# Thickening Outside the Box – A Systematic Thickening Wean Protocol

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# Financial Disclosures

- Salaried staff at Michigan Medicine

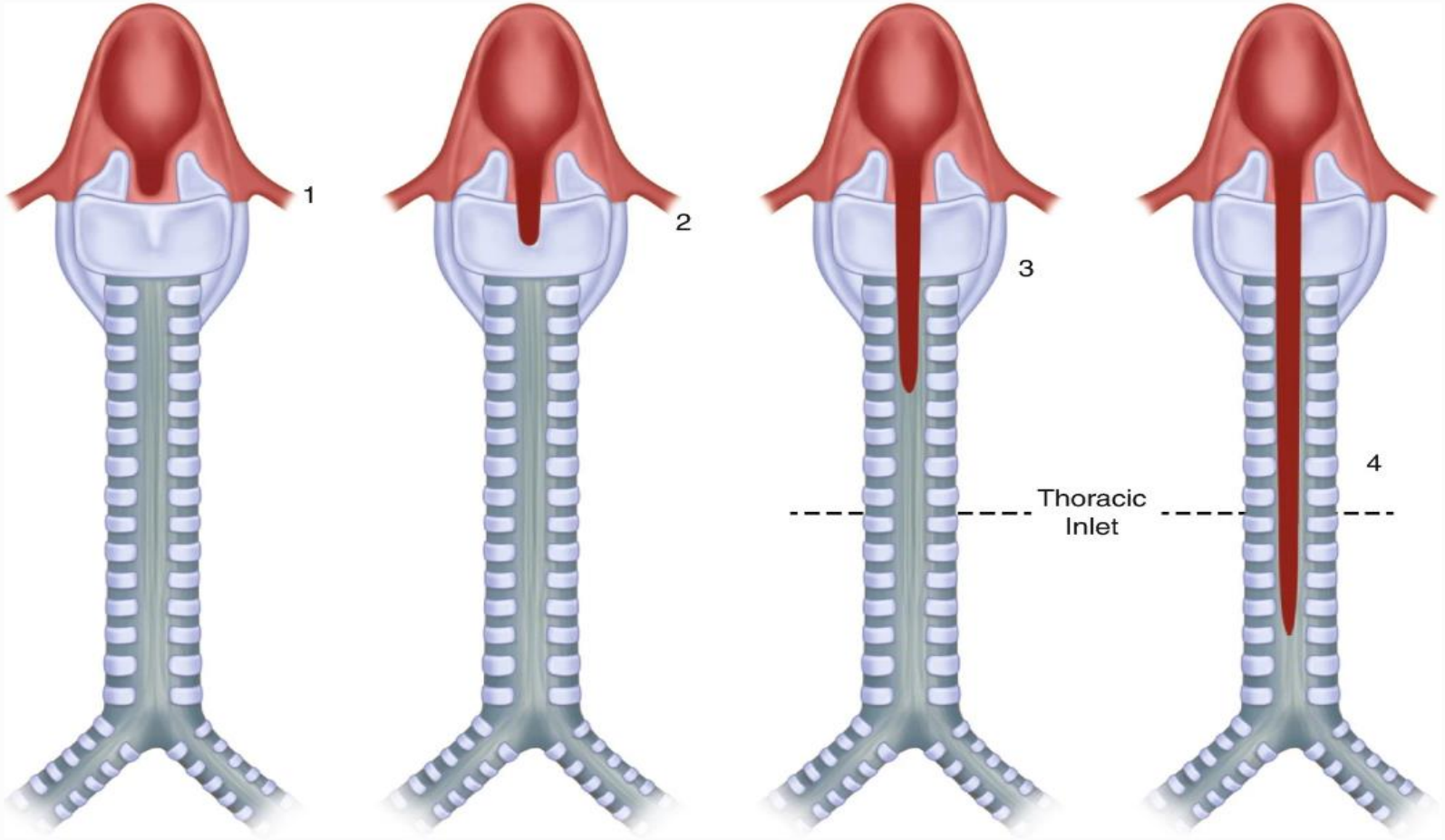
# AGENDA

1. Understanding of laryngeal cleft and potential impact on swallow function
2. Discussion of literature regarding thickening wean protocols
3. Review example of Thickening Wean Protocol
4. Case Studies

# Laryngeal Cleft

# Laryngeal Cleft

- Anatomic lack of separation between airway and swallowing pathway in the posterior midline of airway (Balakrishnan and Krein, 2020).
- Larynx and trachea not adequately separated from the esophagus.
- Different from tracheosophageal fistula (TEF).
- Begins at arytenoid cartilages/supraglottis, and extends inferiorly as a continuous cleft.




