

Pediatric Asthma Masqueraders



William C. Anderson III, MD^a, and David R. Stukus, MD^b

INSTRUCTIONS

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Overall Purpose/Goal: To provide excellent case-based reviews on key aspects of allergic disease to those who research, treat, or manage allergic disease.

Target Audience: Physicians and researchers within the field of allergic disease.

Accreditation/Provider Statements and Credit Designation: The American Academy of Allergy, Asthma & Immunology (AAAAI) is accredited by the Accreditation Council for Continuing Medical Education (ACCME) to provide continuing medical education for physicians. The AAAAI designates this journal-based CME activity for 1.00 AMA PRA Category 1 Credit™. Physicians should claim only the credit commensurate with the extent of their participation in the activity.

List of Design Committee Members: William C. Anderson III, MD, and David R. Stukus, MD (authors); Michael Schatz, MD, MS (editor)

Learning objectives:

1. Identify clinical features that would raise suspicion for a condition incorrectly presenting as asthma.
2. Define the criterion standard tests for the diagnosis of vocal cord dysfunction (VCD) and tracheomalacia.
3. Describe symptoms that can help distinguish VCD from asthma.

Recognition of Commercial Support: This CME has not received external commercial support.

Disclosure of Relevant Financial Relationships with Commercial Interests: D. R. Stukus is an unpaid member of the Asthma and Allergy Foundation of America board of directors; has received consultancy fees from Aimmune Therapeutics; and has received lecture fees from the American College of Allergy Asthma and Immunology. W. C. Anderson declares no relevant conflicts of interest. M. Schatz declares no relevant conflicts of interest.

The Difficult Cases Feature is based on the *Difficult Cases* Course presented at the AAAAI Annual Meeting and coordinated by the AAAAI New Allergist-Immunologist Assembly (NAIA). View the entire presentation and obtain CME or MOC credit by visiting the *JACI: In Practice* homepage www.jaci-inpractice.org.

CASE REPORT

Asthma is one of the most prevalent chronic pediatric conditions, affecting approximately 9% of all children.¹ Diagnosis can be challenging in young children, who are unable to verbalize symptoms and participate in spirometry.² Other pediatric conditions have similar presentations to asthma, and comorbid conditions can exacerbate asthma.³⁻⁵ In this *Difficult Cases* presentation, 2 cases will illustrate these concepts.

An 8-year-old girl with previously diagnosed asthma who recently moved from out of state presented with recurrent cough, wheeze, and dyspnea, requiring 6 courses of prednisone last year. Her triggers included upper respiratory tract infections and aerosolized products. At initial presentation, treatment consisted of daily montelukast and cetirizine. Physical examination was significant only for moderate nasal turbinate hypertrophy. Skin

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prick testing was negative to all environmental aeroallergens. Spirometry and exhaled nitric oxide were within normal limits, with no change in lung function postbronchodilator. Despite escalation of controller therapy to high-dose inhaled corticosteroid/long-acting beta-agonist, she had 11 separate emergency department visits and 5 hospitalizations for acute dyspnea during the ensuing 15 months. During acute encounters, she had dyspnea, intermittent audible wheezing, and inability to speak or take full inspiratory breaths, which did not improve with bronchodilators or steroids. Pulse oximetry was never below 95%. Nine months after initial evaluation, direct laryngoscopy revealed vocal cord adduction during inspiration, consistent with a diagnosis of vocal cord dysfunction (VCD).

The prototypical patient with VCD is a high-achieving, adolescent female experiencing acute audible stridor/wheezing localized to the throat triggered by exercise, emotions, or fragranced products.⁶ However, VCD is increasingly being recognized in younger children with variable presentations.⁷ Direct laryngoscopy is diagnostic for VCD, demonstrating adduction of the vocal cords during inspiration.⁸ VCD, unlike asthma, has a rapid onset and resolution, absence of nocturnal awakenings, and nonresponse to bronchodilators. Throat tightness, dysphonia, and absence of wheezing can help distinguish VCD from asthma.⁹ Spirometry is not diagnostic for VCD, but a flattened inspiratory loop, when present, may indicate adduction of the vocal cords. To compound confusion, VCD and asthma also commonly occur together in the same patient and are not mutually exclusive.¹⁰

