

ABCs of ACDF: Pre-Operative to Outpatient Care

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Disclosures

Bethany A. Berry

Financial:

- Serves as a consultant to and receives compensation from Guidepoint Global
- Bethany is an employee of Ephraim McDowell Health and has provided education for ACDF patients during their pre-operative spine education program.

Nonfinancial:

- Committee member for the Technical Advisory Committee for Medicare and Medicaid Services
- Awards and Grants Chair for the Kentucky Speech-Language-Hearing Association

Product Disclosure:

- No product disclosures

Disclosures

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Financial:

- Mindy is an employee of Ephraim McDowell Health and provides education for ACDF patients during their pre-operative spine education program.

Non-financial:

- No disclosures

Product Disclosure:

- No disclosures

Disclosures

Michele Zapanick-Brown

Financial:

- Michele is a employed by Ephraim McDowell Health and is involved in pre-operative education of ACDF patients with EMH's Spine Education Class.

Nonfinancial:

- Member of the Kentucky Speech-Language-Hearing Association Scholarships and Grants Committee

Product Disclosure:

- No disclosures

Agenda

Part 1

- Anatomy and Physiology
- Risks/Complications of ACDF surgery
- Program Development

Break

Part 2

- Program Development Cont.'d
- Evaluation and treatment
- Case Studies

Learner Outcomes

- Participants will identify pertinent anatomy and physiology with regard to surgical changes pre-and post-ACDF.
- Participants will identify evaluation methods and treatment options as it pertains to ACDF.
- Participants will demonstrate basic understanding of development of an ACDF spine education voice and swallowing program at their facilities.
- Participants will describe possible causes of swallowing and voice deficits post operatively.

Introduction to ACDF

- Anterior Cervical Discectomy and Fusion
 - also referred to as Anterior Cervical Spine Surgery (ACSS) in the literature
- Common surgical treatment for degenerative disc disease, cervical spondylosis, severe neck pain, herniation, spinal stenosis, and cervical spine myelopathy.
 - Pathophysiology of deficit
 - Symptoms: persistent neck, shoulder, and arm pain; numbness and tingling in hands/arms. Symptoms impair patients ability to work and sleep
- Introduced in the 1950s and has been a widely accepted surgical procedure to restore disc height and stability as well as neural decompression.
- History of the surgical procedure (Song & Choi, 2014)

Introduction of ACDF

- Surgery is only considered after non-surgical treatments unless symptoms are rapidly progressing leading to permanent or irreversible spinal cord damage. (Kamani et al, 2016)
 - Anti-inflammatory medications
 - Traction
 - Physical therapy

Anatomy & Physiology

- Phases of the swallow
 - Oral, oral prep
 - Pharyngeal
 - Esophageal
- Orientation of structures in the cervical spine area
 - Trachea, larynx
 - Esophagus
 - Cervical spine (C1-C7)
- At-risk anatomy
 - Hypoglossal nerve (C3 level or above)
 - Glossopharyngeal nerve (C3 level or above)
 - Vagus nerve
 - Superior laryngeal nerve (C3-4 level)
 - Recurrent laryngeal nerve (C6 or below)
 - Non-recurrent laryngeal nerve

Vagus

- Longest cranial nerve
- Motor and sensory fibers
- Widest distribution in the body (neck, thorax, abdomen)
- Critical for swallowing, phonation, taste, involuntary muscle and gland control, etc.

Anatomy & Physiology

- Recurrent Laryngeal Nerve (RLN) is also known as the Inferior Laryngeal Nerve and originates from the vagus nerve
- RLN on the right side originate from the vagus nerve and loops around the right subclavian artery and ascends in the tracheoesophageal groove. It enters the larynx from behind the cricothyroid joint. The right RLN lies outside the tracheoesophageal groove near the C6-7 level. (Chen et al, 2014)
- RLN on the left side loops around the aorta and then ascends in the tracheoesophageal groove. The left RLN has a longer loop and is better protected in the tracheoesophageal groove. (Kahrman et al, 2007)
- All the intrinsic laryngeal musculature is supplied by the ipsilateral recurrent nerve (except cricothyroid which is supplied by the superior laryngeal nerve). The interarytenoid muscle receives bilateral nerve supply.

