Multi-disciplinary Evaluation and Management of Aerodigestive Issues in Pediatric Patients

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Purpose of the Aerodigestive Center (ADC)

- Improve multidisciplinary care
  - For kids with complex problems
- Enhance and Augment current programs
  - Involved with care of complex patients at COA
- Improve Coordination of Care
  - tests, procedures, clinic visits, OR procedures
  - Follow up care
- Communication
  - COA Inter-specialty, referral sources, national
- Support families
  - Social worker designated for ADC
- Confirm improvement
  - Outcomes and other coordinated research

Aerodigestive Program Components

- Primary Partners
  - Otolaryngology (ENT)
  - Pulmonary Medicine
  - Gastroenterology
  - Multidisciplinary feeding team
  - Nutrition
  - Social Work

- Additional Providers
  - General Surgery
  - Anesthesia
  - Cardio-thoracic Surgery
  - Sleep Center

ADC Coordinator
- Ashley Chapman, RN

Aerodigestive Centers in USA

- Cincinnati*
- Denver*
- Boston*
- Milwaukee
- Omaha
- Pittsburgh*
- Nashville†
- Chapel Hill†
- Phoenix
- Baltimore*
- New York City
- Houston*
- Hartford
- Atlanta†
- Little Rock

*US News Top 10 Children’s Hospital
†Southeastern regional peer institution

What is the typical AERO patient?

- 3 yo with noisy breathing, reflux and chronic cough

ENT perspective on this typical patient

- History:
  - Onset
  - Severity
  - Airway instrumentation
- Physical Exam:
  - Auscultation
  - Work of Breathing
  - Phase of respiration
  - Growth parameters
- DDx:
  - Adenotonsillar hypertrophy
  - Nasopharyngeal obstruction
  - Allergic rhinitis
  - Laryngeal cleft
  - Vocal cord paralysis
  - Airway stenosis
  - Airway malacia
ENT evaluation of the typical AERO patient

- Diagnostic testing
  - Office flexible laryngoscopy
  - Airway films
  - Operative laryngoscopy with bronchoscopy +/- intervention
  - Lab work (allergens)

Flexible Laryngoscopy—Left Vocal Cord Paralysis

ENT treatment of the typical AERO patient

- Operative intervention
  - Adenotonsillectomy
  - Endoscopic Interventions
    - Supraglottoplasty
    - Laryngeal cleft repair
    - Airway dilation
    - Suprastomal granuloma excision
  - Laryngotracheal reconstruction
- Medical management
  - Antihistamines
  - Nasal steroids
  - Reflux control
- Observation

What is typically seen on Operative Laryngoscopy and Bronchoscopy?

- Subglottic stenosis: 26%
- Tracheomalacia: 16%
- Vocal cord anomaly: 15%
- Laryngomalacia 14%
- Laryngeal cleft 12%

Operative Laryngoscopy with Bronchoscopy—Type 1 Laryngeal Cleft

Operative Laryngoscopy with Bronchoscopy—Laryngomalacia
Operative Laryngoscopy with Bronchoscopy—Tracheomalacia

Operative Laryngoscopy with Bronchoscopy—Suprastomal Granuloma

Operative Laryngoscopy with Bronchoscopy—Subglottic Stenosis

Operative Laryngoscopy with Bronchoscopy—Balloon Dilation

What is infrequently seen on operative laryngoscopy with bronchoscopy?

- Tracheoesophageal fistula
- Tracheal stenosis with complete tracheal rings

Laryngotracheal Reconstruction
ENT feedback on benefits of Aerodigestive Center

- Improved medical management of complex
- Enhanced evaluation of lower respiratory and GI tract, of particular importance to LTR planning
- Increased recognition of prevalence of asthma
- More common diagnosis of airway malacia as contributor
- Inter-specialty communication

GI perspective on typical patient

- History:
  - Nutrition
  - Growth
  - Route of nutrition
  - Reflux
  - Atopy
  - Behavior

- Diagnostics
  - Physical exam
  - Weight/Height
  - Growth Curves
  - Abdomen
  - Investigations
    - Lab work
    - UGI/Mobility
    - pH/Impedance
    - EGD

GI evaluation and management

- DDx
  - GERD
  - EoE
  - Suboptimal nutritional intake
  - Lactose intolerance

- Management:
  - Reflux management
  - EoE control
  - Dietary modification
  - Reassurance