A 6-year-old boy with asthma, allergic rhinitis, and eczema presented for second opinion of recurrent barking cough, wheeze, and dyspnea. He had 12 separate emergency department visits during the previous 2 years for these symptoms. During acute episodes, oxygen saturations were below 90% with minimal improvement from bronchodilators and systemic steroids. He remained symptomatic despite escalation of his controller medications to high-dose inhaled corticosteroid/long-acting beta-agonist therapy and montelukast. Evaluation before presentation demonstrated normal lung function, normal chest x-ray, and aeroallergen polysensitization. Flexible bronchoscopy revealed a compression of the intrathoracic trachea during forced expiration.

Index of suspicion for an anatomical abnormality compressing the intrathoracic airway and mimicking asthma, such as tracheomalacia, should be raised when children have chronic audible

wheezing that may worsen in certain positions (prone) and fail to respond to bronchodilators or steroids. Flexible bronchoscopy is the criterion standard to visualize the anatomy during inhalation and exhalation, to identify any changes during active respiration.¹¹

Both cases have similar features that should raise suspicion for an asthma masquerader. These include ongoing respiratory symptoms despite the following:

- Treatment with albuterol
- Treatment with systemic corticosteroids
- Escalation in controller medication
- Confirmed adherence with medications
- Avoidance of triggers

With a systematic approach to history taking, physical examination, and use of a stepwise adjustment to asthma therapy, asthma masqueraders will not remain hidden for long.

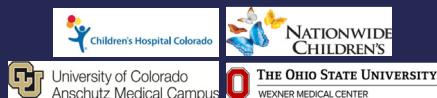
Further information can be obtained by viewing the original Difficult Cases presentation in this article's Online Repository at www.jaci-inpractice.org.

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4. Malka J, Spahn JD. When cough wheeze and shortness of breath don't equal asthma. *J Allergy Clin Immunol Pract* 2016;4:179-81.
5. Brożek JL, Bousquet J, Agache I, Agarwal A, Bachert C, Bosnic-Anticevich S, et al. Allergic Rhinitis and its Impact on Asthma (ARIA) guidelines-2016 revision. *J Allergy Clin Immunol* 2017;140:950-8.
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10. Low K, Ruane L, Uddin N, Finlay P, Lau KK, Hamza K, et al. Abnormal vocal cord movement in patients with and without airway obstruction and asthma symptoms. *Clin Exp Allergy* 2017;47:200-7.
11. Choo EM, Seaman JC, Musani AI. Tracheomalacia/tracheobronchomalacia and hyperdynamic airway collapse. *Immunol Allergy Clin North Am* 2013;33:23-34.

Difficult Cases **Pediatric Asthma Masqueraders**

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Disclosures

- Bill Anderson
 - ☐ None
- Dave Stukus
 - ☐ None

Question #1

In children, which of the following indicates a diagnosis other than asthma?

- A. Recurrent cough/wheeze that improves with albuterol
- B. Recurrent or prolonged cough/wheeze that does not improve with systemic corticosteroids
- C. Normal spirometry findings
- D. Fractional exhaled nitric oxide < 20 ppb
- E. Absence of wheezing

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- C. Normal spirometry findings
- D. Fractional exhaled nitric oxide < 20 ppb
- E. Absence of wheezing

Suspecting a Masquerader

- Symptoms despite
 - ☐ Treatment with albuterol
 - ☐ Treatment with systemic steroids
 - ☐ Confirmed adherence
 - ☐ Escalating controller medication dosage
 - ☐ Removal of triggering exposures
 - ☐ Exclusion of steroid resistance



Case #1



Case 1 – History

- 8 year old female with asthma and allergic rhinitis
- Recurrent episodes of dyspnea, cough, and wheezing
 - Triggers: URIs, cold air, cigarette smoke, scented products
 - Denies nocturnal or exercise-induced symptoms
 - Prednisone 5-6 times/year
 - Albuterol 1-2 times/week
- Chronic nasal congestion with intermittent clear rhinorrhea

