Managing Pediatric Asthma

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No disclosures
THORACIC PARK
OBJECTIVES

• Understand the extent of the problem
• Correctly define asthma and understand disease mechanisms
• Importance of patient-careprovider partnerships
• Identify poorly controlled asthma
• Understand roles of medications used in treatment
INTRODUCTION

• Major cause of morbidity and mortality throughout the world
• Affects nearly 300 million people worldwide
• One of the most common chronic diseases of childhood
• Increasing prevalence in children
INTRODUCTION

• Who is affected (US)?
  – 18.7 million adults (1 in 12)
  – 7 million children (1 in 11)

• What does this mean:

• $56 billion dollars in healthcare costs
INTRODUCTION

- Average yearly cost - $1,039 dollars for the care of each child (2009)
- Other socio-economic impact:
  - 10.5 million missed school days
  - 14.2 million missed days of work
On average, 3 children in a classroom of 30 are likely to have asthma
# Pediatric Asthma in Tennessee

Overall prevalence: 9.5% in the 0 to 17 year age group

<table>
<thead>
<tr>
<th>Gender</th>
<th>Race/Ethnicity</th>
<th>Age Groups</th>
<th>Federal Poverty Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Males: 10.7%</td>
<td>African Americans: 16.1%</td>
<td>0-5 years 6.3%</td>
<td>0-99% 12.4%</td>
</tr>
<tr>
<td>Females: 8.2%</td>
<td>Caucasians: 7.6%</td>
<td>6-11 years 10.6%</td>
<td>100-199% 11.0%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>12-17 years 11.4%</td>
<td>200-399% 8.2%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>≥400% 6.6%</td>
</tr>
</tbody>
</table>

Pediatric Asthma in Tennessee

- Mortality:
  - 5 per year
  - 3.3 per 100,000
- Healthcare costs: $41.4 million

Data Source: Tennessee Department of Health; Division of Health Statistics; Death Statistical System. Mortality data are 2006-2010 annual averages.

Data Source: Tennessee Department of Health; Division of Health Statistics; Charges data are for 2010
# Pediatric Asthma in Tennessee

<table>
<thead>
<tr>
<th>County</th>
<th>Hospitalization rate (per 100,000)</th>
<th>ER visit rate (per 100,000)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shelby</td>
<td>255</td>
<td>2018</td>
</tr>
<tr>
<td>Southwest</td>
<td>173</td>
<td>1,193</td>
</tr>
<tr>
<td>Sullivan</td>
<td>146</td>
<td>868</td>
</tr>
<tr>
<td>Knox</td>
<td>142</td>
<td>1,316</td>
</tr>
<tr>
<td>Madison</td>
<td>136</td>
<td>1,271</td>
</tr>
<tr>
<td>Davidson</td>
<td>95</td>
<td>774</td>
</tr>
<tr>
<td>Hamilton</td>
<td>52</td>
<td>1,060</td>
</tr>
</tbody>
</table>

Data Source: Tennessee Department of Health; Division of Health Statistics; Hospital Discharge Data System. Except for trend and charges data, all inpatient hospitalization and ED visit data are 2006-2010 annual averages. Trend data are for 2001-2010.
DEFINITION

- Chronic inflammatory disease of the airways
- Recurrent episodes of wheezing, shortness of breath, cough, chest tightness, especially late in the night or in the early hours of the morning.
DEFINITION

• Episodes associated with widespread but variable airways obstruction

• Reversal of airflow obstruction spontaneously or with broncho-dilator therapy
PATHOPHYSIOLOGY

- Bronchoconstriction
- Airway edema
- Airway hyper-responsiveness
- Airway remodeling
PATHOPHYSIOLOGY

• Bronchoconstriction
• Airway edema
• Airway hyper-responsiveness
• Airway remodeling
BRONCHO-CONSTRICITION

• Narrowing of airway smooth muscle
• Resultant decrease in airflow
• Stimuli:
  – Allergens.
  – NSAIDs.
  – Cold air, exercise.
  – Stress.
BRONCHO-CONSTRICTION
PATHOPHYSIOLOGY

- Bronchoconstriction
- Airway edema
- Airway hyper-responsiveness
- Airway remodeling
AIRWAY EDEMA

• Noted with more persistent disease and more progressive inflammation

• Further airflow limitation
PATHOPHYSIOLOGY

- Bronchoconstriction
- Airway edema
- Airway hyper-responsiveness
- Airway remodeling
AIRWAY HYPER-RESPONSIVENESS

• Exaggerated broncho-constrictor response to a variety of stimuli.