Posterior vs Anterior Approach

- Pathophysiology of post-operative dysphagia may be due to intraluminal esophageal pressure and esophageal mucosal ischemia (Mendoza-Lattes et al, 2008) or spinal cord dysfunction and pain (Radcliff et al, 2013).
- Posterior approach results in immediate post-operative dysphagia.
- Incidence of dysphagia is reportedly less frequent than with anterior approach.
- Posterior approach generally used with older patients.
- Resolution of dysphagia is similar when comparing these 2 approaches.
- Dysphonia and tetraplegia are other risks associated with posterior approach.

Laterality of Approach

- ACDF surgeries can be approached from the left or right side.
- Side of approach is typically dependent upon surgeon training and preference (hand dominance).
- Buetler and colleagues (2001) reported “no difference in incidence of clinically significant RLN symptoms with the side of surgical approach.

Variations Associated with Anterior Approach

- Single or multiple levels
- Corpectomy
- With or without instrumentation
 - PEEK spacer
 - Plating

Complications of Surgery

- Recurrent laryngeal nerve injury
 - Resulting in hoarseness, persistent cough, aspiration and dysphagia
 - Most common neurological complication
 - Etiology of dysphagia/dysphonia is not well understood
- Esophageal irritation, ischemia, perforation
- Adhesions
- Screw or plate migrations
- Prevertebral swelling
 - Peak swelling at POD #2, 3 with almost complete resolution at 6 weeks
- Hematoma
- Superior Laryngeal Nerve Palsy
- Pharyngeal diverticulum
- Direct surgical trauma
- Stretch induced neuropraxis

Risk Factors for Dysphagia and Dysphonia

- Gender
- Age
- Number of levels/length of surgery/C4-5 and C5-6 ACDF
 - Endotracheal tube mediated compression/displacement
- Presence of dysphagia/dysphonia prior to the surgery
- Use of plates (thicker plates associated with chronic dysphagia)
- Prior ACDF surgery
- Amount of neck extension during surgery

Patient Outcomes/Benefits of ACDF

- “A holistic approach to the education and support of patients undergoing ACDF surgery is recommended throughout the preoperative and postoperative periods.” (Fowler, et al 2005)
- Symptoms of cervical spine disease or trauma affect a person’s perception of health and interfere with function during ADLs.
 - Even short-term dysphagia and dysphonia may negatively impact self-perception.
- Outcome investigations exploring adverse effects of surgery including dysphagia, hoarseness, headaches, donor site pain indicate that dysphagia and hoarseness may adversely affect recovery and sense of well-being.
 - Emphasis on pre- and post-operative education by all healthcare providers
- Quality of Life outcomes(Alvin et al., 2015)
 - Male vs female
 - Age, ethnicity, smoking history, BMI, medication use, laterality of radiculopathy and level of surgery medications

Development of Spine Education Program

- Dysphagia education was added to existing Spine Education class at Ephraim once it was identified as a need
 - Class is obligatory for both upper and lower spine patients at EMH
- Initiated in March 2014 prior to Joint Commission survey for Gold Seal of Approval
 - “Innovative” program because of inclusion of dysphagia education (2014)
- Follow up phone calls were initially added as a program indicator/performance measure following ACDF surgery

Pre-Op Spine Education Class

- Basic overview of procedure
- Discussion of what to expect following surgery
 - Pt experiences may vary based upon how many levels completed and length of stay
 - Diet recommendations following surgery
 - When to expect the most amount of swelling
 - Sign/Symptoms of dysphagia and compensatory strategies during post-operative period
 - Speak with MD for pre-assessment for voice or dysphagia

Dysphagia following ACDF surgery

- Known as a common surgical complication following ACDF
- Incidence varies depending on the reference: 1-79% of individuals (Anderson & Arnold, 2013)
- Variation in literature for duration: complete resolution following 6 months up to 2 years depending on source
- Pay attention to clinical course and symptoms

Signs/Symptoms of Dysphagia

Discussion of most salient characteristics:

- Coughing/choking/strangling when eating/drinking,
- Difficulty taking whole pills,
- Lump-like/phelgm sensation in their throat (globus sensation)