Case 1 – History

- PMH
 - Mild persistent asthma diagnosed at 5 years of age – diagnosed/managed by previous allergist (out of state)
 - Allergic Rhinitis (reportedly positive to “everything”)
- PSH
 - None
- Family History
 - No history of atopy in immediate family members

Case 1 – History

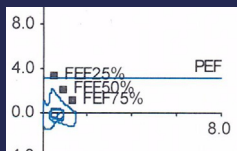
- Medications
 - Montelukast 5 mg by mouth once daily
 - Cetirizine 5 mg by mouth once daily
- Social History
 - Cats in the home
 - Currently in 3rd grade
 - Bullied at school
 - No smokers in the home

Case 1 – Physical Examination

- Nasal Exam
 - Moderate turbinate hypertrophy bilaterally
- Lung Exam
 - Clear to auscultation
 - No wheeze, rhonchi, rales, or cough

Case 1 – Initial Diagnostic Testing

	% Predicted
FVC	88%
FEV1	80%
FEV1/FVC	82
FEF25-75%	64%



- No change in FEV1 post-bronchodilator
- Aeroallergen skin prick testing negative
- FeNO = 8 ppb

Case 1 – Initial Recommendations

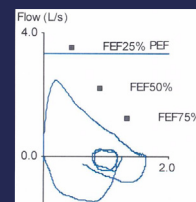
- Start fluticasone 110 mcg 2 puffs inhaled BID with spacer
- Continue montelukast
- Discontinued cetirizine
- Start intranasal fluticasone 2 sprays in each nostril daily

Case 1 – Follow Up 3 Months Later

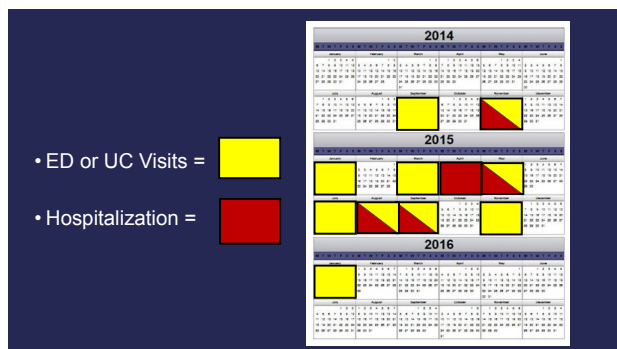
- Treated with dexamethasone once
- No improvement in cough, congestion, or audible wheeze
- Frequent nonproductive cough but clear to auscultation
- Stepped up to fluticasone/salmeterol 115/21 mcg 2 puffs inhaled twice daily with spacer
- Resumed cetirizine
 - Continued intranasal fluticasone
- Addressed trigger avoidance and medication adherence

Case 1 – Follow Up Spirometry

	% Predicted
FVC	93%
FEV1	78%
FEV1/FVC	76
FEF25-75%	55%



- FeNO = 13 ppb



Case 1 – UC/ED Visits Summary

- Cough and dyspnea with mid-chest tightness
- Unable to speak or take full deep breaths
- Intermittent audible stridor/wheezing
- Normal oxygen saturation
- Spirometry shows non-obstructive pattern
- Treated with azithromycin, dexamethasone, prednisone, and albuterol, without improvement

Case 1 – Hospitalizations Summary

- Chest tightness localized to mid-sternum
- Decreased ability to take deep inspirations
- Rhino/enterovirus infection x3
- PICU admission and $MgSO_4$ x2
- Treated with azithromycin, prednisone, atrovent, albuterol with no immediate/apparent improvement in symptoms during each hospitalization
- Stepped up to fluticasone/salmeterol 230/21 mcg 2 puffs BID with spacer + montelukast

Case 1 – Psych-Based Symptoms

- Unable/refused to speak during two hospitalizations
- Admitted for 4 days with conversion disorder
 - ☐ Lower extremity weakness and numbness
 - ☐ Inability to walk
 - ☐ Referred to psychology

What Is Your Next Step?



