Basic Asthma Care

Karen H. Calhoun MD FACS FAAOA
Why otolaryngologists and asthma?

- Lungs are connected to and influenced by the upper airway
- Many patients with allergic rhinitis
- Provide better patient care.
Unified Airway

- Inflammation in the nose usually means inflammation in the lungs
- 78% asthma patients have nasal sx
- Patients with AR are 3-4 times more likely to develop asthma than those without.
- Asthma occurs in 5-8% of the general population, 20% with CRS
- CRS: 57% have positive allergy tests
Unified Airway- AR and Asthma

- Rhinitis, asthma (and sinusitis) are disease of chronic inflammation.
- Nasal symptoms, airflow and inflammatory markers directly correlate with lower airway involvement.
- Even AR patients without frank asthma symptoms frequently have subclinical changes in the lower airways with increase in inflammatory mediators.
Asthma in AR Patients

- Italian study, 1469 consecutive patients with persistent AR, no asthma
- Spirometry pre and post BD
- 69.2% had reversibility
- 17.8% had FEF25-75 < 65% of predicted on pre BD, predicted reversibility
AR and Asthma

- 475 Cases for analysis
- 436 Definite Asthma Y/N, 39 no firm dx
- 223 of them had AR, 104 did not
- 153/332 with AR had asthma- 46.1%
- 8 of 104 without AR had asthma- 7.7%
“Allergic rhinitis and asthma go hand-in-hand. If a patient comes to us with one condition, we should actively look for the other. Treating the co-existing asthma or allergic rhinitis improves the quality of life of the patient.”
What is Asthma?

- A chronic disease of the lungs causing inflammation and narrowing of the airways
How allergic asthma happens

Pathogenesis of asthma

antigen → naive T-lymphocyte

IL-12 → Th-0

Th-1 response
(IFN-γ, lymphotoxin, IL-2)

Cell mediated immunity and Neutrophilic inflammation

Th-2 response

IL-4, IL-13 → IL-9, IL-4, IL-3, GM-CSF

IgE → Mast cells → Basophils → Eosinophils

Mediators of inflammation (eg. histamine, prostaglandins, leukotrienes, enzymes)

Asthma symptoms

Bronchial hyperresponsiveness
Airway obstruction
Small Airway Diseases

- Chronic bronchitis
- Emphysema
- COPD
- Airflow obstruction
- Asthma
How do you screen for asthma or BHR?

- We don’t
- Questionnaire like ATAQ or ACT
- Peak Flow
- Spirometry
- Exhaled nitric oxide
- Methacholine or mannitol challenge
How is asthma diagnosed?

- Episodic airflow obstruction symptoms occur
- Airflow obstruction or symptoms are at least partially reversible
- Alternate diagnoses are excluded
Which alternate diagnoses?

- Paradoxical Vocal Fold Dysfunction
- Tracheal or bronchial lesions
- Foreign bodies
- Congestive heart failure
- Diffuse panbronchiolitis
- Aortic arch abnormalities
- Sinus disease
- GERD
Less common alternate diagnoses

- Aspergillosis
- COPD
- Churg-Strauss syndrome
- Cystic fibrosis
- Pulmonary embolism
- Sarcoidosis
- Tracheomalacia
Clinical History

- Air hunger
- Episodic rather than constant
- There are specific triggers
- Family history
- Frequent episodes of bronchitis or pneumonia
Five Cardinal History Points

- Shortness of breath
- Chest tightness
- Wheezing
- Cough
- Awakened from sleep by SOB or cough
Asthma Control Test (ACT)

1. In the past 4 weeks, how much of the time did your asthma keep you from getting as much done at work, school or at home?

2. During the past 4 weeks, how often have you had shortness of breath?

3. During the past 4 weeks, how often did your asthma symptoms (wheezing, coughing, shortness of breath, chest tightness or pain) wake you up at night or earlier than usual in the morning?

4. During the past 4 weeks, how often have you used your rescue inhaler or nebulizer medication (such as albuterol)?

5. How would you rate your asthma control during the past 4 weeks?
INSTRUCTIONS: Check 1 answer to each question and enter point value (0 or 1) on line.