Factors which Impact Swallowing Recovery

- Age
- Sex
- Revision/additional surgeries
- What level and how many levels

Recurrent Laryngeal Nerve (RLN) Injury

- Symptoms: hoarseness, vocal breathiness or fatigue, weak cough, dysphagia + aspiration
- How does it occur:
 - Direct surgical trauma, nerve division or ligature, pressure or stretching of nerve and post operative edema
- Incidence: 2-11% total with permanent injury ~ <1% to 3.5%

Rarer Complications

- Pharyngeal diverticulum
 - Different from forces which create a Zenker's diverticulum and these vary:
 - Possible increased incidence with revision → recurrent injury to pharyngeal wall,
 - Bone graft or hardware displacement,
 - Hx of neck abscess or peri-operative infection
 - Fistula as a result of surgery
 - Complaints include: persistent dysphagia, REGURGITATION, odynophagia, weight loss, globus sensation, fevers, weight loss, etc. (Allis, Grant & Davidson, 2010)

Rarer Complications

- Esophageal perforation
 - Incidence w/ and w/o instrumentation ranges between .25% and 1.49%
 - Typically occurs acutely during surgery and is repaired; however, delayed presentations usually include a dramatic clinical decline with mortality between 20-50%
 - multi-level ACDFs, hardware failure: graft extrusion, plate migration, screw pullout/loosening (Nathani et al, 2015)

“Common Sense” Strategies

- Small bites/sips,
- Thorough mastication of solids,
- Softer solids/purees until pt can tolerate regular solids,
- Optimal positioning-ACDF collar can be removed while sitting in the bed or bedside chair
- Multiple swallows
- Consulting a pharmacist if whole pill medications are a challenge

Appropriate Referrals

- Patients are encouraged to talk about their voice/swallowing at f/u appointments or call the office if they are having difficulty
- Most common referrals include:
 - GI specialist
 - Ears, nose and throat specialist
 - OP MBS/FEES or OP speech therapy

Questionnaire

- Patients fill out a questionnaire based upon the *Eating Assessment Tool-10 (EAT-10)*
- Provides SLPs background information on pt’s swallow fx and voice prior to surgery
 - Important factors include pre-existing dysphagia, attitudes toward their swallow fx, what impact voice deficits may have i.e. work, recreational activities

Incidence of Dysphagia Post ACDF

Dysphagia is one of the most common complications following ACDF

According to Anderson and Arnold,

- Incidence of dysphagia 1 week post ACSS is 1% to 79%
- Incidence of dysphagia in intermediate to long term post-op (i.e. 1-6 weeks) is 28-57%.

Etiology of dysphagia as it pertains to ACDF

Causes of oropharyngeal dysphagia according to operative approach and techniques	
Excessive or prolonged retraction	Esophageal edema, PPW edema, preventing full epiglottic deflection
Retraction	Denervation involving the glossopharyngeal nerve and the pharyngeal branch of the vagus nerve
Dissection or retraction of the longus colli muscle	Prevertebral soft tissue swelling

Note: While the above are influencing/contributing factors for dysphagia post ACDF, there is a general consensus we may never know direct cause of swallow dysfunction.

Modified from Anderson & Arnold, 2013

Characteristics of swallowing post ACDF:

- Edema of pharyngeal wall
- Impaired epiglottic inversion
- Decreased pharyngeal constriction
- Increased transit time
- Reduced hyolaryngeal elevation
- Reduced UES opening
- All resulting in increased aspiration
- Superior hyoid movement (Muss et al, 2017)

Clinical signs of dysphagia following ACDF

- Wet/gurgly voice after swallow
- Globus sensation
- Reflexive coughing
- Weight loss
- Added effort to chew or swallow
- Added time to chew or swallow
- Multiple swallows
- Recurring pneumonia

What to include during your clinical dysphagia evaluation...

