“Asthma after the Sun Goes Down”

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No disclosures

Objectives:
At the end of this session, the participant would be able to:

• Discuss the pathophysiology and the nocturnal nature of asthma
• List differential diagnoses and co-morbidities of asthma manifesting as nighttime symptoms
• Discuss specific cases with effective and efficient management options
Why is poorly controlled asthma prominent at night?

Assessing Control: 12 years and older

<table>
<thead>
<tr>
<th>Components of Control</th>
<th>Well Controlled</th>
<th>Not Well Controlled</th>
<th>Very Poorly Controlled</th>
</tr>
</thead>
<tbody>
<tr>
<td>Impairment</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nighttime awakenings</td>
<td>≤ 2 days/week</td>
<td>&gt; 2 days/week</td>
<td>≥ 4 days/week</td>
</tr>
<tr>
<td>Activity limits</td>
<td>None</td>
<td>Some limitation</td>
<td>Extremely limited</td>
</tr>
<tr>
<td>β2-agonist use (not prevention of EIB)</td>
<td>≤ 2 days/week</td>
<td>&gt; 2 days/week</td>
<td>Several times per day</td>
</tr>
<tr>
<td>Lung function FEV1 or FF &gt; 80%</td>
<td>FEV1 or FF = 60-80%</td>
<td>FEV1 or FF &lt; 60%</td>
<td></td>
</tr>
<tr>
<td>QOL indicator ACT ≥ 20</td>
<td>ACT = 16-19</td>
<td>ACT ≤ 15</td>
<td></td>
</tr>
<tr>
<td>Risk</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Evaluation requires long-term follow-up</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Treatment-related adverse effects</td>
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</tr>
</tbody>
</table>

Asthma symptoms during sleep
- Wheezing
- Cough
- Trouble breathing
Reasons asthma is worse during sleep

• increased exposure to allergens
• cooling of the airways
• reclining position
• hormone secretions that follow a circadian pattern
• changes in bronchial function

Epidemiology of nocturnal asthma

• Large study of general practice: 60% (n=13,493)
• Childhood Asthma Management Program: 34% (n=1041)
• Pediatric chest clinic: 44% (n= 691)
• Urban children: 40% (n=287)
• Mild to moderate asthma on controller meds: 72% (n=285)
  - Albuterol use at least once in 48 weeks
  - Nocturnal symptoms occur outside of exacerbations

Circadian pattern in lung function

Best function typically at around 4 PM, and the worst at around 4 AM
Peak flow meter

- monitor how lung function is altered throughout the day and night
- pattern of lung function affected
- Discuss plan with provider to resolve nighttime asthma symptoms

Hyperinflation: radial traction on the walls of airways

when lung volumes decrease (sleep), airflow limitation increases due to decreased traction on the airways.


Bronchial hyperresponsiveness

- inhaled bronchoconstrictors (metacholine) - markedly increased at night in asthmatic subjects
- The overnight fall in peak flow is related to daytime airflow limitation and bronchial responsiveness (n=20)
  the worse the daytime PFT and metacholine challenge, the bigger drop in peak flow at night;
  >20% drop in FEV1 at 4 am even with just normal saline

Airway inflammation

Studies on nocturnal asthmatics:

- greatest inflammation occurred in the alveolar tissue area at 4 AM compared to 4 PM
- eosinophilic inflammation correlated with the overnight fall in lung function
- increase in CD51 suggested a relationship to the lung inflammatory and repair processes in response to injury


Type/route of medications

- Inhaled corticosteroids with extra fine particle size (<2 microns) may reach distal smaller airways
  - And reduce peripheral lung inflammation

- Oral glucocorticoids timing of dosing
  - 50 mg prednisone at 3 PM with reduction of the overnight fall in FEV1 and reduction inflammatory cells (bronchoalveolar lavage) compared with the same dose at 8 AM or 8 PM

### Assessing Control: 12 years and older

#### Components of Control

<table>
<thead>
<tr>
<th>Impairment</th>
<th>Classification of Asthma Control</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Well Controlled</td>
</tr>
<tr>
<td>Symptoms</td>
<td>≤ 2 days/week</td>
</tr>
<tr>
<td>Nighttime awakening</td>
<td>Nonawaking</td>
</tr>
<tr>
<td>Activity limits</td>
<td>None</td>
</tr>
<tr>
<td>Lung function</td>
<td>FEV&lt;sub&gt;1&lt;/sub&gt; or PF &gt;80%</td>
</tr>
<tr>
<td>Corticosteroid use</td>
<td>≤2 days/week</td>
</tr>
</tbody>
</table>

#### Risk

- Combines with daytime symptoms and pulmonary function (FEV<sub>1</sub>)
- Evaluation requires long-term follow-up
- Treatment-related adverse effects

Medication side effects can vary in intensity from rare to very troublesome and severe. The level of intensity does not correlate to specific levels of control but should be considered in the overall assessment of risk.

#### Contributing factors

- Environmental allergens
- Cigarette smoking
- GERD

#### Early and late phase reactions

Differential diagnosis

**ADULTS**
- COPD
- GERD
- Obstructive sleep apnea
- Heart failure
- Hypersensitivity pneumonitis

**CHILDREN**
- Enlarged tonsils and adenoids
- GERD
- Obstructive sleep apnea
- Protracted bacterial bronchitis

Allergies
- Allergic rhinitis

Management goals

- Reduction of symptoms
- Improvement of lung function
- Reduce risk of exacerbation
- Medication regimen
  - Optimize
  - Adhere
- Control contributing factors
  - Allergen exposure
  - Rhinitis/sinusitis
  - GERD
  - OSA

Therapies

- Inhaled corticosteroids – inflammation
  - Long-acting inhaled corticosteroid
- Long-acting bronchodilator – preventing bronchospasm
- Reflux medications - GERD and asthma
- Allergen/trigger avoidance – dust mites, animal dander, or feathers in a down comforter
CASES

Summary

• Circadian, physiology, mechanical and inflammatory changes could explain the nighttime symptoms of asthma
• Differential diagnoses and co-morbidities of asthma should be addressed
• Appropriate management including appropriate choices of asthma medications, trigger avoidance and other possible explanations for refractory nighttime symptoms are beneficial