Benjamin-Inglis classification of laryngotracheal clefts. Type 1 is a supraglottic interarytenoid cleft. Type 2 is a partial cricoid cleft. Type 3 extends to cervical trachea. Type 4 extends to thoracic trachea (From Benjamin and Inglis [1], with permission)

# Signs and Symptoms – Martha et al 2021

Type I

- Choking during feeding/drinking (34%)
- Swallowing difficulties (19%)
- Recurrent respiratory infections (15%)
- Stridor (12%)
- Cyanosis during feeds (11%)
- Aspiration (5%)
- Cough (3%)
- Airway Compromise (0.2%)

# Signs and Symptoms – Martha et al 2021

Type II

- Stridor, aspiration and recurrent respiratory infections (18.5% each)
- Swallow dysfunction, cough (11% each)
- Choking during feeding/drinking, cyanosis during feeds (7% each)
- Airway Compromise, GERD (4%)

# Signs and Symptoms – Martha et al 2021

Type III

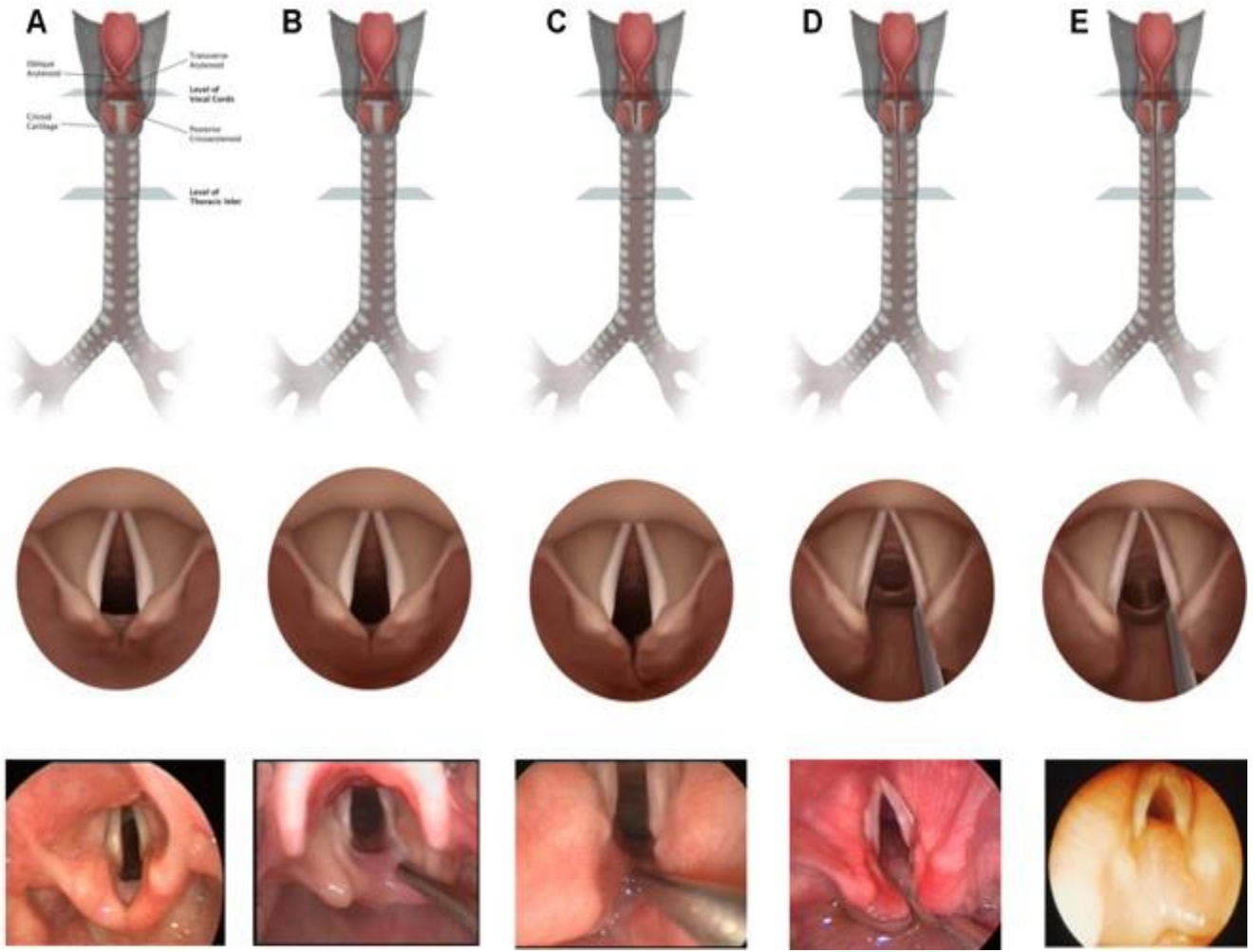
- Swallow Dysfunction (28%)
- Recurrent respiratory infections (22%)
- Stridor (17%)
- Aspiration (17%)
- Cough (11%)
- Airway Compromise (0.2%)
- Cyanosis during feeds (6%)