• Results from:
  – Inflammation.
  – Dysfunctional neuronal regulation.
  – Structural changes.
PATHOPHYSIOLOGY

• Bronchoconstriction
• Airway edema
• Airway hyper-responsiveness
• Airway remodeling
AIRWAY REMODELING

• Structural changes result in progressive loss of lung function and incomplete response to therapy.

• Characterized by:
  – Inflammation
  – Mucus hyper-secretion
  – Sub-epithelial fibrosis
  – Smooth muscle hypertrophy
  – Angiogenesis
PATHOPHYSIOLOGIC MECHANISMS

• Inflammation has a central role.
• Inflammatory cells.
• Inflammatory mediators.
PATHOGENESIS

Persistent wheezing and asthma

Lower Respiratory Infections

Altered Innate and Adaptive Immune Responses

Age

Environmental factors:
- Allergens
- Pollution
- Infections
- Microbes
- Stress

Genetic factors:
- Cytokine response profiles
PATHOGENESIS

• Genetics

• Gender: more common in boys in childhood, girls post puberty

• Environmental factors:
  – Allergen exposure
  – Lower respiratory infections.
  – Other environmental factors: tobacco smoke, air pollution
Airway Effects
Bronchospasm
Acute Inflammation
Persistent Inflammation
Remodeling

Environmental factors
Th2/Th1 cytokines (e.g., IL-13, TNF-α)

B lymphocyte → T lymphocyte
IL-3, IL-4, IL-13, IL-9
GM-CSF

Environmental factors and inflammatory products

mucus

Initiation

(myo) fibroblasts

Amplification

Smooth muscle

Propagation

Blood vessels

Persistence of inflammation and development of remodeling

Airway microenvironment

Pro-inflammatory mediators

Dendritic cell

Mast cell

Eosinophil

Neutrophil
MANAGEMENT

• Establishing the diagnosis
• Excluding other diagnoses
• Measures of disease assessment and monitoring disease severity - Goal: good symptom control
MANAGEMENT

• Establishing the diagnosis
• Excluding other diagnoses
• Measures of disease assessment and monitoring disease severity - Goal: good symptom control
DIAGNOSIS

• Symptoms from episodic airflow obstruction
• Airflow obstruction is at least partially reversible.
• Alternative diagnoses are excluded.
DIAGNOSIS

• Factors in establishing the diagnosis:
• Detailed medical history
• Thorough physical examination
• Reversible airway obstruction on spirometry: ≥ 10% change in FEV$_1$ post aerosolized bronchodilator
• Tests to exclude alternate diagnoses
■ Wheezing—high-pitched whistling sounds when breathing out—especially in children. (Lack of wheezing and a normal chest examination do not exclude asthma.)

■ History of any of the following:
  — Cough, worse particularly at night
  — Recurrent wheeze
  — Recurrent difficulty in breathing
  — Recurrent chest tightness

■ Symptoms occur or worsen in the presence of:
  — Exercise
  — Viral infection
  — Animals with fur or hair
  — House-dust mites (in mattresses, pillows, upholstered furniture, carpets)
  — Mold
  — Smoke (tobacco, wood)
  — Pollen
  — Changes in weather
  — Strong emotional expression (laughing or crying hard)
  — Airborne chemicals or dusts
  — Menstrual cycles

■ Symptoms occur or worsen at night, awakening the patient.
SPIROMETRY

• Delineating the severity of obstructive disease
• Assessing response to aerosolized bronchodilator
• Excluding other diagnoses
• Methacholine challenges to help establish diagnosis
# SPIROMETRY

