Diagnosis of Asthma in Young Children

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Objectives

• To identify risk factors, comorbidities, and natural history of wheezing and asthma in young children

• To identify common diagnostic challenges in the diagnosis of asthma in young children

• To understand the recommended initial evaluations and management in young children with recurrent wheezing

Diagnostic challenges in young children

• Not all that wheezes is asthma

• Limitations in objective evaluations

• Not all respond to typical asthma medications

• Not all asthma persists into later childhood

What is Asthma?
National Heart, Lung, and Blood Institute: Definition of Asthma

- Chronic disease involving airway inflammation, bronchial hyper-responsiveness, and reversible airflow obstruction
- Disease manifests as recurrent:
  - Wheeze
  - Cough
  - Chest tightness
  - Difficulty breathing
  - Nighttime cough
- Most children have symptoms before age 5

Key Points When Establishing Diagnosis

- Determine that episodic symptoms are present
- Demonstrate at least partial reversibility in airflow obstruction
- Exclude alternative diagnoses

Differential Diagnosis

- Recurrent respiratory tract infections – pneumonia, bronchiolitis
- Airway malacia
- Airway compression
- Foreign body
- Cystic fibrosis
- Primary ciliary dyskinesia
- Congenital heart disease
- GERD
- Aspiration

Natural History of Wheezing in Infancy

- Transient wheezer
- Non-atopic (persistent) wheezer
- Atopic wheezer
Transient Wheezer

- Begins during first year of life and resolves by preschool years
- Decreased lung function before any lower respiratory tract infections
- Associated with:
  - Prematurity
  - Prenatal smoke exposure
  - Early childhood viral exposure (siblings, daycare)
  - Discrete wheezing episodes associated with viral infection
  - Often no family history of asthma

Non-Atopic Wheezer (Persistent Wheezer)

- Wheezing begins before age 3 and still present at age 6
- Start out with normal lung function at birth compared to non-wheezees with gradual decline over time
- Wheezing predominantly associated with viral infection

Atopic Wheezer

- Associated with:
  - Parental asthma
  - Male sex
  - Atopic dermatitis
  - Elevated IgE at 19 months
  - Early sensitization to food or aeroallergens
  - Symptoms between exacerbations
  - Often family history of asthma and atopic disease
- Start out with normal lung function at birth compared to non-wheezees with gradual decline over time
- Early and late onset phenotypes but typically starts after the first year of life

Asthma Prediction Index

Children younger than 3 years who have had 4 or more significant wheezing episodes in the past year are much more likely to have lifelong asthma after 5 years if...

Major Criteria (1 required)
- Parent with asthma
- Provider diagnosis of eczema
- Positive sensitivity to aeroallergens

OR

Minor Criteria (2 required)
- Food allergy
- >4% eosinophils on CBC
- Wheezing apart from colds
Challenges to Diagnostic Testing

- Infants/young children cannot perform spirometry
- Infant pulmonary function testing (PFTs) are difficult
  - Sedation, limited availability, not generally recommended
- Symptoms can rapidly change

So, how do you evaluate the wheezing 2 year old?

A Clinical Diagnosis

- **History**
  - Pattern of wheezing
    - Chronicity of symptoms
    - Severity of exacerbations
    - Episodic vs continuous
    - What triggers
    - Positional
    - Age
  - Comorbidities
    - GERD/Aspiration
    - Smoke exposure
    - Atopic dermatitis (eczema)
    - Food allergy
  - Birth history
    - Prematurity
    - Prenatal tobacco smoke exposure
  - Family history
    - Asthma
    - Eczema
    - Allergic rhinitis
    - Food allergy

- **Physical exam**
  - Lungs → Bilateral expiratory polyphonic wheezing
    - Inspiratory/expiratory
    - Polyphonic/monophonic
    - Local or diffuse
    - Response to albuterol
  - Skin → atopic disease
    - Eczema
    - Allergic "shiners"
  - ENT →
    - Pale/blue boggy nasal turbinates vs. Red irritated nasal turbinates
    - Tonsillar hypertrophy

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Initial Work-up

• Imaging: All new onset wheezing deserves a CXR

Respiratory Virus Epidemiology

• Major viruses responsible for wheezing:
  • Rhinovirus
  • Human metapneumovirus
  • RSV
  • Influenza

Viral testing: depends on other clinical symptoms and testing capabilities
### Initial Work-up