- Patient history
- Physical examination including thorough oral motor examination
- Clinical dysphagia evaluation
- Bazaz Dysphagia Score/Functional Dysphagia Scale
- Eating Assessment Tool-10
- Instrumental assessment: VFSS/MBS, FEES

Bazaz Dysphagia Score

Severity of dysphagia	Episodes of swallowing difficulty (by patient report)	
	Liquid	Solid
None	None	None
Mild	None	Rare
Moderate	None or rare	Occasional (only with specific foods like bread or meat)
Severe	Present	Frequent (and with a majority of solids)

Adapted from Bazaz et al. 2002.³⁵

(Anderson & Arnold, 2013)

Eating Assessment Tool (EAT-10)

Circle the appropriate response

To what extent are the following scenarios problematic for you?	0 = No problem 4 = Severe problem				
1. My swallowing problem has caused me to lose weight.	0	1	2	3	4
2. My swallowing problem interferes with my ability to go out for meals.	0	1	2	3	4
3. Swallowing liquids takes extra effort.	0	1	2	3	4
4. Swallowing solids takes extra effort.	0	1	2	3	4
5. Swallowing pills takes extra effort.	0	1	2	3	4
6. Swallowing is painful.	0	1	2	3	4
7. The pleasure of eating is affected by my swallowing.	0	1	2	3	4
8. When I swallow food sticks in my throat.	0	1	2	3	4
9. I cough when I eat.	0	1	2	3	4
10. Swallowing is stressful.	0	1	2	3	4
Total EAT-10					

(Belafsky et al, 2008)

Treatment

Primary treatment interventions for oropharyngeal dysphagia include:

- Diet modifications
- Swallow function exercises
- Swallowing maneuvers
- Postural changes
- Behavioral Strategies
- Sensory input

Evaluation: Dysphonia

Incidence of dysphonia post ACDF

- Multiple authors have reported on incidence of hoarseness ranging from .3% to 51%.

- Bulger R.F., Rejowski, J. E., Beatty, R.A. (1985). Vocal cord paralysis associated with anterior cervical fusion: considerations for prevention and treatment. *Journal Neurosurgery*, 62: 657-661.
- Morpeth, J.F., William, M.F. (2000). Vocal fold paralysis after anterior cervical discectomy and fusion. *Laryngoscope*. 110:43-45.
- Winslow, C.P., Meyers, A.D. (2001). Dysphonia and dysphagia following the anterior approach to the cervical spine. *Arch Otolaryngol Head Neck Surg*. 127: 51-55.

Incidence of dysphonia-Literature Review

A study by Wai-Mun et al followed 176 patients who had ACDF by a single surgeon between 1/1992 and 12/1997. Seventy-four returned for follow up including 39 females and 35 males.

- Bazaz Dysphagia Score
- Dysphonia assessed via none, mild, moderate, severe.

Results:

- Dysphonia occurred in 23 patients (31.1%) in the early post-op period. Exact duration undetermined.
- Persisted in 14 patients; 18.9%.
- More common in females (11/39 patients, 28.2% vs 3/35 patients, 8.6%).
- Problems with singing were present in 1 patient pre-operatively and 16 patients at final review, 21.6%.
- Singing difficulties occurred more frequently if the C3-C4 level was included (4/7 patients; 57.1%) than if not (12/67 patients; 17.9%).

Etiology of dysphonia as it pertains to ACDF

Causes of dysphonia according to operative approach and technique	
Significant tension during lateralization of the larynx	RLN injury which can cause vocal fold paresis or paralysis
RLN stretch injury and/or compression injury	RLN injury
Concurrent intraoperative traction on both the RLN and pharyngeal plexus	RLN injury

Characteristics of Dysphonia post ACDF:

- Hoarseness
- Inability to hit high notes
- Inability to vary pitch
- Weakness of their singing voices

Wai-Mun, et al (2005)

Clinical Signs of Dysphonia Following ACDF

- Hoarseness
- Decreased pitch
- Decreased pitch range
- Decreased amplitude and projection
- Observation:
- Patient reports are consistent with evaluation findings

What to include during your clinical dysphonia evaluation...

- Patient history (location and # of levels, symptoms prior to and after sx, duration of symptoms, how far post op, etc)
- Physical examination including thorough oral motor examination
- Voice Evaluation
 - Vocal Hygiene
 - Vocal Activities
 - Environmental Issues
 - Reflux: See Reflux Symptoms Index (Belafsky, et al 2002)
 - Vocal Performer
 - Consensus Auditory-Perceptual Evaluation of Voice (CAPE-V)
 - Voice Handicap Index (VHI)

Laryngeal Performance/Acoustic
Pitch
Mean fundamental Frequency
Range

Amplitude

Shimmer/Jitter

*Laryngoscope/videostrobe-2013 study by Curry and Young showing, "PLE is a simple and effective way of screening patients for abnormalities prior to revision ACDF surgery."