# Signs and Symptoms – Martha et al 2021

Type IV

- Swallow dysfunction, cough (57%)
- Aspiration (14%)
- Recurrent respiratory infections (14%)
- Stridor (14%)

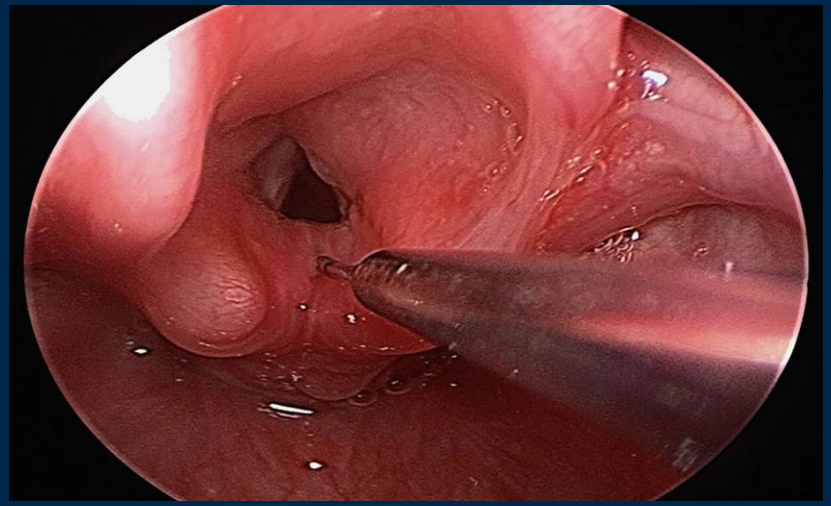
# Endoscopic View of Laryngeal Cleft

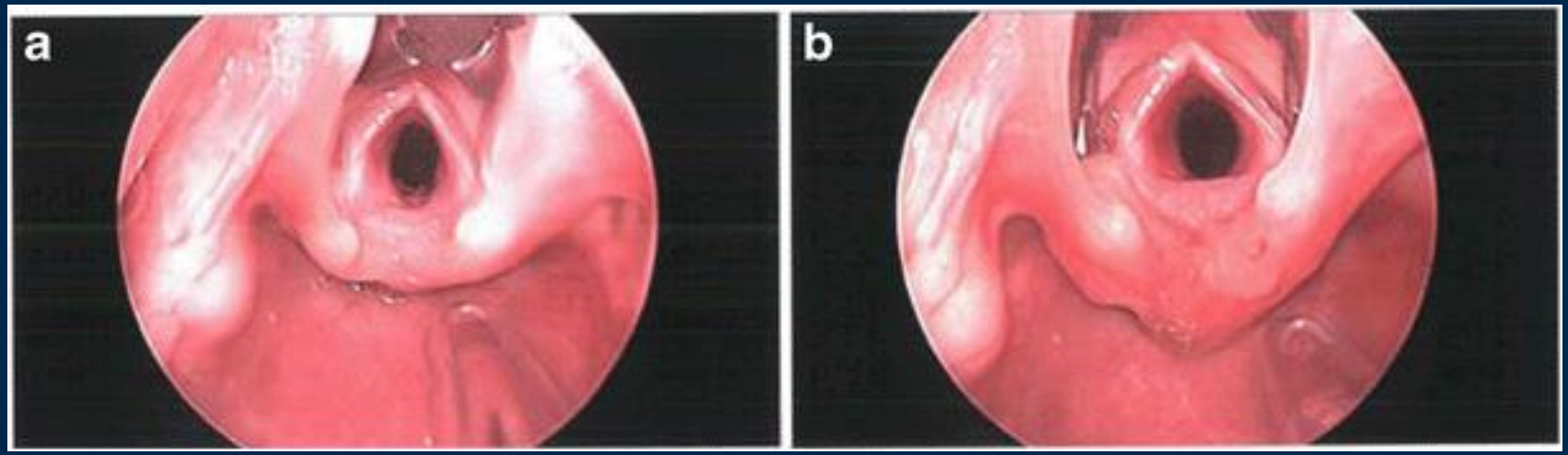