1. In the past 4 weeks, did you:
   a) Miss any work, school, or normal daily activity because of your asthma?
   b) Wake up at night because of asthma?
   c) Feel your asthma was well controlled?

2. Do you use an inhaler for quick relief from asthma symptoms?
   (If Yes) In the past 4 weeks, what was the greatest number of puffs in 1 day you took of the inhaler?
   0 puffs n (0)  9 to 12 puffs n (0)
   1 to 4 puffs n (0)  More than 12 puffs n (1)
   5 to 8 puffs n (0)  Enter score ___
Tests to Diagnose Asthma

- Peak flow
- FeNO
- Spirometry
- Methacholine challenge
Dilemma

- There is no one specific history point or test that provides a definitive diagnosis of asthma.
- “...there is no agreed upon “gold standard” for categorizing asthma severity…”

What acuity of asthma do you care for?

- We provide no asthma care
- Mild intermittent, needing occasional albuterol only
- Mild-Moderate persistent, needing daily controller medication
- Severe, needing frequent oral steroids
- Life-threatening, requiring hospitalization and possibly intubation
Peak Flow

- Measurement of the maximum speed of exhalation, measured with a peak flow meter.
Peak flow measurement

1. Take a Deep Breath
2. Blow out hard and fast
3. Record the reading on the meter
### Scoring Peak Flow

#### Peak Flow Values in Liters/Minute

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Home Use: Exacerbation Prevention

**Peak flow chart**

- **Untreated Asthma**
  Note there is quite a difference between the morning and evening readings with the morning usually lower.

- **Treatment with preventer inhaler starts**

- **Treatment continues**
  Note: the readings improve. There is still a slight difference between morning and evening (which is normal) but the difference is much less than in untreated asthma.
Asthma Action Plan
Do you use FeNO in your practice?

- Yes
- No
- What’s that?
Fractional Exhaled Nitric Oxide

- Marker for pulmonary eosinophilic inflammation
- Correlates with bronchial hyperresponsiveness, bronchodilator reversibility and atopy
- Under 20 ppb is normal
- 20-50 ppb prompts additional hx, consider spirometry before allergy skin testing
- >50 ppb: spirometry before allergy skin testing
Clinical Uses

- Distinguishing asthma from other pulmonary conditions
- Predicting steroid responsiveness
- Assists optimizing steroid dose
- Monitoring ICS adherence
Niox MINO for FeNO
Performing FeNO

- Exhalation limited to steady state
- Speed of exhalation affects NO concentration
- Using a mirror for feedback
- Same mouthpiece can be used for a number of tries
What impacts FeNO

- Asthmatic children
- Spirometry: small drop at 5 and 15 minutes (p<0.4), back to normal at 30 minutes.
- Exercise. Six minute walk test larger drop in FeNO (p<.004), normal by 30 minutes
FeNO helpful for:
- Detecting of eosinophilic airway inflammation,
- Determining the likelihood of corticosteroid responsiveness,
- Monitoring of airway inflammation to determine the potential need for ICS
- Unmasking of otherwise unsuspected nonadherence ICS therapy
Diagnosing Asthma with FeNO

### Conventional
- Recurrent cough, wheezing or dyspnea
- At least 2 of following:
  - Airway hyperresponsiveness
    - Sputum eosinophilia (eosinophil count 3%)
    - FeNO 40 ppb
    - Reversible airflow limitation
- Exclusion of other lung diseases

### FeNO
- Recurrent cough, wheezing, or dyspnea
- FeNO >40
- Exclusion of other lung diseases

Sensitivity = 78.6%, Specificity = 89.5%, Concordance rate = 0.62.
FeNO and ICS

- FeNO very sensitive to ICS
- Decrease begins within 6 hours of first dose
- Initial decrease continues for 3-4 weeks, then plateaus.
- High FeNO predictive of good response to ICS
- Dose-response curve for increasing ICS, decreasing FeNO
FeNO levels by Symptoms