Muscle Tension Assessment

Laryngeal Carriage

Breath Support/Respiratory

/s/: /z/ ratio

MPT

Postural Alignment

Other considerations: ASHA, Boone Voice Evaluation

The Reflux Symptom Index (Belasky et al, 2002)

Within the past month, how did the following problems affect you?	0 = No Problem 5 = Severe Problem					
Hoarseness or a problem with your voice	0	1	2	3	4	5
Clearing your throat	0	1	2	3	4	5
Excess throat mucus or postnasal drip	0	1	2	3	4	5
Difficulty swallowing food, liquids, or pills	0	1	2	3	4	5
Coughing after you ate or after lying down	0	1	2	3	4	5
Breathing difficulties or choking episodes	0	1	2	3	4	5
Troublesome or annoying cough	0	1	2	3	4	5
Sensations of something sticking in your throat or a lump in your throat	0	1	2	3	4	5
Heartburn, chest pain, indigestion, or stomach acid coming up	0	1	2	3	4	5

Consensus Auditory-Perceptual Evaluation of Voice (CAPE-V)

Voice Sample # _____

The following parameters of voice quality will be scored on a scale of 0 to 5 for the following tasks:

1. Sustained vowel, 10 sec. (1.0 sec. intervals)
2. Sustained vowel, 10 sec. (1.0 sec. intervals)
3. Sustained vowel, 10 sec. (1.0 sec. intervals)
4. 10 sec. vowel, 10 sec. (1.0 sec. intervals)
5. 10 sec. vowel, 10 sec. (1.0 sec. intervals)
6. 10 sec. vowel, 10 sec. (1.0 sec. intervals)
7. 10 sec. vowel, 10 sec. (1.0 sec. intervals)
8. 10 sec. vowel, 10 sec. (1.0 sec. intervals)
9. 10 sec. vowel, 10 sec. (1.0 sec. intervals)
10. 10 sec. vowel, 10 sec. (1.0 sec. intervals)

Legend: 0 = Normal, 1 = Slightly Abnormal, 2 = Moderately Abnormal, 3 = Severely Abnormal, 4 = Very Severely Abnormal, 5 = Extremely Abnormal

Overall Severity: _____ C I _____

Register: _____ C I _____

Timbre: _____ C I _____

Pitch: (Calculate the average of the above 4) _____ C I _____

Intensity: (Calculate the average of the above 4) _____ C I _____

Quality: (Calculate the average of the above 4) _____ C I _____

Comments about performance: _____

Additional comments: _____

Observer: _____

Table 3. Voice Handicap Index (adapted from Jacobson et al., 1997)

VHI-10 Functional aspect	
1) Do you have difficulty understanding your voice?	0/2/4
2) Do you have difficulty understanding people in noisy environments?	0/2/4
3) Do you have difficulty hearing your voice when you are alone?	0/2/4
4) Do you stop using the telephone because of your voice?	0/2/4
5) Do you avoid social gatherings because of your voice?	0/2/4
6) Do you have to be heard, repeated, or louder because of your voice?	0/2/4
7) Do you have to be heard, repeated, or louder because of your voice?	0/2/4
8) Do you have to be heard, repeated, or louder because of your voice?	0/2/4
9) Do you have to be heard, repeated, or louder because of your voice?	0/2/4
10) Do you have to be heard, repeated, or louder because of your voice?	0/2/4
11) Do you have to be heard, repeated, or louder because of your voice?	0/2/4
12) Do you have to be heard, repeated, or louder because of your voice?	0/2/4
13) Do you have to be heard, repeated, or louder because of your voice?	0/2/4
14) Do you have to be heard, repeated, or louder because of your voice?	0/2/4
15) Do you have to be heard, repeated, or louder because of your voice?	0/2/4
16) Do you have to be heard, repeated, or louder because of your voice?	0/2/4
17) Do you have to be heard, repeated, or louder because of your voice?	0/2/4
18) Do you have to be heard, repeated, or louder because of your voice?	0/2/4
19) Do you have to be heard, repeated, or louder because of your voice?	0/2/4
20) Do you have to be heard, repeated, or louder because of your voice?	0/2/4

(Jacobson et al, 1997)

Treatment

Dependent on individualized care plan.