# Laryngeal Cleft Management

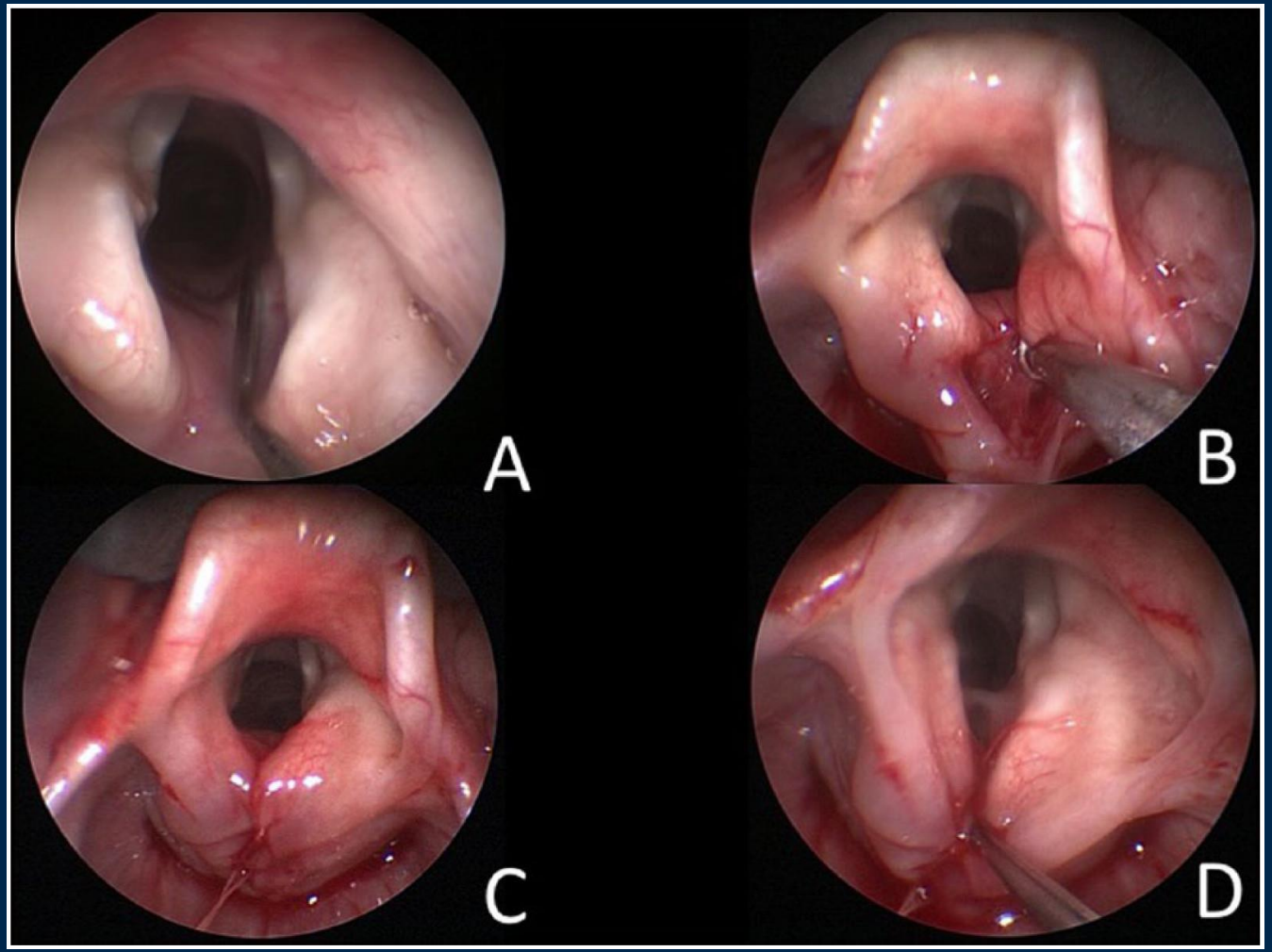
- Type I
  - Conservative/ non-surgical treatment
  - Injection laryngoplasty
  - Endoscopic surgical repair
- Type II
- Type III
- Type IV