- Chest X-Ray
- Chest CT Scan
- Laryngoscopy
- Bronchoscopy
- CF Sweat Test
- Immunoglobulins
- pH Probe

Case 1 – Additional Work Up

- Bronchoscopy:
 - ☐ Anomalous right upper lobe bronchus of unknown significance
- Laryngoscopy:
 - ☐ Paradoxical vocal cord movement on inspiration

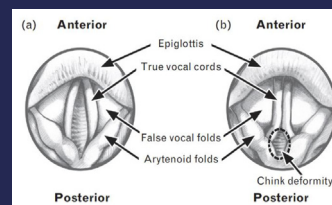


Case 1 – Outcome

- Multidisciplinary meeting with jointly devised treatment plan
 1. Breathing exercises
 2. Albuterol
 3. Prednisone if needed
- Improved ability to recognize VCD vs asthma symptoms
 - ☐ No prednisone bursts since that time
- Reduced school absences and increased social activities
 - ☐ Captain of basketball team

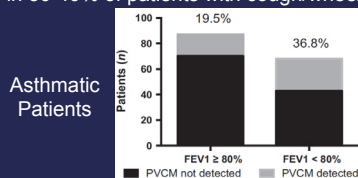
Vocal Cord Dysfunction

- Intermittent inspiratory extra-thoracic airway obstruction



Associations Between VCD and Asthma

- Combined bronchial and laryngeal hyperresponsiveness occurs in 30-40% of patients with cough/wheeze/dyspnea



Bucca C, Rolla G, et al, Lancet 1995;346:719-5.
Ipek T, Dalgic N, et al, Pediatr Pulmonol 2002;34:172-80
Low K, Ruane L, et al, Clin Exp Allergy 2017;47:200-7.

	Asthma	VCD
Onset	Minutes	Seconds
Duration	Minutes to hours	Seconds to minutes
Dyspnea during	Expiration	Inspiration
Nocturnal Symptoms	Present	Absent
Obstruction location	Lower airways	Throat
Inhaled therapy	High effective	Ineffective/aggravating
Flow-volume loop	Reduced expiratory	Flattened inspiratory
O ₂ saturation w/attack	Reduced	Normal

Balkissoon R, Kenn K, Semin Respir Crit Care Med 2012;33:595-605.
Idrees M, FitzGerald JM, J Asthma 2015;52:327-35.
Kenn K, Balkissoon R, Eur Respir J 2011;37:194-200.
Noyes BE, Kemp JS, Paediatr Respir Rev 2007;8:155-63.

Question #2

What test finding is diagnostic for vocal cord dysfunction?

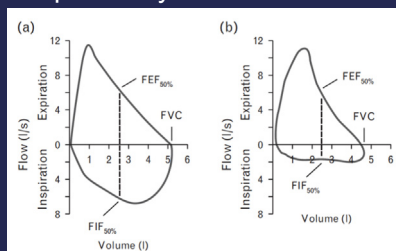
- A. ≤ 12% increase in FEV₁ after bronchodilator
- B. Flattened inspiratory curve on spirometry
- C. ≥ 20% decline in FEV₁ after ≤ 10 mg/ml methacholine
- D. Direct laryngoscopy demonstrating adduction of vocal cords during inspiration
- E. Direct laryngoscopy demonstrating abduction of vocal cords during exhalation

Question #2

What test finding is diagnostic for vocal cord dysfunction?

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- B. Flattened inspiratory curve on spirometry
- C. ≥ 20% decline in FEV₁ after ≤ 10 mg/ml methacholine
- D. Direct laryngoscopy demonstrating adduction of vocal cords during inspiration
- E. Direct laryngoscopy demonstrating abduction of vocal cords during exhalation

Spirometry and VCD



- Flattened/truncated inspiratory loop
- MIF50%/MEF50% less than 1

Ledford DK, Lockey RF, Curr Opin Allergy Clin Immunol 2013;13:78-86.