- **Imaging:** All new onset wheezing deserves a CXR
- **Viral testing:** depends on other clinical symptoms and testing capabilities
- **Trial of bronchodilators**
- **Consideration of secondary insults to the lung** (e.g. GE reflux, aspiration)

### Reasons to Refer

- Requiring high-dose controller therapy
- Frequent exacerbations
- Persistent wheezing unresponsive to bronchodilator therapy
- Unusual recurrent infections
- Suspect alternative diagnosis other than asthma
Advanced Work-Up

- Spirometry
- Video swallow test
- Sweat chloride
- Chest CT
- Flexible bronchoscopy with BAL
- CBC and total IgE
- Skin prick testing
- Impedance probe, trial of GERD medication
- Polysomnogram
- Nasal nitric oxide

Treatment

- Identify and modify comorbidities
- Smoking cessation
- Allergic trigger avoidance
- Treatment of GERD

Treatment

- Medications
  - Inhaled Corticosteroids (ICS)

Expert Panel Report – 3 (NHLBI)

Consider daily long-term control therapy: Young children may be at high risk for severe exacerbations, yet have low levels of impairment. Baseline evaluation. Other long-term control therapy for:

- Children with frequent asthma exacerbations (>4 exacerbations in a year) and failure to respond to inhaled corticosteroids or other long-term control therapy.
- Children with moderate to severe asthma and failure to respond to inhaled corticosteroids or other long-term control therapy.
- Children with frequent asthma exacerbations (>4 exacerbations in a year) and failure to respond to inhaled corticosteroids or other long-term control therapy.

Monitor response closely, and adjust treatment.
**Why stronger recommendation for ICS for the “atopic wheezers”?**

- Most studies of ICS in recurrent wheezers in infancy and early childhood have not shown benefit
- Studies looking at specific subgroups do show decrease in symptoms
- ICS are not entirely benign drugs
  - Known effects on linear growth
  - Alterations in lung development in animal models

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**Treatment with ICS more likely to be effective for...**

- Atopic phenotypes
- Children > 2 years of age
- Children with prior documented response to bronchodilators
- Episodes of wheezing triggered by events other than viral infection

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**Expert Panel Report – 3 (NHLBI)**

Monitor response closely, and adjust treatment.

If no clear and positive response occurs within 4–6 weeks and the patient’s treatment’s medication technique and adherence are satisfactory, stop the treatment and consider alternative therapies or diagnoses. If clear benefit is sustained for at least 3 months, consider step down to evaluate the continued need for daily therapy. Children this age have high rates of spontaneous remission of symptoms.
Treatment

- Management of comorbidities
- Medications
  - ICS
  - LABA
    - No good evidence for efficacy/safety in this age group
    - Montelukast (Singulair)
      - Studies show tolerance but not efficacy in younger children
      - 3 years and up may be considered as an adjuvant

Prevention / Education

- Asthma action plan
- Avoidance of triggers

Asthma Action Plan

- Goal: Clear communication of asthma care plan
  - Needs to be easily understood
  - When to use medications
  - How to use medications
  - When to call doctor or seek emergency help
Asthma Education

- Key topics:
  - Spacer education
  - Medications (controller vs. rescue inhaler)
  - MDI vs. nebulizer treatments
  - What triggers symptoms

What happens to early wheezers later in life?

Tucson Children’s Respiratory Study

- Enrolled approximately 1200 children at birth

- Defined early wheezing symptoms as follows:
  - Never wheeze: no symptoms up to age 6yrs
  - Transient early wheeze: wheeze before age 3yrs
  - Late onset wheeze: wheeze at age 6yrs only
  - Persistent wheeze: wheeze before age 3 and at 6yrs
Summary

• Diagnosing and managing asthma in the young child has challenges → mostly a clinical diagnosis
• Initial work-up involves consideration of other causes of wheezing as well as trigger/co-morbidity evaluation
• Wheezing early in childhood does not always equal wheezing later in childhood

Summary

• Long term management involves medications, education, and avoidance of triggers
  • Transient viral wheezing is most common cause
  • Atopic features more common in older preschoolers
  • Atopic features predict response to ICS therapy
  • Trial of low dose ICS and discontinue if no response

References

• Inoue T Shimjo N. Epidemiology of virus-induced wheezing/asthma in children. Front Micro. 2013 Apr 1;2:5.