## Bronchodilator Response

<table>
<thead>
<tr>
<th>Spirometry</th>
<th>(BTPS)</th>
<th>PRED</th>
<th>BEST</th>
<th>%PRED</th>
<th>POST-RX</th>
<th>%CHG</th>
</tr>
</thead>
<tbody>
<tr>
<td>FVC</td>
<td>Liters</td>
<td>2.38</td>
<td>1.87</td>
<td>79</td>
<td>2.37</td>
<td>99</td>
</tr>
<tr>
<td>FEV1</td>
<td>Liters</td>
<td>2.19</td>
<td>1.06</td>
<td>48</td>
<td>1.89</td>
<td>86</td>
</tr>
<tr>
<td>FEF25-75%</td>
<td>L/sec</td>
<td>2.48</td>
<td>0.54</td>
<td>22</td>
<td>1.70</td>
<td>69</td>
</tr>
<tr>
<td>PEF</td>
<td>L/sec</td>
<td>4.69</td>
<td>2.46</td>
<td>53</td>
<td>4.27</td>
<td>91</td>
</tr>
<tr>
<td>FET100%</td>
<td>Sec</td>
<td>5.64</td>
<td>3.70</td>
<td>69</td>
<td>3.70</td>
<td>91</td>
</tr>
<tr>
<td>FVC</td>
<td>Liters</td>
<td>2.38</td>
<td>1.07</td>
<td>45</td>
<td>2.20</td>
<td>92</td>
</tr>
<tr>
<td>FEF/FIF50</td>
<td>&lt;1.00</td>
<td>0.57</td>
<td>45</td>
<td></td>
<td>0.92</td>
<td></td>
</tr>
</tbody>
</table>

Comments:
MANAGEMENT

• Establishing the diagnosis
• Excluding other diagnoses
• Measures of disease assessment and monitoring disease severity - Goal: good symptom control
DIFFERENTIAL DIAGNOSES

• Upper airways disease:
  – Allergic rhinitis/ sinusitis

• Large airway obstruction:
  – Foreign body
  – Vocal cord dysfunction
  – Tracheo-bronchomalacia
  – Vascular ring
  – Enlarged mediastinal lymph nodes

• Small airway obstruction:
  – Bronchiolitis
  – Cystic fibrosis
  – Bronchopulmonary dysplasia.

• Others:
  – Cough due to dysphagia or due to gastro-esophageal reflux disease
MANAGEMENT

• Establishing the diagnosis
• Excluding other diagnoses
• Measures of disease assessment and monitoring disease severity - Goal: good symptom control
GOOD SYMPTOM CONTROL

• Avoid troublesome symptoms during the day and during the night
• Use little or no quick relief medication
• Lead a physically active lifestyle
• Normal/ near normal lung function
• Avoid exacerbations

GINA guidelines, 2011
MANAGEMENT

• Disease severity:
  – Assessed on initial presentation

• Disease control:
  – Assess response once appropriate therapy is initiated

• Disease responsiveness:
  – ↓ symptoms, fewer urgent care visits.
  – ↓ use of quick relief medication.
## ASSESSMENT OF CURRENT CLINICAL CONTROL

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Controlled (all of the following)</th>
<th>Partly controlled (any measure presented)</th>
<th>Uncontrolled</th>
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<tbody>
<tr>
<td>Daytime symptoms</td>
<td>None</td>
<td>&gt; Twice /week</td>
<td>Three or more features of partly controlled asthma</td>
</tr>
<tr>
<td>Limitation of activity</td>
<td>None</td>
<td>Any</td>
<td></td>
</tr>
<tr>
<td>Nocturnal symptoms</td>
<td>None</td>
<td>Any</td>
<td></td>
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<td>Need for reliever medication</td>
<td>≤ 2 per week</td>
<td>&gt; Twice /week</td>
<td></td>
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<tr>
<td>Lung function</td>
<td>Normal</td>
<td>&lt; 80% predicted</td>
<td></td>
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</tbody>
</table>
MANAGEMENT

• Evaluate frequency & intensity of symptoms
• Evaluate functional limitation
• Evaluate risk of:
  • Exacerbations
  • Decline in lung function
  • Adverse effects from medications
RISK FACTORS FOR INCREASED ADVERSE EVENTS

• Poor clinical control
• Frequent exacerbations in the past year
• Any admission ever to an intensive care unit
• Poor lung function
• Exposure to cigarette smoke
• High dosage of medications
COMPONENTS OF ASTHMA CARE