- May include:
- Education/training regarding dx, prognosis, ACDF specific information
- Vocal hygiene
- Vocal modifications
- Vocal Function Exercises (Stemple et al, 1995)
- Resonant Voice Therapy
- Laryngeal massage*
- Symptomatic voice therapy

Know when to make appropriate referrals...

Real world implications....

Case Study: Patient A

- 53 yo female
- Had ACDF at levels C4-5, C5-6, C6-7, and removal of 5 bone spurs in July 2012
- Referred for OP ST evaluation on October 2012 secondary to persisting dysphonia

Outpatient voice evaluation:

Subjective reports:

Dysphagia with foods and liquids, no reported complications with ACDF sx, decreased pitch range, fatigue, difficulty with voice projection, and weakness. Pain at level 4 to 5 for back and shoulder pain

Objective:

Oral mechanism examination: unremarkable

Vocal hygiene: unremarkable

Vocal activities: occupational use of phone with headset ~70-80% of her 8 hour working day. Otherwise, nothing significant.

Environmental: Seasonal allergens (Singulair 10 mg)

Reflux: RSI of 13; taking Nexium at 40 mg qd

Vocal Performer: Voice Minor; performed since age 10; singing range is C below middle C and second G above middle C; theatre, Broadway, contemporary, Christian; Amplification with standard mic; uses vocal warm-ups and cool down regimen

VHI: Functional=15, Emotional=17, Physical=6

Laryngeal Performance:

s/z ratio =1.0

MPT=19.25

Pitch= Fundamental Pitch 133.08 (reduced for gender)

Pitch Range=Low 117.60 Hz and High of 484.64

Amplitude=58.25

Muscle Tension: Soreness to palpation of neck and shoulders

Breath Support: Excellent awareness to respiration. During community speaking tasks, reports mildly speaking on residual air.

Postural alignment: Excellent.

Patient goal: "I want to get as much of my singing voice back that I can and be able to talk to people with my voice like it used to be."

Plan:

1. Refer to ENT
2. Instrumental assessment for swallow function with goals added per results.
3. Vocal hygiene program
4. Vocal function exercises
5. Reflux precautions
6. Pitch and pitch range exercises-pitch pipe, Sona-Speech software
7. Manual technique/myofascial release to cervical and laryngeal area
8. Vocal intensity exercises
9. HEP

Monitor-respiration to phonation

Outpatient dysphagia evaluation:

Subjective reports

Reports coughing and "food going the wrong way" at OP voice evaluation resulting in referral for instrumental assessment.

Objective

MBS October 2012 revealing mild oropharyngeal dysphagia characterized by:

- Decreased oral control resulting in premature loss of the bolus,
- Multiple swallows,
- Decreased, but functional, base of tongue retraction,
- Decreased, but functional, hyolaryngeal elevation/excursion
- Flash penetration with thin via straw on ½ trials
- Cough following swallow of mechanical soft although no penetration/aspiration was observed.

Recommendations: Regular diet. Thin liquids. Avoid juicy/mixed consistencies. Upright during and 20 minutes after meals. Oral Care. Swallow exercises via OP ST for noted deficits.

Dysphagia evaluation in November 2012

Subjective reports:

-Takes extra effort to swallow; Foods sometimes get "stuck" in throat

Followed up with ENT with reports showing

- true vocal folds both adducted and abducted symmetrically to midline
- no polyps or nodules
- slight inflammation over the arytenoids consistent with known hx of LPR and
- no damage to vocal cords or RLN

Objective:

Results consistent with MBS findings noting mild oropharyngeal dysphagia. EAT-10 with a total score of 13.

Plan: OP ST for dysphagia targeting swallow function exercises concurrently with voice objectives.

At Discharge:

Patient had participated in treatment x 4 for dysphagia and x 8 for voice.

Dysphagia: She met her goals for dysphagia.

Voice: She made progress towards voice goals increasing vocal amplitude, decreasing vocal strain, tension, and fatigue. Vocal range improved but not at pre-surgery baseline.