Diagnostic Value of Spirometry for VCD

- 3 staff pulmonologists blinded to laryngoscopy
- All agreed on which flow-volume loops predicted VCD
- Loop prediction of VCD did NOT correlate with laryngoscopy
 - 38% of "normal" loops had VCD
 - 72% of "VCD" loops did not have VCD

Watson MA, King CS, Respir Care 2009;54:467-473.

Question #3

Which of the following symptoms are more predictive of asthma compared with vocal cord dysfunction?

- A. Dysphonia
- B. Throat tightness
- C. Wheezing
- D. Cough
- E. Shortness of breath

Question #3

Which of the following symptoms are more predictive of asthma compared with vocal cord dysfunction?

- A. Dysphonia
- B. Throat tightness
- C. Wheezing
- D. Cough
- E. Shortness of breath

Pittsburgh VCD Index

- Scoring system to distinguish VCD vs. asthma
- Throat tightness, dysphonia, absence of wheezing
- Score ≥ 4 had 83% sensitivity, 95% specificity for VCD

Symptoms, no. of patients	VCD (n = 89)	Asthma (n = 59)	Crude OR	P value for crude OR	Adjusted OR	P value for adjusted OR	Score assigned
Cough	53	42	0.6 (0.3-1.1)	.11			
SOB	68	52	0.4 (0.2-1.1)	.07			
Heartburn	29	7	3.6 (1.5-9.5)	.003			
Dysphonia	32	4	8.0 (2.9-28.2)	<.0001	5.1 (1.1-27.8)	.04	2
Absence of wheezing	60	12	8.1 (3.8-18.2)	<.0001	6.0 (1.9-21.0)	.002	2
Throat tightness	59	1	114.1 (23.3-2063.9)	<.0001	43.5 (7.3-847.8)	<.0001	4

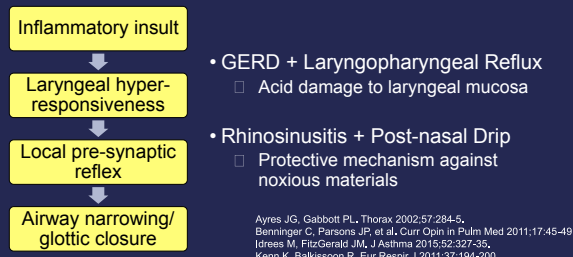
Traister RS, Fajt ML, et al. J Allergy Clin Immunol Pract 2014;2:65-9.

VCD and Psychological Disorders

- Pediatric VCD
 - Higher levels of anxiety and anxiety-related diagnoses
 - Academic and athletic over-achievers
- Adult VCD
 - Increase in conversion disorder pattern
 - No overall increase in amount stress but increase in trouble coping with stress
 - 23% had no psychological disorders

Forrest LA, Husein T, Husein O. Laryngoscope 2012;122:844-853.
Gavin LA, Wamboldt M, et al. J Asthma 1998;35:409-17.
Husein OF, Husein TN, et al. Laryngoscope 2008;118:740-47.
Noyes BE, Kemp JS. Paediatr Respir Rev 2007;8:155-63.

VCD – Beyond Psychiatric Disorders



Treatment of Vocal Cord Dysfunction

- Multidisciplinary approach
 - Allergy, Pulmonology, speech therapy, psychiatry, etc
- Speech therapy exercises
 - Tightening/relaxing exercise
 - Diaphragmatic breathing
 - Breathing Recovery/"sniff" inspiration and "s" exhalation
- Address co-morbid conditions
 - GERD, Postnasal drip, psychosocial issue

Balkissoon R, Kenn K. Semin Respir Crit Care Med 2012;33:595-605.
Wilson JJ, Wilson EM. Clin J Sport Med 2006;16:357-60.