# Prolaryn Injection





# Suture Repair



# Management of Type 1 Laryngeal Clefts: A Systematic Review and Meta-analysis – Timashpolsky 2021

- 27 studies met inclusion criteria

**Table 4.** Prevalence of Initial Presenting Symptoms.

| Sign or symptom | No. of studies | Prevalence, % | | $I^2$, % |
|---|---|---|---|---|
| | | Range | Pooled (95% CI) | |
| Aspiration | 19 | 9-100 | 56 (39-71) | 85 |
| Choking | 11 | 17-87 | 49 (36-62) | 75 |
| Cough | 15 | 19-100 | 44 (29-59) | 84 |
| Cyanotic attacks | 10 | 6-46 | 17 (11-25) | 52 |
| Dysphagia | 6 | 18-100 | 63 (40-82) | 67 |
| Failure to thrive | 6 | 6-29 | 9 (6-14) | 0 |
| Recurrent pneumonia | 14 | 13-100 | 42 (30-56) | 67 |
| Stridor | 15 | 4-83 | 28 (20-36) | 57 |
| Nasogastric tube | 7 | 18-80 | 28 (20-38) | 7 |
| Gastrostomy tube | 4 | 9-22 | 14 (9-21) | 11 |

**Table 3.** Prevalence of Patient Comorbidities.

| Comorbidity (No. of studies) | Prevalence, %, median (range) |
|---|---|
| GERD (18) | 59 (21-100) |
| Tracheostomy (6) | 17 (4-24) |
| Fundoplication (9) | 17 (8-22) |
| Prematurity (9) | 20 (13-50) |
| Neuro/developmental (16) | 10 (6-83) |
| Syndromic (10) | 14 (3-33) |
| Cardiac anomalies (11) | 13 (3-44) |
| Asthma (10) | 23 (6-63) |
| TEF (8) | 19 (5-36) |
| Laryngomalacia (8) | 31 (13-39) |

# Management of Type 1 Laryngeal Clefts: A Systematic Review and Meta-analysis – Timashpolsky 2021

- Results
  - Conservative Therapy
    - **52%** success rate with improving symptoms
  - Endoscopic Repair
    - **70%** success rate with improving symptoms
  - Injection Laryngoplasty
    - **36%** success rate with improving symptoms
- Key Findings:
  - ER had the greatest success in treating symptoms of type 1 LC in those who failed conservative treatment
  - IL can confer long-term improvement in symptoms without the need for definitive repair
  - Conservative treatment can manage the symptoms of up to 50% of patients with type 1 LC without the need for surgical intervention

# Management of Type 1 Laryngeal Clefts: A Systematic Review and Meta-analysis – Timashpolsky 2021

**Table 5.** Resolution of Aspiration on Thin Liquids.

| Treatment | No. of studies | Aspiration resolved, % (95% CI) | $I^2$, % |
|---|---|---|---|
| Conservative | 0 | — | — |
| Injection | 6 | 50 (25-75) | 81 |
| Endoscopic | 7 | 71 (56-83) | 48 |

**Table 6.** Resolution of Penetration on Thin Liquids.

| Treatment | No. of studies | Penetration resolved, % (95% CI) | $I^2$, % |
|---|---|---|---|
| Conservative | 0 | — | — |
| Injection | 4 | 28 (7-64) | 57 |
| Endoscopic | 1 | 22 (6-58) | 0 |

