradigm
- Home carry-over (8-8 wks)

MDACC Boot Camp Experience
sEMG and/or MDT (n=29)

Global Composite

20 40 60 80

Mean MDADI scores

Pre PrePre Pre
Post Post Post Post

{p=.05 {p=.08 {p=.12 {p=.21

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

Pre-Post Pen-Asp Scores.
Penetration-Aspiration scale scores pre-post boot camp (Δ0, p=0.999)

QOL improves (efficiency) (adaptation)

Aspiration persists


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

Avoid pneumonia

Keep eating

Downstream targets respiratory system?

- Respiratory pattern training (Martin-Harris, 2014)
- Expiratory muscle strength training - EMST (Kajastia, 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)

57%↑, p<0.001


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
Female: 2 (13%)
Male: 13 (87%)
Age, median (range): 67 (37-79)
Survival time, median (range): 98 (2-192)

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

Sex
Female
Male
2 (13%)
13 (87%)

CROM significantly improved after single session

All 15 improved CROM
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)

Manual Therapy for Fibrosis-Related Late Effect Dysphagia in Head and Neck Cancer Survivors: The Pilot MANTLE trial (2018-0052, NCI R21CA226200)

Myofascial release
Massage
Passive and active ROM

Manual therapy
Pre MT
Post MT
Pre-washout
Post-washout

“lift your head as high as you can”
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
- PSS-HN (Diet, Eating in Public)

Patient-reported outcomes (PROs)
- MDADI
- Functional status scale
- PSS-HN (Diet, Eating in Public)
- MDADI

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

MDAnderson DIGEST

- MBS tool (pharyngeal dysphagia)
- 5-point severity staging
- CTCAE benchmarks
- Safety (Pen-Asp) x Efficiency (residue) interaction
- FOR BOOT CAMP 4 predlowl (av: 51-54 C0)
**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: ___)

**Functional therapy phase (boot camp)**

- McNeil Dysphagia Therapy Program (start level: ___)
- sEMG biofeedback swallows
- bioFEESback

**History**

- 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

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Dysphagia in HNC (Hutcheson, Vanderbilt Medical SLP Course | 2019)
**Swallowing BOOT CAMP**

- **Mass practice**
  - Intensive, daily
  - QD or BID
  - 2-3 weeks
- **FUNCTIONAL task = swallowing**
- **Intensifies over time = progressive, resistive 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**

**McNeill Dysphagia Therapy Program (MDTP)**

- Mass practice
- Food hierarchy
- Strengthening & coordination
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: Functional Outcomes Post-Bootcamp</th>
<th>Device-driven (sEMG biofeedback)</th>
<th>Bolus-driven (McNeill “MDTP”)</th>
</tr>
</thead>
<tbody>
<tr>
<td>cough</td>
<td>Device</td>
<td>25%</td>
</tr>
<tr>
<td>T2N2 NPC</td>
<td>Tube removal</td>
<td>27%</td>
</tr>
<tr>
<td>Dysphagia recovery (per FESS)</td>
<td>12%</td>
<td>75%</td>
</tr>
<tr>
<td>Continued aspiration</td>
<td>62%</td>
<td>35%</td>
</tr>
</tbody>
</table>

T2 N2 NPC

- No pneumonia
- MDADI > 55
- PSSHN > 50
- Oesophagoscopic or radiologic aspiration
- Hemitongue paresis, atrophy, fasciculation

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

Post-boot camp (MDTP)

5-months later

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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!

Reflections on boot camp for late-RAD

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 (RRfixed, 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 aspirators)
- Cranial nerve exam → prefer endoscopy
- Manometry

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

What else?

![Diagram of upper respiratory system]

Late RAD:

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

Table 1: Comparison of Swallowing Related Outcomes before and after Total Laryngectomy

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Before TL (n=24)</th>
<th>After TL (n=24)</th>
<th>P-value</th>
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<tr>
<td>Swallowing disorder</td>
<td>11 (46%)</td>
<td>2.25</td>
<td>&lt;0.001</td>
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<td>15 (63%)</td>
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Considerations:
- Pre-TL function: CN exam, stricture, trismus
- Extent TL: flap?

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

Table 2: Comparison of Swallowing Related Outcomes before and after Total Laryngectomy

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Assessment:
- NPO, silent or not
- NPO, TEP → among others, NPO successful

* Thresholds:
  - FEES: 0.01, silent (1); very silent, silent (2)
  - Phase 1: day 1
Conclusions

- 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