- FENO levels were increased in children with current asthma (32.2 ppb),
- Wheeze (27.0 ppb), or
- Rhinitis (23.2 ppb)
- compared with subjects without these respective symptoms/diagnoses
- (16.4-16.6 ppb, P < .005 for all comparisons).
Predict ICS responsiveness

- Steroid-naïve patients with asthma sx
- 1/3 had FeNO >47, and best response to ICS
- In absence of high FeNO, response to ICS much lower
- Negative predictive value:
  - FeNO <47, 77% lack improved sx, 89% lack improvement on spirometry.
Predict Response to stop ICS

- 40 children with stable asthma
- Stepdown to withdrawal of ICS
- Relapsers (n=9) during 4 weeks, FeNO rose from 14.8 to 40.8
- Non-relapsers during same time, FeNO rose from 10.5 to 15.9
Helpful in ICS stepdowns

- FeNO < 25 ppb
- In sx-free patient on ICS, dose can be lowered or withdrawn.
- Low FeNO in sx-ic patient, allergic inflammation probably not the cause of the sx.
More Predictions

- A 10 ppb rise in FeNO or more 60% of baseline, positive predictive value of 80% for future loss of asthma control
- Reduction in peak flow, increased rescue need, nighttime arousals.
Predict Exacerbations?

- Non-smoking asthmatic adults
- Exacerbations requiring oral steroids
- If FEV1 >76% predicted, 2/13
- If FEV1 <76%, 20/31
- If FeNO <28 ppb, 9/27
- If FeNO >28 ppb, 13/17
Exacerbations 2

- FeNO >28 AND FEV1<76, correctly identified 13 stable asthmatics with 85% probability of future exacerbation (n=13)
- FeNO<28 AND FEV1>76%, predicted a ZERO probability of future exacerbation (n=9)
- Combination permits risk stratification among clinically similar stable adult asthma patients.
Pediatric Exacerbations

- 77 children with asthma, daily FeNO for 30 weeks
- 25 mod, 12 severe exacerbations
- Looking retrospectively, there were FeNO increases leading up to exacerbations
- Will this be useful prospectively?
Spirometry in your office?

- Yes
- No
Lung Volumes

- Inspiratory Reserve Volume (IRV)
- Inspiratory Reserve Volume (IRV)
- Tidal Volume (TV or V)
- Tidal Volume (TV or V)
- Expiratory Reserve Volume (ERV)
- Functional Residual Capacity (FRC)
- Residual Volume (RV)
- Vital Capacity (VC)
- Total Lung Capacity (TLC)
Spirometry

![Spirometry Graph]

- **PEFR**: Peak Expiratory Flow Rate
- **TLC**: Total Lung Capacity
- **FEV₁**: Forced Expiratory Volume in 1 second
- **RV**: Residual Volume
- **FVC**: Forced Vital Capacity
- **FEV₁/VC**: Ratio of Forced Expiratory Volume in 1 second to the Forced Vital Capacity

FEV₁ = 2.0 L
FVC = 3.9 L
FEV₁/VC = 2.0/3.9 = 0.51

Medscape
Measurements

- Compared to normative data stratified by:
  - Age
  - Height
  - Gender
What flow volume loop tells:
Important Spirometry Measurements

- FVC
- FEV1
- FEV1% = FEV1/FVC
- FEF25-75
- Measurement before and after bronchodilator administration
Forced Vital Capacity

- FVC = IRV + TV + ERV
- Draw in maximal breath, exhale quickly and forcefully
- FEV1 is the amount of air expelled in the first 1 second
- With obstructive disease, this is typically proportionally lower than the FVC
Lung Defects

- Obstructive: decreased maximum flow rate so rapid emptying of the lungs not possible
- FEV1 and FEV1% both low

- Restrictive: lung volume decreased
- FEV1 low but FEV1% normal
• Spirometry suggests asthma if after bronchodilator administration there is a 12% or more increase in the FVC or the FEV1
• **AND** this represents an increase of at least 200mL.
FEF25-75

- Average forced expiratory flow rate between the 25th and 75th percentile of exhalation.
- Mid-expiratory flow
- More variable, dependent on FVC
- Value of less that 60-65% of predicted usually accompanied by measurable bronchial hyper-reactivity.
- An improvement in MMEF after administration of a bronchodilator, if not accompanied by an improvement in FEV1 and/or VC, should be disregarded.
Bronchodilator