# A Systematic Process for Weaning Children with Aspiration from Thickened Fluids – Wolter et al 2018

- SWP
  - Method for transitioning from thickened liquids to a normal fluid diet
  - 10% reduction in thickness every 2 weeks
  - Consistency was maintained for 2 weeks until the next incremental change
  - Parents educated on signs/symptoms of aspiration and instructed not to progress to the next wean if signs were present
  - Individual calculations made based on type of thickening product being used and dysphagia severity
  - Clinical “check-in” every 4-8 weeks – more frequent follow-up with silent aspirators
  - “Success” – transitioned to thin liquids without signs of aspiration and stable pulmonary health

# A Systematic Process for Weaning Children with Aspiration from Thickened Fluids – Wolter et al 2018

- Retrospective review of patients evaluated at The Center for Airway Disorders who underwent SWP from 2010 – 2015 at Boston Children's
- 346 evaluated by SLP for Feeding/Swallowing concerns
- 91% participated in SWP – only 50 had follow up 4+ months
- Most common etiology of dysphagia - anatomic:
  - Laryngeal cleft
  - Laryngomalacia
  - VF dysfunction

# A Systematic Process for Weaning Children with Aspiration from Thickened Fluids – Wolter et al 2018

- 39 (78%) successfully weaned to thin liquids
  - Temporary stalls: 36%
  - 88% in total tolerated permanent reduction in fluid thickener
- Mean duration: 0.6 years
- Permanent stalls: 10%
  - None developed PNA
- 92% required <2 VFSS assessments
- Limitations
  - Imaging post thickener wean
  - Laryngeal cleft management pre- thickener wean?

Deep Interarytenoid Notch in Young Children Managed with Systemic Thickener Wean and Injection Laryngoplasty – Basharat et al 2019

- Clinical outcomes of patients treated with both IL and Thickener Wean Protocol (TWP)
  - Major comorbidities excluded
- Study inclusion: 13 patients
  - Mean age: 21 months
- Average time between IL and starting TWP – 42.2 days
- All patients received MBS
  - 7 demonstrated aspiration; of those, 4 were silent
  - 6 demonstrated penetration
- Overall reduction in thickener: 3.61 (baseline pre-treatment of 5.76)

# Michigan Medicine TWP

# Gradual Thickener Wean Protocol

| ELIGIBLE FOR WEAN | NOT ELIGIBLE FOR WEAN |
| --- | --- |
| • Laryngeal cleft or interarytenoid groove s/p injection or suture repair<br>• Vocal fold paresis<br>• Pre-op VFSS, in which child passed VFSS for at least mod thick liquid. Ideally will have one in previous 6 months.<br>• Reliable family follow up<br>• Portal access (Or willingness to get portal access)<br>• *Silent aspirators are not excluded from this wean, but will require more frequent, closer follow up | • Severe cardiopulmonary issues, unstable respiratory status, multiple complex comorbidities with potential to impact swallow<br>• Unreliable caregiver follow up<br>• Children who failed VFSS for all liquid consistencies |

# Gradual Thickener Wean Protocol

PROTOCOL:

- Child to remain on baseline diet for ~2-4 weeks post **injection**; 4-6 weeks post **suture.**
- **Post-op VFSS ~2-4 weeks post injection; 4-6 weeks post suture repair**
- At VFSS SLP to create POC at that time for follow-up
  - Update least restrictive diet
- Schedule follow up virtual visits (every 2 weeks, or more frequent as needed)
- FEES as needed to coordinate with Oto follow up
- Utilize/score (caregiver to communicate score with SLP via portal and/or scheduled phone call) the Dysphagia and Aspiration Questionnaire: (Table 1) every 2 weeks with reduction in thickener

# Gradual Thickener Wean Protocol

| | | | | | |
|---|---|---|---|---|---|
| Cough | 0 | 1 | 2 | 3 | 4 |
| Cough with food | 0 | 1 | 2 | 3 | 4 |
| Cough with liquid | 0 | 1 | 2 | 3 | 4 |
| Night time cough | 0 | 1 | 2 | 3 | 4 |
| Nasal congestion | 0 | 1 | 2 | 3 | 4 |
| Chest congestion | 0 | 1 | 2 | 3 | 4 |
| Wheezing | 0 | 1 | 2 | 3 | 4 |
| Choke with food | 0 | 1 | 2 | 3 | 4 |
| Choke with liquid | 0 | 1 | 2 | 3 | 4 |
| Choke without feed | 0 | 1 | 2 | 3 | 4 |
| Gag with food | 0 | 1 | 2 | 3 | 4 |
| Gag with liquid | 0 | 1 | 2 | 3 | 4 |
| Gag without feed | 0 | 1 | 2 | 3 | 4 |
| Vomit | 0 | 1 | 2 | 3 | 4 |
| Feeding refusal | 0 | 1 | 2 | 3 | 4 |
| Wet voice | 0 | 1 | 2 | 3 | 4 |
| Hoarse voice | 0 | 1 | 2 | 3 | 4 |