Case #2

Case 2 – History

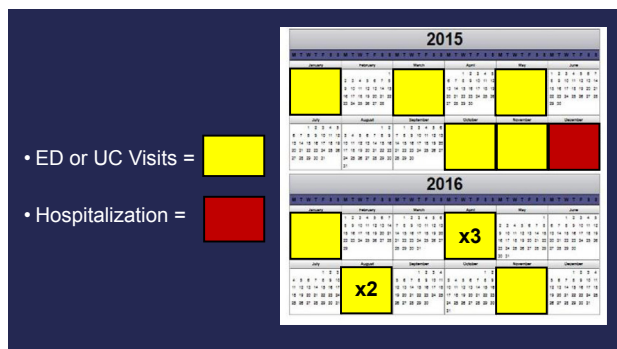
- 6 year old male with asthma, allergic rhinitis, and eczema
- Recurrent cough, wheeze, and increased WoB
 - Daytime symptoms 4-5 days/week
 - Nocturnal awakenings 3 nights/week
 - Albuterol 1-3 times/day for the last month
 - Triggered by URIs, exercise, and weather/seasonal changes
 - Recurrent barking cough

Case 2 – History

- PMH
 - Asthma (dx 3 y.o.; albuterol-response wheezing with URIs)
 - Allergic rhinitis
 - Eczema
 - Milk allergy (resolved)
- PSH
 - None
- Family History
 - Mother with childhood asthma

Case 2 – History

- Medications
 - Mometasone/formoterol 200/5 mcg 2 puffs inhaled BID with spacer
 - Montelukast 5 mg by mouth daily
 - Cetirizine 5 mg by mouth daily
 - Intranasal fluticasone 1 spray in each nostril daily
 - Desonide/triamcinolone
- Social History
 - Currently in kindergarten
 - Dog in the home with access to bedroom
 - No smokers in the home



Case 2 – ED Summaries

- Barking cough without stridor, dyspnea, wheezing
 - ☐ Oxygen desaturations
- Triggered by URIs
- Primary diagnosis of asthma x9 and croup x3
- Treated with
 - ☐ Albuterol
 - ☐ Ipratropium bromide
 - ☐ Dexamethasone/prednisone

Case 2 – Escalating Therapy

- 03/15 – Started on fluticasone 44 mcg 2 puffs BID
- 05/15 – Montelukast added
- 06/15 – Stepped up to fluticasone/salmeterol 45/21 mcg 2 puffs BID + montelukast
- 11/15 – Stepped up to fluticasone/salmeterol 115/21 mcg 2 puffs BID + montelukast
- 04/16 – Switched to mometasone/formoterol 200/5 mcg 2 puffs BID + montelukast
- Azithromycin x3 for suspected mycoplasma

Case 2 – Physical Exam

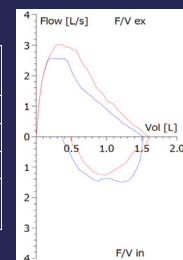
- HEENT
 - ☐ Moderate turbinate hypertrophy bilaterally
 - ☐ 2+ tonsillar hypertrophy
- Lung Exam
 - ☐ Clear to auscultation
 - ☐ No wheeze, rhonchi, rales, or cough
- Skin Exam
 - ☐ Xerosis
 - ☐ Erythematous, excoriated bilateral popliteal fossa

Case 2 – Initial Evaluation

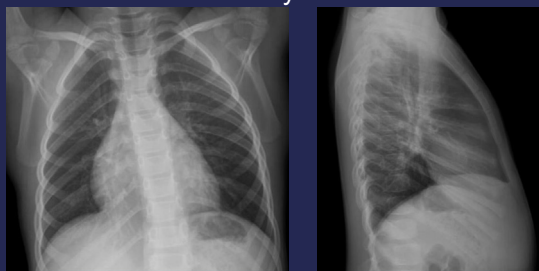
- Positive skin prick testing to tree pollen, grass pollen, weed pollen, Alternaria, Penicillium, dog, and cat
- IgE 33.1 kU/L
- Eosinophil 320/ μ L

Case 2 – Spirometry

	Pre %Predict	Post %Predict	% Change
FVC	98%	103%	5%
FEV1	96%	107%	11%
FEV1/FVC	83.7	88.5	6%
FEF 25-75%	74%	99%	33%



Case 2 – Chest X-Ray

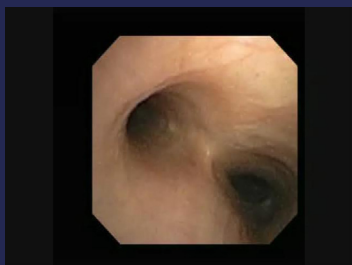


What Is Your Next Step?