- MDI or nebulizer
- Wait 15 minutes
- Are the FVC and/or the FEV1 improved by 12% AND 200 mL?
- If not, does it mean this person doesn’t have asthma?
Asthma Action Plan
- FVC: 118 132
- FEV1: 93 128
- FEV1%: 79 97
- MEF: 59 116
Methacholine

- Cholinergic Rx that stimulates muscarinic receptors causing small airway constriction
- Don’t do if baseline FEV1 <75%
- One breath. In 1 minute repeat spiro. If down 20% confirmed asthma, stop
- If down 15-19%, 2 more breaths
- If down <15%, 4 more breaths
- Down 20% or more at any point confirms asthma, especially if recreates sx
# Severity of Asthma

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<td>&gt;2d/wk, not d</td>
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<td>0</td>
<td>1-2/mo</td>
<td>3-4/mo</td>
<td>&gt;1/wk</td>
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<td>SABA</td>
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<td>&gt;2d/wk, not d</td>
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<td>Multiple/day</td>
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<tr>
<td>QOL</td>
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<td>Minor limits</td>
<td>Some limits</td>
<td>Very limited</td>
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Asthma Treatments

- Avoid triggers, control stress
- Aggressive allergy treatment
- Inhalers
- Oral medications
- Injectable medications
- Bronchial thermoplasty
- Goal: Day after day without asthma symptoms (AFDs)
Stepwise Asthma Treatment

Goal is asthma-free days on the least amount of medication possible.
Controller Inhalers

- Inhaled Corticosteroids
- Beclamethasone (QVAR)
- Mometaxine (Asmanex) twisthaler
- Triamcinolone (Azmacort)
- Fluticasone (Flovent)
- Budesonide (Pulmocort) respules, flexhaler
Thrush Risk

- Any inhaler containing a corticosteroid has the potential to cause oropharyngeal or laryngeal thrush.
- 10-30% of dose reaches lungs
- Imperative to brush teeth/gargle well after each use.
Spacers

- Have patient demonstrate inhaler use for you. Many not using efficiently
- Consider a spacer: A tube-like device places between the medication canister and the patient’s mouth.
- One way valve between canister and spacer.
- Those who can’t coordinate canister activation with inspiration get much more the medication this way.
Spacers
Combo Inhalers

- ICS + LABA
- Advair = Fluticasone + Salmeterol
- Dulera = Mometasone + Formoterol
- Symbicort = Budesonide + Formoterol
Anticholinergic Inhalers

- Historically used for COPD and not asthma, with ICS used for asthma and not COPD
- Because of great heterogeneity of both diseases, anticholinergics recently found to be useful in asthma, especially in severe asthma not well controlled.
- Tiotropium = Spiriva
Oral Medications for Asthma

- (Theophylline)
- Oral corticosteroids
- Leukotriene modifiers
  - Singulair=montelukast
    - Once daily dosing, >12mo
  - Zyflo=zileuton
    - QID dosing, >12 yo, ALT monitoring recommended
  - Accolate=zafirleukast
    - BID dosing, >5 yo, LFTs recommended
Leukotriene modifiers

Source: Curr Opin Allergy Clin Immunol © 2002 Lippincott & Wilkins
Bronchial Thermoplasty

- Radiofrequency energy delivered directly to bronchial wall.
- Destroys tissue which regenerates, but smooth muscle replace almost entirely with connective tissue
- Very helpful for severe asthma
BT- technique

- Three treatments about three weeks apart
- Each lower lobe by itself, both upper lobes together, middle lobe not treated
- No smoking for past year, no more than 10 pack year history
- No pacemaker or other implanted device
- No re-treatment
Xolair

- Omalizumab: humanized murine anti-IgE Ag
- Approved for use in severe asthma not well controlled by high dose ICS, over 12 yo
- Serum IgE 700 or less
- Off-label for food allergies, urticaria, starting peanut or venom IT
- Given SubQ once or twice monthly
- Expensive, $800-1200/month
Asthma Apps

- 103 Apps: 56 information sources, 47 management tools
- Extremely comprehensive review including accuracy of health information, completeness of instructions for use, concordance to current BTS best practice guidelines and ease of use.
- “Although our search identified 103 English language asthma apps, none combined comprehensive, evidence-based information with reliable supportive tools.”