Case Study: Patient B

- 77 year old male
- 7/3/17 – (office visit) diagnoses: cervicalgia, cervical spondylosis with myelopathy, spinal stenosis and cervical disc degeneration; C3-4, C4-5, C5-6, C6-7 affected per cervical MRI. Patient complained of 6 month history of chronic pain with worsening over the previous 6-8 weeks and "drastic deterioration daily for the last 2 weeks" per surgeon notes. Patient characterized pain as throbbing, constant, and aching in the cervical spine with radiation of pain to both arms. Pain rating was 7/10.
- Medical/surgical history included: HTN, glaucoma, macular degeneration, abdominal hernia repair, prostate cancer with surgical treatment, and left Achilles tendon repair,
- Patient was unable to attend the Spine Education Class prior to the surgery secondary to the "rapid progression of his symptoms". Surgery was scheduled 2 days after initial office visit.

Case Study: Patient B

- 7/5/17 – Tracheostomy performed by ENT secondary to multiple failed attempts at intubation.
- 7/6/17 – ACDF completed addressing the 4 levels previously noted
- 7/7/17 – SLP consulted for PMV and swallowing
 - Swallow screening completed; FEES recommended but declined by patient secondary to pain, lethargy. FEES scheduled for 7/10/17. Education provided regarding impact of ACDF and tracheostomy on swallowing function. Patient demonstrated significant increase in anxiety during attempts to swallow single ice chip presentations.
 - PMV evaluation completed. Patient tolerated finger occlusion but not PMV placement. On 7/8/17, ENT changed out trach tube to an uncuffed #6 Shiley. ENT placed purple PMV which the patient was able to wear comfortably that day during ambulation. He exhibited 100% intelligibility in conversation with PMV in place. Education provided regarding use and care of the device.

Case Study: Patient B

- 7/9/17 – Patient decannulated by ENT after tolerating 24 hours of plugging. ENT trialed Jell-O and ice chips.
- 7/9/17 – Patient discharged by spine surgeon stating that ENT indicated the patient able to swallow. Recommended follow-up outpatient MBS study at the time of discharge.
- 7/12/17 – Outpatient MBS study results and recommendations:
 - Patient exhibited a pharyngeal dysphagia with the following physiological impairments:
 1. Repetitive/disorganized tongue motion prior to oral swallow initiation which may be related to anxiety versus neurological deficit,
 2. Initiation of pharyngeal swallow with bolus head in the valleculae,
 3. Collection of lingual residual post swallow across consistencies,
 4. Reduced laryngeal elevation with reduced anterior hyoid excursion,
 5. Partial inversion of the epiglottis which may be the result of contact with posterior pharyngeal wall,
 6. Absent pharyngeal stripping wave,
 7. Minimal distention with marked obstruction of flow of bolus through the pharyngoesophageal segment,
 8. Reduced tongue base retraction,
 9. Majority of bolus remaining in the pharyngeal cavity (tongue base, valleculae, posterior pharyngeal wall, piriform sinuses) after initial swallow across consistencies.

Case Study: Patient B

MBS study results (continued):

- Aspiration with thin liquid
- Aspiration during cough after puree trial
- Esophageal return of nectar thick and puree
- Diffuse pharyngeal residual after all consistencies

Radiologist noted moderate soft tissue swelling and commented on choking sensation with all consistencies.

Recommendations: Instrumental exam in 1 week with education and intervention provided. Patient was admitted to the hospital that day.

Case Study: Patient B

- Inpatient stay:
 - Dobhoff placed; patient NPO with Free Water Protocol
 - SLP intervention included:
 - Free Water Protocol education and trials
 - Nectar thick liquid via spoon trials
 - FEES completed on 7/18/17
 - Moderate pharyngeal dysphagia with episodes of penetration and aspiration
 - Recommended removal of Dobhoff for intake of thin liquids with chin tuck (including supplemental nutrition drinks); dietary consult completed
 - 7/20/17 - PEG recommended by ENT secondary to inadequate intake. Patient in agreement with recommendation.
 - 7/21/17 - PEG placed. Patient discharged home with home health on 7/22/17. Patient lost to SLP follow-up.
 - 8/8/17 - Per ENT, patient working with home health SLP; NPO except sips of water. Wound from trach closed. Patient unable to consistently use chin tuck because of tightness in neck. Fiberoptic laryngoscopy revealed no edema, normal VF mobility. PEG removal anticipated in 2-3 months.

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Questions???