GI evaluation and management

- History and physical examination
- Upper GI series
- Esophageal pH monitoring/impedence
- Esophagogastroduodenoscopy and biopsy
- Empirical medical therapy

Diagnostic approach in GERD

- History and physical examination
- Upper GI series
- Esophageal pH monitoring/impedence
- Esophagogastroduodenoscopy and biopsy
- Empirical medical therapy

Upper GI Radiography

- Advantage
  - Useful for detecting anatomic abnormalities

- Limitation
  - Cannot discriminate between physiologic and nonphysiologic GER episodes

Esophageal pH Monitoring

- Advantages
  - Detects episodes of reflux
  - Determines temporal association between acid GER and symptoms
  - Determines effectiveness of esophageal clearance mechanisms
  - Assesses adequacy of H2RA or PPI dosage in unresponsive patients

- Limitations
  - Cannot detect nonacidic reflux
  - Cannot detect GER complications associated with "normal" range of GER
  - Not useful in detecting association between GER and apnea unless combined with other techniques
Multiple Intraluminal Electrical Impedance Measurement

**Advantages**
- Detects nonacidic GER episodes
- Detects brief (<15 s) acidic GER episodes
- Useful for studying respiratory symptoms and GER in infants

**Limitations**
- Normal values in pediatric age groups not fully defined
- Analysis of tracings time-consuming
- Portable device unavailable for outpatient studies

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Symptom Progression in EoE

Feeding Disorder 13%

Vomiting 59%

Abdominal Pain 50%

Dysphagia
- 30% (Pediatrics)
- 97% (Adults)

Food Impaction
- 13% (Pediatrics)
- 51% (Adults)

Stricture
- 10% (Pediatrics)
- 37% (Adults)

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Biopsy results

- Epithelial hyperplasia
- Eosinophils
  - >15/hpf
  - Clusters/abscess

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EoE Incidence

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EoE Endoscopy Findings

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Reflux versus EoE

**GERD**
- Atopy neutral
- Slight increase male gender
- Impaction rare
- Abnormal pH study
- No proximal disease
- No clusters of eosinophils
- Moderate epithelial hyperplasia

**EoE**
- Atopy high
- Greater male gender
- Impaction common
- Normal pH study
- Proximal involved
- Clusters of eosinophils
- Marked epithelial hyperplasia
What are the findings of GI studies in Aerodigestive pts?

- EGD Biopsy
  - Normal: 66%
  - GERD: 11%
  - EoE: 16%

- pH/impedance:
  - Normal: 70%
  - Acid reflux: 22%
  - Retrograde impedance: 13%
  - Both acid and retrograde: 11%

GI comments on Aerodigestive Center

- Reflux less common than anticipated
- Eosinophilic esophagitis more common than anticipated
- Improved medical management of patients with cough-associated emesis.

Pulmonary perspective on the typical patient

- History
  - Onset
  - Severity
  - Previous medical management
  - Atopy history
  - Feed tolerance
  - Immune function

- Physical exam:
  - Growth
  - Respiratory effort
  - Location of noise
  - Stridor (phase)
  - Wheezing
  - Extremities

Pulmonary evaluation and management

- DDx:
  - Asthma
  - Upper airway obstruction
  - Aspiration
  - Laryngomalacia
  - Bronchitis

- Interventions:
  - Tests:
    - CXR
    - PFT’s
    - Labwork
    - Bronchoscopy
  - Therapies:
    - Asthma
    - Reflux
    - Nasal
    - Allergies

Speech perspective on a typical patient

- DDx:
  - Aspiration
  - Laryngeal penetration
  - Oral aversion
  - Normal variant

- Diagnostics
  - Family interview
  - Observation
  - MBS
  - FEES

- Interventions:
  - Speech therapy
  - VitalStim
  - Thickening
  - Intensive Feeding Therapy

Who is referred the Children’s of Alabama Aerodigestive Center

- GERD (76%)
- Cough (67%)
- Dysphagia (56%)
- Asthma (51%)
- Vomiting (41%)
- Stridor (38%)
- Failure to Thrive (26%)
- Obstructive Sleep Apnea (22%)
- Tracheostomy tube (20%)
- Noisy Breathing (19%)
Where do our referrals reside?

How do we work together?