• Developing a patient/health care team partnership
• Identify and decrease exposure to risk factors
• Assess, treat and monitor asthma
• Manage acute asthma exacerbations
COMPONENTS OF ASTHMA CARE

- Developing a patient/health care team partnership
- Identify and decrease exposure to risk factors
- Assess, treat and monitor asthma
- Manage acute asthma exacerbations
PATIENT/HEALTH-CARE TEAM PARTNERSHIP

Help patients to:

• Avoid risk factors
• Take medications correctly
• Understand the role of medications: ‘controller’ as compared to ‘reliever’
PATIENT/HEALTH-CARE TEAM PARTNERSHIP

Help patients to:

• Monitor their own status based on symptoms or on peak expiratory flow (PEF)
• Recognize signs of worsening asthma and take appropriate action
• Seek medical advice promptly when needed
PATIENT/HEALTH-CARE TEAM PARTNERSHIP

Education

• Integral part of all patient health-care team interactions

• Can be done singly or in groups

• Variety of methods including direct education, use of videos

Working together to generate a written personalized asthma care plan
ASTHMA ACTION PLAN

Describes medicines to use and actions to take

Source: www.cdc.gov
COMPONENTS OF ASTHMA CARE

• Developing a patient/health care team partnership
• Identify and decrease exposure to risk factors
• Assess, treat and monitor asthma
• Manage acute asthma exacerbations
REDUCE EXPOSURE TO RISK FACTORS

• Identify and avoid precipitating factors
• Use controller medications as prescribed in patients who react to multiple factors that are ubiquitous - better asthma control may make them less sensitive to these risk factors.
REDUCE EXPOSURE TO RISK FACTORS

• Exercise: should not be avoided – instead, prevent symptoms by pre-treating with the ‘reliever’ medication

• Annual influenza vaccination as recommended by the Centers for Disease Control

www.ginasthma.com
SLEEPING WITH THE ENEMY?

Avoiding exposure to risk factors

Le Bonheur Children's Hospital

The University of Tennessee Health Science Center
HOUSE DUST MITES

• Use covers for mattresses and pillows
• Wash bed linens weekly with hot water
• Avoid down fillings
• Limit stuffed animals to those that can be washed
• Reduce humidity level (between 30% and 50% relative humidity per EPR-3)

www.cdc.gov
A ROACH BY ANY OTHER NAME......

- Clean home thoroughly
- Pesticide sprays – to be used when asthma patient is away from home

www.cdc.gov
REDUCING PET EXPOSURE

• Air filters

• Keep pets away from patient as far as possible, especially from the sleeping area

www.ginasthma.com
REDUCING MOLD EXPOSURE

- Reduce dampness
- Clean damp areas frequently

www.cdc.gov
OTHER ASTHMA TRIGGERS

- Air pollution
- Trees, grass, pollen

www.cdc.gov
AVOID PASSIVE SMOKE EXPOSURE
COMPONENTS OF ASTHMA CARE

• Developing a patient/health care team partnership
• Identify and decrease exposure to risk factors
• Assess, treat and monitor asthma
• Manage acute asthma exacerbations
GOALS OF TREATMENT

• Achieve and maintain clinical control
• Reached by a cycle that involves:
  – Assessing the level of disease control
  – Treating to achieve control
  – Monitoring to maintain control

www.ginasthma.com
## ASSESSING ASTHMA CONTROL

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<td>Normal</td>
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</tr>
</tbody>
</table>
TREating TO aChievE cONTROL

<table>
<thead>
<tr>
<th>Level of control</th>
<th>Treatment Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Controlled</td>
<td>Reduce Maintain and find lowest controlling step</td>
</tr>
<tr>
<td>Partly controlled</td>
<td>Increase Consider stepping up treatment to gain control</td>
</tr>
<tr>
<td>Uncontrolled</td>
<td>Increase Step up to achieve control</td>
</tr>
<tr>
<td>Exacerbation</td>
<td>Increase Treat as exacerbation</td>
</tr>
</tbody>
</table>
STEP THERAPY IN ASTHMA
TREATMENT STEPS

• Treatment adjusted according to the patient’s needs
• ICS: inhaled corticosteroids
• LTRA: leukotriene receptor antagonist
• LPOI: 5’lipoxygenase inhibitor
• SABA: short acting beta 2 agonist
• LABA: long acting beta 2 agonist
Persistent Asthma: Daily Medication
Consult with asthma specialist if step 4 care or higher is required.
Consider consultation at step 3.