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(0-never, 1-monthly, 2-weekly, 3-daily, 4-multiple times per day). Ongoing assessment: Establish baseline score first visit for TWP, goal for child to not exceed baseline score on follow up questionnaires. If scores 3 or higher on any red item, further discussion with SLP Team before proceeding.

# Gradual Thickener Wean Protocol

- If tolerating with agreed upon criteria score, reduce thickener level (Table 2):

**TABLE 2: SYSTEMATIC WEANING PROCESS REGIMEN**

| Decreasing Thickness<br>**Mildly-Thick Recipe = 1 Tablespoon Infant Cereal per 2 oz Fluid** | Recipe<br>Thickener, tsp | <br>Fluid, oz |
|---|---|---|
| Mildly thick | 9 | 6 |
| Less than mildly thick | 8 | 6 |
| | 7 | 6 |
| | 6 | 6 |
| Half-strength (50%) mildly thick | 5 | 6 |
| Less than half strength | 4 | 6 |
| | 3 | 6 |
| | 2 | 6 |
| | 1 | 6 |
| Thin liquid | 0 | NA |
| **Mildly-Thick Recipe = 1 packet SimplyThick (Mildly) per 4 oz Fluid** | **Thickener, Packets** | **Fluid, oz** |
| Mildly Thick | 1 | 4 |
| Less than mildly thick | 1 | 5 |
| | 1 | 6 |
| | 1 | 7 |
| Half-strength (50%) mildly thick | 1 | 8 |
| Less than half strength | 1 | 9 |
| | 1 | 10 |
| | 1 | 11 |
| | 1 | 12 |
| Thin liquid | 0 | NA |

# Gradual Thickener Wean Protocol

- Reduce by 10% (drop down a number on above example)
- Instruct parents to then reduce by 10% every 2 weeks following review and scoring of Dysphagia and Aspiration scale with SLP
- If s/s of aspiration with reduction in thickener, return to previously tolerated consistency until further contact/evaluation by SLP.
- If they stall for more than 3 months; refer back to Oto and repeat VFSS
- If successful with wean to thin with no s/s of aspiration, follow up only if there are concerns.
    - Ideally only one VFSS post-procedure
    - Silent aspirators will have VFSS or FEES at end of wean

# Michigan Medicine Thickener Wean Outcomes

- Started November 2022 – present (April 2024)
- 22 total participants
- 9 in process currently
- 2 did not follow up
- 7 did not tolerate (of these with Type 1 laryngeal cleft, other comorbid dx including Trisomy 21, h/o prematurity, hypotonia, etc were involved)
- 4 successfully weaned to thin liquid (2 of which were Type 1 laryngeal cleft with no other medical dx)

# Case Studies

# Case Study 1

- Medical History: Interarytenoid injection augmentation at 1 year of age
  - Wet/gurgly vocal quality as infant, prompted VFSS, demonstrated silent aspiration was on mild and moderately thick liquid for nearly 4 years
  - Family moved to MI, most recent VFSS at OSH demonstrated persistent deep laryngeal penetration with thins, recommended slightly thick and TWP
  - Family established care with Oto clinic and SLP at MM, initiated TWP in September 2023, child was 5 years old at this time
  - Initial recipe was: 1 packet mildly Simply Thick to 8 ounces of liquid
  - Advanced to 1 packet mildly to 12 ounces
  - Other family members had medical issues, stalled wean for ~6 weeks, when contacted child was on thin liquid
  - Repeat VFSS March 2024: no laryngeal penetration no aspiration