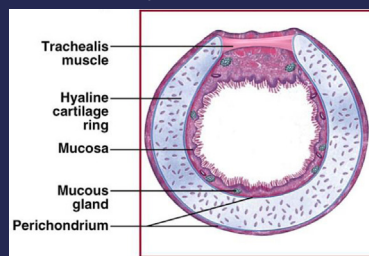


- Chest X-Ray
- Chest CT Scan
- Laryngoscopy
- Bronchoscopy
- CF Sweat Test
- Immunoglobulins
- pH Probe

Case 2 – Flexible Bronchoscopy

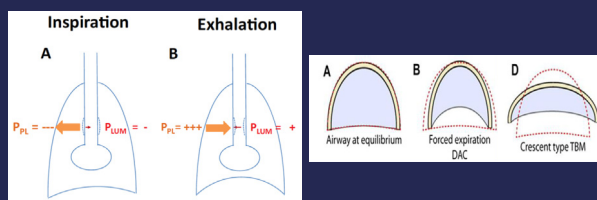


Tracheal Anatomy



Google Images

Tracheomalacia Pathophysiology



Choo EM, Seaman JC, Musani AL. Immunol Allergy Clin N Am 2013;33:23-34.
Hysinger EB, Panitch HB. Paediatr Respir Rev 2016;17:9-15.

	Asthma	Intrathoracic Tracheomalacia
Dyspnea during	Expiration	Expiration
Wheezing	High-Pitched Musical	Low-Pitched Monophonic
Stridor	Absent	Absent
Obstruction location	Lower airways	Large airway
Flow-volume loop	Reduced expiratory	Reduced expiratory
Beta-agonist therapy	High effective	Potentially aggravating

Hysinger EB, Panitch HB. Paediatr Respir Rev 2016;17:9-15.
Kugler C, Stanzel F. Thorac Surg Clin 2014;24:51-8.
Tan JZY, Ditchfield M, Freezer N. Pediatr Radiol 2012;42:906-15.

Croup, Tracheomalacia, and Atopy

- 53% of children referred for recurrent croup and chronic cough had airway abnormalities
 - Tracheomalacia was found in 30%
- 44% of children with atypical croup had an atopic condition
- Seasonal allergies were a risk factor in predicting moderately/severely abnormal laryngo/bronchoscopy findings

Cooper T, Kuruvilla G, et al. Otolaryngol Head Neck Surg 2012;147:209-14.
DeJany DR, Johnston DR. Otolaryngol Head Neck Surg 2015;152:159-64.
Greifer M, Santiago MT, et al. Int J Pediatr Otorhinolaryngol 2015;79:749-52.

Question #4

When tracheobronchomalacia is suspected, which is the BEST test to confirm the diagnosis?

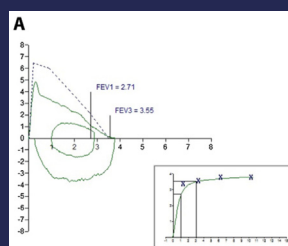
- Flexible bronchoscopy
- Spirometry
- Inspiratory/expiratory chest radiographs
- CT scan
- MRI

Question #4

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- Spirometry
- Inspiratory/expiratory chest radiographs
- CT scan
- MRI

Spirometry and Tracheomalacia



- Rapid decline in expiratory flow after sharp peak
- Not specific to tracheomalacia
- PFTs may not correlate directly to degree of malacia

Hysinger EB, Panitch HB. Paediatr Respir Rev 2016;17:9-15.
Kugler C, Stanzel F. Thorac Surg Clin 2014;24:51-8.