Step 1
Preferred: Low-dose ICS
Alternative: Cromolyn, LTRA, Nedocromil, or Theophylline
OR Medium-dose ICS

Step 2
Preferred: Low-dose ICS + either LABA, LTRA, or Theophylline
Alternative: Medium-dose ICS + either LTRA or Theophylline

Step 3
Preferred: High-dose ICS + LABA
Alternative: High-dose ICS + either LTRA or Theophylline

Step 4
Preferred: High-dose ICS + LABA + oral systemic corticosteroid
Alternative: High-dose ICS + either LTRA or Theophylline + oral systemic corticosteroid

Step 5
Preferred: High-dose ICS + LABA + oral systemic corticosteroid
Alternative: High-dose ICS + either LTRA or Theophylline + oral systemic corticosteroid

Step 6
Preferred: High-dose ICS + LABA + oral systemic corticosteroid

Each step: Patient education, environmental control, and management of comorbidities.
Steps 2–4: Consider subcutaneous allergen immunotherapy for patients who have allergic asthma (see notes).

Quick-Relief Medication for All Patients
• SABA as needed for symptoms. Intensity of treatment depends on severity of symptoms: up to 3 treatments at 20-minute intervals as needed. Short course of oral systemic corticosteroids may be needed.
• Caution: Increasing use of SABA or use >2 days a week for symptom relief (not prevention of EIB) generally indicates inadequate control and the need to step up treatment.
GOALS OF TREATMENT

• Achieve and maintain clinical control
• Reached by a cycle that involves:
  – Assessing the level of disease control
  – Treating to achieve control
  – Monitoring to maintain control

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MONITORING TO MAINTAIN CONTROL

• Ongoing to maintain disease control

• Establish lowest step of therapy, lowest drug dose

• Patients seen 1 to 3 months after first visit and at least every 3 months thereafter

• Seen 2 weeks to a month after any exacerbation

www.ginasthma.com
MEETING EXPECTED GOALS

• Ask the patient on clinic visits:
  – Frequency of daytime and night time symptoms
  – Frequency of using reliever medication
  – Urgent medical visits
  – Level of physical activity

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MEETING EXPECTED GOALS

• Checking the patient’s technique on the use of inhaled medications on each visit
• Assessing adherence to treatment regimen
• Reinforce avoidance of risk factors
ADMINISTERING MEDICATION

Courtesy: University of Michigan
ADMINISTERING MEDICATION

University of MN Medical Center
QUICK RELIEF MEDICATIONS

• Short acting β-2 agonists:
  – Mainstay of therapy for acute bronchospasm.
  – Frequency of use to assess level of disease control: use of > 1 canister in a 1 to 2 month period associated with increased risk of ED visit/hospitalization.

• Systemic corticosteroids
QUICK RELIEF MEDICATIONS

- ProAir® HFA
- Proventil® HFA
- Ventolin® HFA
- Xopenex® HFA

- albuterol sulfate
- albuterol sulfate
- albuterol sulfate
- levalbuterol tartrate
PHARMACOLOGIC THERAPY - CONTROLLERS

• Long term controller medications

• Inhaled corticosteroids: most potent and effective controller medications:
  – Suppress cytokine generation
  – Decrease recruitment of eosinophils
  – Well tolerated and safe
  – More effective than LTRA’s
INHALED CORTICOSTEROIDS (ICS)

• To reduce potential side effects:
  – Use of valved holding chambers.
  – Rinse mouth after use.
  – Lowest medication dose to maintain control.
  – Monitor growth in children.
ADVERSE EFFECTS

• Local:
  – Candidiasis.
  – Dysphonia.
  – Cough and bronchospasm

• Systemic:
  – Effect on linear growth.
  – Bone mineral density.
  – Glucose intolerance.