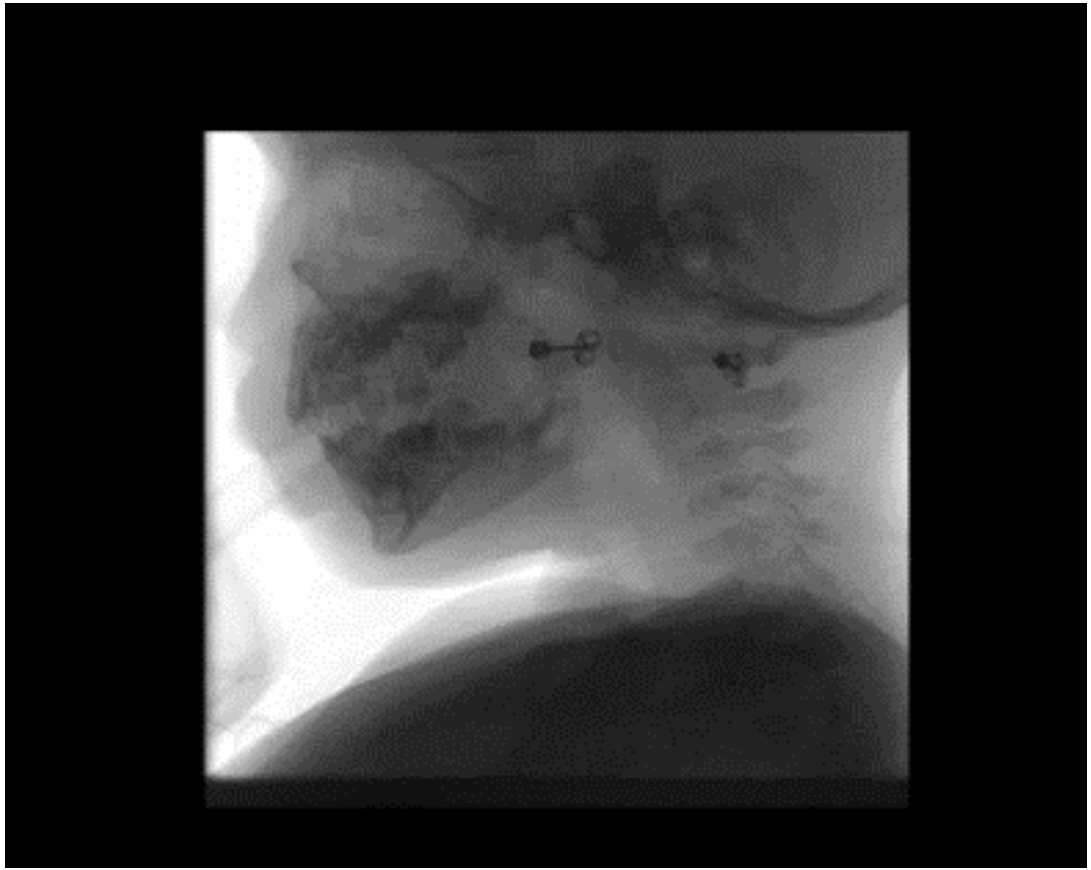
# Case Study 2

- Medical history: GERD, left vocal fold hypomobility (resolved) of unknown etiology, and oropharyngeal dysphagia with aspiration s/p direct laryngoscopy and bronchoscopy with Prolaryn injection (Type 1 laryngeal cleft) on 10/03/2022 with persistent aspiration of thin liquids.
    - Initiated TWP (child was 11 m.o.), was not able to advance without increase in symptoms
- She underwent direct laryngoscopy and bronchoscopy with left vocal fold injection, laryngeal EMG and an EGD on 5/23/2023 in coordination with an MRI. A repeat VFSS was performed on 6/19/2023, which showed no aspiration of mildly thickened liquids although results were limited.
    - Due to limited results and length of time on thickened liquids, participation in TWP initiated again
    - Starting recipe: 10mL (~2 teaspoons) of oatmeal to every once of liquid (mod thick); age at start of wean: 19 m.o.
    - Able to advance well thru wean, June 2023-December 2023, transitioned to true thin

# Case Study 2

Initial VFSS:

- Pharyngeal phase dysphagia R13.13 characterized by silent aspiration of  Thin Liquids and Nectar Thick Liquids during the trigger of swallow. The safety of her pharyngeal swallow function was not improved with these consistencies despite trial of right side lying position given known left vocal fold immobility and variety of flow rates to improve respiration/coordination. Based on these findings, recommend transition to moderately thickened liquids PO (as demonstrated safety with only this consistency on VFSS) as per feeding instructions.



# THANK YOU

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