A 34-year old non-smoking man with a history of allergic rhinitis, acid reflux, and anxiety presents with symptoms of cough, wheeze, nasal congestion, and post-nasal drainage. His symptoms have been ongoing for several weeks and do not respond to albuterol.

He uses a nasal steroid and an antihistamine daily for allergic rhinitis. Cough and wheeze occur both day and night, and are not aggravated by activity, although he does note dyspnea with exertion.

He previously had been placed on a combination therapy of an ICS and a LABA for asthma. He also stopped taking prescribed acid suppressive therapy (ranitidine and omeprazole) due to bloating. He notes symptoms of heartburn a few times a week.

Physical exam is remarkable for obesity, bilateral nasal turbinate edema and a clear/white mucous discharge, as well as for posterior pharyngeal cobblestoning, erythema and mucoid exudate.
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Assessment

- Cough and wheeze, historical diagnosis of asthma
- No objective evidence ongoing airway inflammation suggesting benefit from ICS
- History of GERD, currently off therapy.
- Allergic rhinitis, SPT confirmation HDM sensitivity.
- Ongoing rhinitis symptoms despite nasal steroid and antihistamine therapy.
Plan

1. Start PPI therapy for GERD and possible GERD underlying non-specific symptoms of cough and wheeze.
2. Continue therapy with a nasal steroid and antihistamine. Recommend nasal saline irrigations.
3. DO NOT start anti-inflammatory therapy for asthma given the objective measurement of FENO at 10ppb which suggests patient would not benefit from such therapy.
4. Consider CT of sinuses to evaluate for ongoing sinus disease that may benefit from antimicrobial therapy.
Followup

- After 1 month, the patient notes significant, albeit incomplete improvement in his respiratory symptoms of cough and wheeze.
- He is continuing to use his nasal steroid and antihistamine and has also found benefit from nasal saline irrigations.
- Admits to not using his PPI regularly due to continued side effects and feels this may be responsible for his incomplete response.
Analysis

- This patient presents with multiple co-morbid conditions which could have contributed to his symptoms of cough and wheeze.
- Exhaled nitric oxide essentially excluded eosinophilic asthma as the underlying cause for his symptoms.
- The patient historically had been diagnosed with asthma and demonstrated some obstruction on spirometry with a low ACT score, suggesting that the addition of an ICS would have been the next step.
- The low FENO resulted in a focus on co-morbid conditions instead.
- In this case, measurement of FENO played a significant role in preventing an erroneous diagnosis of asthma and a potential escalating course of inhaled steroids.
- If this therapeutic approach failed to improve the condition for this patient, further evaluation for possible non-eosinophilic asthma might be warranted.
Case Study

- A 7-year old girl was evaluated for food allergies to milk and peanut.
- History of eczema as an infant and preschool child
- Recurrent episodes of wheezing in her first 3 years of life.
- In the past four years, she has had approximately 2 significant episodes per year of wheezing, for which she uses albuterol and occasionally steroids.
- She is currently asymptomatic, and reports no symptoms with exercise.
- Her father denies nasal allergy symptoms.
- A physical exam is remarkable for allergic shiners, significant inferior turbinate edema. Lungs and skin are normal.
- Skin tests are positive for ash, maple, Kentucky Blue and timothy grass, dog dander, Alternia, milk and peanut.
### Spirometry

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Assessment

1. Asthma, currently asymptomatic but with significantly elevated FENO.
2. Atopic dermatitis.
3. Allergic sensitization to milk, peanuts and perennial allergens.
4. Consider whether child is at risk for worsening asthma and progressive loss of lung function over time.
Plan

1. If symptoms increase, begin low-dose ICS therapy.
2. Patient education about allergen exposure and avoidance.