Reduced by Use of a VHC
# ICS FORMULATIONS

<table>
<thead>
<tr>
<th>Name</th>
<th>Dosage (mcg) per actuation (inhaler)</th>
<th>Dosage for nebulization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fluticasone dipropionate</td>
<td>44, 110, 220</td>
<td></td>
</tr>
<tr>
<td>Budesonide</td>
<td>90, 180 (Flexhaler)</td>
<td>250 mcg 500 mcg</td>
</tr>
<tr>
<td>Mometasone</td>
<td>220</td>
<td></td>
</tr>
<tr>
<td>Beclomethasone (Qvar)</td>
<td>40, 80</td>
<td></td>
</tr>
<tr>
<td>Fluticasone/ Salmeterol (Advair)</td>
<td>100/50, 250/50, 500/50 (diskus)</td>
<td></td>
</tr>
<tr>
<td>Budesonide/ Formoterol</td>
<td>80/4.5, 160/4.5</td>
<td></td>
</tr>
</tbody>
</table>
Persistent Asthma: Daily Medication
Consult with asthma specialist if step 4 care or higher is required. Consider consultation at step 3.

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Step 4
Preferred: High-dose ICS + LABA
Alternative: High-dose ICS + either LTRA or Theophylline

Step 5
Preferred: High-dose ICS + LABA + oral systemic corticosteroid
Alternative: High-dose ICS + either LTRA or Theophylline + oral systemic corticosteroid

Step 6

Step up if needed
(first, check adherence, inhaler technique, environmental control, and comorbid conditions)
Assess control
Step down if possible
(and asthma is well controlled at least 3 months)

Each step: Patient education, environmental control, and management of comorbidities.
Steps 2–4: Consider subcutaneous allergen immunotherapy for patients who have allergic asthma (see notes).

Quick-Relief Medication for All Patients
- SABA as needed for symptoms. Intensity of treatment depends on severity of symptoms: up to 3 treatments at 20-minute intervals as needed. Short course of oral systemic corticosteroids may be needed.
- Caution: Increasing use of SABA or use >2 days a week for symptom relief (not prevention of EIB) generally indicates inadequate control and the need to step up treatment.
## INHALED CORTICOSTEROIDS

<table>
<thead>
<tr>
<th>Medication name</th>
<th>Low dose (μg)</th>
<th>Medium dose (μg)</th>
<th>High dose (μg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fluticasone</td>
<td>100-250</td>
<td>&gt;250-500</td>
<td>&gt;500-1000</td>
</tr>
<tr>
<td>Budesonide</td>
<td>200-400</td>
<td>&gt;400-800</td>
<td>&gt;800-1600</td>
</tr>
<tr>
<td>Beclomethasone dipropionate - HFA</td>
<td>100-250</td>
<td>&gt;250-500</td>
<td>&gt;500-1000</td>
</tr>
<tr>
<td>Mometasone furoate</td>
<td>200</td>
<td>&gt;400</td>
<td>&gt;800</td>
</tr>
<tr>
<td>Ciclesonide</td>
<td>80-160</td>
<td>&gt;160-320</td>
<td>&gt;320-1280</td>
</tr>
</tbody>
</table>
Fluticasone inhaler and diskus

Budesonide nebulization solution

Beclomethasone inhaler

Budesonide turbuhaler
OTHER CONTROLLER MEDICATIONS

• Leukotriene Receptor Antagonists (LTRA):
  – Less effective than ICS as controllers.
  – Role in exercise induced bronchospasm.
  – Montelukast, Zafirlukast.

• 5’lipoxygenase inhibitor: Zileuton:
  – Not studied in children under 12.
  – Liver function needs to be monitored.
LONG ACTING β-2 AGONISTS

• Use as adjunct to ICS in long term asthma therapy.

• Not recommended as mono-therapy.

• Agents: Salmeterol, Formoterol.

• Maximum daily dose:
  – Salmeterol: 100 mcg.
  – Formoterol: 24 mcg.
ICS+LABA COMBINATIONS

- Budesonide/Formoterol inhaler
- Fluticasone/Salmeterol inhaler
- Fluticasone/Salmeterol diskus
OTHER CONTROLLER MEDICATIONS

- Systemic corticosteroids: reserved for the most difficult to control asthma.
- Omalizumab: monoclonal antibody that binds to the FC region of IgE.
- Methylxanthines: adjunctive therapy to inhaled corticosteroids.
COMPONENTS OF ASTHMA CARE