Utility of History, Physical Exam, Spirometry

- Pediatric pulmonologists diagnosis before bronchoscopy
 - Symptoms + History + Lung function
- Correct pre-bronch diagnosis in 72% of cases
- Diagnosis not suspected in 52% of malacia diagnosed on bronch

Boogard R, Huijsmans S, et al, Chest 2005;128:3391-7.

Diagnostic Methods

- Most common
 - Flexible fiberoptic bronchoscopy – Gold standard
 - Multi-detector CT
- Less frequently
 - Dynamic MRI
 - Bronchography
 - Cine fluoroscopy

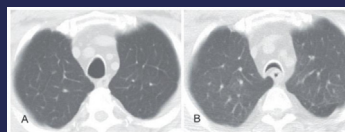
Choo EM, Seaman JC, Musani AL, Immunol Allergy Clin N Am 2013;33:23-34.
 Hysinger EB, Panitch HB, Paediatr Respir Rev 2016;17:9-15.
 Kugler C, Stanzel F, Thorac Surg Clin 2014;24:51-8.
 Tan JZY, Ditchfield M, Freezer N, Pediatr Radiol 2012;42:906-15.

Test	Limitation
Flexible bronchoscopy	• Technique/operator dependent • Instrument affects airway dynamics
MDCT	• Increased radiation (inhalation/exhalation) • Requires patient cooperation • Difficulty timing end-inspiration/expiration • Physiologic motion w/respiratory cycle

Hysinger EB, Panitch HB, Paediatr Respir Rev 2016;17:9-15.
 Kugler C, Stanzel F, Thorac Surg Clin 2014;24:51-8.
 Tan JZY, Ditchfield M, Freezer N, Pediatr Radiol 2012;42:906-15.

Bronchoscopy vs. CT to Diagnose Malacia

- End-inspiratory and dynamic expiratory volumetric CT in patients with bronchoscopy-proven malacia
- Malacia defined as $\geq 50\%$ expiratory reduction in lumen
- CT correctly diagnosed malacia in 97% of cases

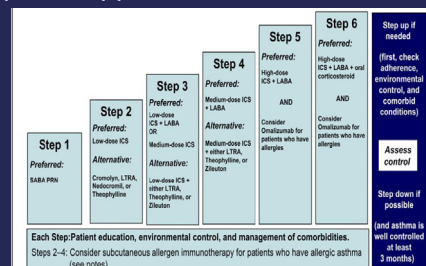


Lee KS, Sun MRM, et al, Chest 2007;131:758-64.

Additional Items for Consideration When Managing Pediatric Asthma

- Addressing adherence and triggers per NHLBI guidelines
- Use of API to help with diagnosis
- Broad differential for asthma in children

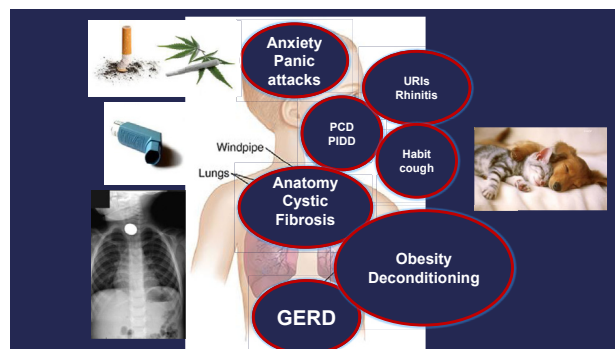
Stepwise Approach to Medications



Application of the API

- Positive API by 3 years of age
 - 77% chance of having asthma from 6-13 years of age
- Negative API by 3 years of age
 - Less than 3% chance of developing active asthma during their school years
- Can help provide earlier diagnosis of asthma
- Initiate daily controller therapy sooner
- Can also help with parental discussion, prognosis, etc.

Castro-Rodriguez J. Curr Opin Allergy Clin Immunol 2011;11:157-61



Final Thoughts

- All that wheezes is not asthma
- Asthma is a clinical diagnosis supported by
 - Historical elements
 - Diagnostic testing
 - Therapeutic trials
- Allergists are well poised to consider phenotypes and endotypes
- Multidisciplinary approach is beneficial in difficult cases



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