• Initial referral to Aerodigestive coordinator
• Chart review
• Discussion at Aerodigestive conference
• Multidisciplinary Aerodigestive clinic
• Discussion at Aerodigestive clinic
• Joint endoscopy (DLB/Flex/EGD) often w/ pH/impedance
• Joint discussion w/ family at time of procedure
• Discussion at Aerodigestive clinic including f/u
• F/u visit 1 mo after airway eval

Whom do our referrals see

• ENT 94%
• Pulm 87%
• GI 84%
• 66% Speech

• 31% seen in Aerodigestive joint clinic

What tests do our patients undergo

• DLB (rigid bronchoscopy) 70%
• Flexible bronchoscopy 64%
• Swallow study 58%
• EGD (GI) 54%
• pH/impedance 52%
• PSG (sleep study) 26%

• 47% of pts had a joint endoscopy

What is typically seen on flexible bronchoscopy?

• Pharyngeal hypotonia: 24%
• Adenoid hypertrophy: 32%
• Lymphoid hyperplasia: 19%
• Laryngomalacia: 35%
• Retroepiglottis: 27%
• Tracheomalacia: 40%
• Bronchomalacia: 33%
• Bronchitis: 43%

What is the result of the swallow evaluation?

• Frank Aspiration: 31%
• Laryngeal penetration: 39%
• Oral aversion/dyscoordination: 13%
What is seen on PSG?

- Mean AHI: 2.9
- OSA: 48%
- Central apnea: 27%

Pulmonary feedback on Aerodigestive Center

- Improved communication between services
- Coordinated care optimizes clinical findings in one anesthesia.
- Instant collaboration
- Ease of operative intervention

Children’s of Alabama
Intensive Feeding Program
A Multidisciplinary, Behavioral, Oral, and Sensorimotor Approach to Treating Feeding Disorders

Who Are Intensive Feeding Patients?

- 3 year old, noisy breathing, reflux, and chronic cough...
- Who also does not eat/drink

What Are Feeding Disorders?

- Feeding Disorders
  - Persistent disturbance in eating
  - Significant clinical consequences
    - weight loss
    - inadequate growth
    - significant nutritional deficiency
    - dependence on tube feeding or supplements
    - impaired psychosocial functioning

Patients We Serve – Diagnoses and Classifications

<table>
<thead>
<tr>
<th>Medical Diagnoses:</th>
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<tbody>
<tr>
<td>Prematurity</td>
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<tr>
<td>Failure to Thrive</td>
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<tr>
<td>Gastroesophageal Reflux (GERD)</td>
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<tr>
<td>Eosinophilic Esophagitis</td>
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<tr>
<td>Oral Dysphagia</td>
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<tr>
<td>Food Allergies</td>
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<tr>
<td>GI Dysmotility and other GI disorders</td>
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<tr>
<td>Cerebral Palsy</td>
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<td>Downs Syndrome</td>
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<tr>
<td>Autism</td>
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<td>Developmental Delays</td>
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<table>
<thead>
<tr>
<th>Classification of Feeding Problem:</th>
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<tbody>
<tr>
<td>Behavioral Issues</td>
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<tr>
<td>Gastrointestinal Problems</td>
</tr>
<tr>
<td>Oral Motor Dysfunction</td>
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<tr>
<td>Neurological Condition</td>
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<tr>
<td>Cardiorespiratory Problems</td>
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<tr>
<td>Metabolic Dysfunction</td>
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<tr>
<td>Structural Abnormality</td>
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<tr>
<td>Social/Family Dysfunction</td>
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Typical Feeding Problems

- Total food refusal
- Limited food intake/Volume restriction
- Bottle Aversion/Respiratory Compromised
- Sleep Drinking
- Difficulty transitioning to solids
- Poor texture grading/Food selectivity by type or texture
- Tube Dependence
- Recurrent Emesis
- Refusal to self-feed
- Excessive meal duration
- Disruptive/inappropriate mealtime behavior
- Phobia (food or choking)
- Oral Motor/Skill Deficit

Why Develop an Intensive Feeding Program?

- Many patients with feeding disorders are effectively treated via a single discipline
  - Speech and Language Pathologist; 1 x week
  - Occupational Therapists; 1 x week
- Our patients are those that:
  - Have intractable challenges
  - Are not improving with single discipline intervention
  - Need a more intensive environment for change such as daily therapy

Why Develop an Intensive Feeding Program?