• Developing a patient/health care team partnership
• Identify and decrease exposure to risk factors
• Assess, treat and monitor asthma
• Manage acute asthma exacerbations
ACUTE EXACERBATION

- Episodes of progressive increase in cough, shortness of breath, wheezing, chest tightness, or a combination of these symptoms
- Severe asthma attacks can be life-threatening
IDENTIFYING PATIENTS AT RISK FOR MORTALITY

Asthma History

• Previous ICU admission/intubation
• ≥ 2 hospitalizations/year
• ≥3 ED visits/year
• Frequent need for \( \beta_2 \) agonist (> 1 canister per month)
• Poor understanding of symptoms

Social History

• Poor socioeconomic strata
• Poor adherence to prescribed therapy
• Co-morbidities including psychiatric illnesses
# SEVERITY OF EXACERBATIONS

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Mild</th>
<th>Moderate</th>
<th>Severe</th>
<th>Imminent respiratory failure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shortness of breath</td>
<td>Able to walk and to lie down</td>
<td>Able to talk</td>
<td>Hunched forward</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Prefers sitting up</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Talking</td>
<td>Sentences</td>
<td>Phrases</td>
<td>Words</td>
<td></td>
</tr>
<tr>
<td>Alertness</td>
<td>May be agitated</td>
<td>Agitated</td>
<td>Agitated</td>
<td>Drowsy or confused</td>
</tr>
<tr>
<td>Respiratory rate</td>
<td>↑</td>
<td>↑</td>
<td>↑</td>
<td>↓</td>
</tr>
</tbody>
</table>

[Image of Le Bonheur Children's Hospital and The University of Tennessee Health Science Center]
# SEVERITY OF EXACERBATIONS

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Mild</th>
<th>Moderate</th>
<th>Severe</th>
<th>Imminent respiratory failure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accessory muscle use</td>
<td>-</td>
<td>+</td>
<td>+</td>
<td>Paradoxical thoraco-abdominal movements</td>
</tr>
<tr>
<td>Wheeze</td>
<td>Expiratory</td>
<td>Loud</td>
<td>Loud</td>
<td>Absent</td>
</tr>
<tr>
<td>Heart rate</td>
<td>&lt; 100</td>
<td>↑</td>
<td>↑</td>
<td>↓</td>
</tr>
<tr>
<td>PEF</td>
<td>&gt; 80%</td>
<td>60-80%</td>
<td>&lt; 60%</td>
<td></td>
</tr>
<tr>
<td>Room air Sao$_2$ (%)</td>
<td>&gt; 95</td>
<td>91-95</td>
<td>&lt; 90</td>
<td></td>
</tr>
</tbody>
</table>
### SEVERITY OF EXACERBATIONS

<table>
<thead>
<tr>
<th>Age</th>
<th>Respiratory Rate (per minute)</th>
<th>Age</th>
<th>Heart rate (per minute)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 2 months</td>
<td>&lt; 60</td>
<td>Infants (2 to 12 months)</td>
<td>&lt; 160</td>
</tr>
<tr>
<td>2 to 12 months</td>
<td>&lt; 50</td>
<td>1 to 2 years</td>
<td>&lt; 120</td>
</tr>
<tr>
<td>1 to 5 years</td>
<td>&lt; 40</td>
<td>2 to 8 years</td>
<td>&lt; 110</td>
</tr>
<tr>
<td>6 to 8 years</td>
<td>&lt; 30</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
GOALS OF THERAPY DURING ACUTE EXACERBATION

• Correct hypoxemia.
• Reverse airflow obstruction.
• Prevent recurrence of the exacerbation.
TREATING THE ACUTE EXACERBATION

• Inhaled short acting $\beta_2$ agonist – 2 to 4 puffs every 20 minutes for 1 hour with subsequent dosing depending upon response

• Oral glucocorticoids

• Supplemental oxygen to keep oxygen saturations > 95%
CONCLUSIONS

• Asthma is a complex disease with significant morbidity and healthcare costs

• Education is an essential component of management

• Need to assess the severity of illness and adjust therapy accordingly
REFERENCES

- Pocket guide for asthma management from the Global Initiative on asthma, updated December 2011 (www.ginasthma.org)
- Centers for Disease Control www.cdc.gov
Thank You

Questions