- Prevalence
  - Typically developing children
    - 45% pediatric population have mealtime problems
    - generally transient
  - Developmentally Delayed
    - 33-60% have feeding difficulties
  - Aerodigestive Center at COA
    - 76% GERD
    - 56% Dysphagia
    - 26% FTT

Intensive Feeding Programs USA

- Alabama
- California
- Colorado
- Delaware
- Georgia
- Indiana
- Kansas
- Maryland
- Michigan
- Nebraska
- New Jersey
- New Mexico
- New York
- North Dakota
- Ohio
- Pennsylvania
- Texas
- Virginia
- Wisconsin

Children’s Hospital of Alabama Intensive Feeding Program

- Formally approved in January 2014

<table>
<thead>
<tr>
<th>Team Members</th>
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<tbody>
<tr>
<td>MD</td>
<td>RD</td>
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<tr>
<td>Nurse</td>
<td>Dietetic Technician</td>
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<tr>
<td>PhD-Psychologist</td>
<td>SLP</td>
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<tr>
<td>Social Worker</td>
<td>OT</td>
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<td>Billing Coordinator</td>
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Description of the Program

- Evaluation Clinic
  - MD, PhD, RD, SLP, OT, MSW

Inpatient
- 7 days a week
- 4 feedings per day

Day Treatment
- 5 days a week
- 4 feedings per day

Outpatient
- Intensive Feeding
- Community/COA
**Evaluation Clinic**

- One day a week
- Evaluation by MD, PHD, RD, SLP, OT, and MSW
  - History
  - Feeding progression
  - Current feeding behaviors
  - Structured oral motor assessment
  - Observation of meal time
  - Impressions and recommendations offered
  - Follow-up medically with MD/Nurse every 3 months

**Treatment Programs**

Inpatient Treatment
- Medically at risk
- Significant psychosocial concerns
- 2 ½ - 3 weeks duration
- Transition to day treatment for completion of 6 - 8 weeks
- 7 days a week
- 4 therapeutic meals per day

Day Treatment
- Medically stable at night and weekends
- 6 - 8 weeks
- 5 days a week
- 4 therapeutic meals per day

**Day Treatment Program**

- Baseline assessment
- Structured individualized protocol for each child to increase oral consumption
- Every meal is videotaped and data is collected on volumes consumed and all meal time behaviors; bug in the ear technologies; parent training
- Treatment plan changes made based on data noted above.

**Day Treatment Programs**

- Daily sessions with:
  - Therapists (SLP, OT)
  - Registered Dietitian
  - Psychologist
  - Medical Team
- Family sessions weekly with:
  - Psychologist
  - Social Worker
  - Dietetic Technician
- Weekly family conferences with the multidisciplinary team

**Outcomes**

- We have seen 95 patients in evaluation clinic
- We have 10 graduates of the program:
  - 50% of patient admitted had G-tubes
    - 100% were 100% dependent on G-tubes for nutrition at admission
    - 100% were 100% weaned from G-tube and receiving 100% of their nutrition orally at discharge
  - 40% of patients admitted were FTT
    - 75% of them had a clinically significant improvement in growth parameters
  - 90% of all discharged patients had appropriate or accelerated growth at discharge

**The Demand**

- Waiting List as of August 2015
  - Evaluation Clinic:
    - Scheduled through October 2015.
    - Takes 12-16 weeks for first appointment
  - Day Treatment:
    - 6-8 week admission
    - Current scheduled through Jan 2018!
    - With increase in staffing and full volume expectations, the wait for day treatment would dramatically decrease.
Acknowledgements

- Alexandra Krause, BS
  - Data Analysis
- Ashley Chapman, RN
  - Aerodigestive Coordinator
- Tracy Howell, RN, CPN
  - Intensive Feeding Program Coordinator
- Kristin Avis, PhD
  - Research Coordinator

Contacts
(Intensive Feeding Program)

- Location: 6th Floor McWane (Old Stem Cell Unit)
- Our Plan: Day Treatment
  - 2 patients this year at a time
  - 3 in year 2
  - 4 in year 3
- To make a referral
  - www.childrensal.org
  - Contact Tracy Howell, RN
    - 205-638-7590
    - 205-638-7995 (fax)

Contacts
(Aerodigestive Program)

- Aerodigestive coordinator:
  - Ashley Chapman, RN
  - ashley.chapman@childrensal.org
  - 205-638-3447
  - www.childrensal.org/aerodigestive
- Faculty contacts
  - Beth Crawford, Speech
  - Reed Dimmit, GI
  - Tom Harris, Pulmonology
  - Michelle Mastin, PhD, Intensive Feeding Program
  - Nick Smith, ENT
  - Brian Wiatrak, ENT

Graduates