1st WAO Allied Health Session - Asthma: Diagnosis, Management and Education

Exacerbations

Ronald Dahl,
Aarhus University Hospital,
Denmark
The health professional that care for patients with asthma exacerbation must be able to

• Identify and diagnose asthma exacerbation
• Evaluate the severity of exacerbation
• Evaluate complications and co-morbidities

• Treat and monitor
Agenda

• The abnormality in the airways, lungs and the clinical consequences
• Clinical evaluation and classification of the severity of asthma exacerbation
• Treatment and monitoring
• Prevention
Acute Severe Asthma Pathology

Airway obstruction and symptoms by:
- Bronchoconstriction
- Mucus plugs
- Mucosal edema
- Inflammatory cell infiltration/activation

<table>
<thead>
<tr>
<th>Features of an asthma attack</th>
<th>Features of an asthma exacerbation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Appear rather sudden</td>
<td>Gradual progression over days</td>
</tr>
<tr>
<td>After exposure to an irritant</td>
<td>Increasing symptoms and nocturnal asthma</td>
</tr>
<tr>
<td>Last from few min to few hours</td>
<td>Respond partial or little to bronchodilators</td>
</tr>
<tr>
<td>Respond immediately to bronchodilators</td>
<td>Related to increased airway inflammation</td>
</tr>
<tr>
<td>No gradual worsening occur</td>
<td>Leads to hospital admission</td>
</tr>
<tr>
<td>Seem not closely related to airway inflammation</td>
<td>Responds to corticosteroids</td>
</tr>
</tbody>
</table>
Exacerbation of bronchial asthma

Ventilation = Spirometric abnormalities
Respiration = Gas exchange abnormality

Central airway narrowing
Peripheral airway narrowing

Bronchospasm
Airway wall inflammation
Bronchospasm
Airway wall inflammation
Exacerbation of bronchial asthma

Ventilation = Spirometric abnormalities

Respiration = Gas exchange abnormality

Central airway narrowing

Peripheral airway narrowing

Bronchospasm
Airway wall inflammation

Bronchospasm
Airway wall inflammation

Treatments must be directed towards these two components

Smooth muscle spasm

Inflammation, edema, plugs
Pathology of Asthma: Ventilation Defects

**Normal**

**Mild**
forced expiratory volume at 1 second (FEV₁)
132% predicted

**Moderate**
FEV₁
83% predicted

**Severe**
FEV₁
34% predicted

Acute severe asthma

monitoration

<table>
<thead>
<tr>
<th>Level</th>
<th>Normo Ventilation</th>
<th>Hyper Ventilation</th>
<th>Hypoventilation Exhaustion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Slight</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Moderate</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Severe</td>
<td></td>
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</tr>
</tbody>
</table>
Acute severe asthma

monitoration

the cross-road of death

<table>
<thead>
<tr>
<th>slight</th>
<th>moderate</th>
<th>severe</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normo ventilation</td>
<td>Hyper ventilation</td>
<td>Hypoventilation exhaustion</td>
</tr>
</tbody>
</table>
Acute severe asthma 
monitoration 

Clinical condition 
PEF or FEV$_1$ 

$P_a O_2$ and $P_a CO_2$
<table>
<thead>
<tr>
<th>Asthma severity stage</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4-5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Respiratory rate</td>
<td>12</td>
<td>15</td>
<td>18</td>
<td>19</td>
<td>25</td>
</tr>
<tr>
<td>Pulse rate</td>
<td>89</td>
<td>103</td>
<td>111</td>
<td>115</td>
<td>127</td>
</tr>
<tr>
<td>Minute ventilation</td>
<td>11</td>
<td>12</td>
<td>14</td>
<td>13</td>
<td>16</td>
</tr>
<tr>
<td>PEF</td>
<td>327</td>
<td>237</td>
<td>124</td>
<td>113</td>
<td>97-219</td>
</tr>
</tbody>
</table>
Acute severe asthma
klinical evaluation

**Respiratory rate:** (number/min)
**Speaking:** short sentences, single word
**Use of auxiliary respiratory muscles**
**Position:** prefer sitting, can lay down?
**Airways obstruction:** ronchi, silent chest (PEF)
**Respiration:** cyanoses, (SaO2, a-blood gasses)
**General evaluation:** degree of normal activities, pulse frequency
Clinical staging of severity of acute asthma exacerbation

stage 0

Unaffected

Few ronchi
Clinical staging of severity of acute asthma exacerbation

**stage 1**

- Breathlessness but unaffected physical activities
- Can lie down
- Ronchi during expiration
Clinical staging of severity of acute asthma exacerbation

stage 2

Some restriction in physical activity
Prefer to sit
Use of auxiliary resp. muscles (neck)
Ronchi during in- and expiration
Clinical staging of severity of acute asthma exacerbation

stage 3

Severe restriction in physical performance
Prefer not to lie down
Conversational dyspnoea
Use of auxilary resp. muscles (neck, abdomen)
Clinical staging of severity of acute asthma exacerbation

stage 4

Sit quiet – bent forward
Answer with single word
Mental alert and orientated
Use of auxiliary resp. muscles (neck, abdomen, arms)
Decreasing ronchi
Clinical staging of severity of acute asthma exacerbation

stage 5

Affected consciousness
Fast, superficial respiration
Silent chest
Near fatal asthma
acute severe asthma

• Respiratory arrest       or
• PaCO2 above 6.7 kPa    and/or
• Altered conscious state  or
• Inability to speak

Campbell et al. ERJ 1994; 7:490-7
Near fatal asthma
acute severe asthma

• Pretreatment SaO2 below 90%
• Normal or high PaCO2 after therapy
• Persistent metabolic acidosis
• Severe obstruction that improve less than 30% or worsen after beta-2-agonist

Near fatal asthma
acute severe asthma

<table>
<thead>
<tr>
<th>Asthma severity (before attack)</th>
<th>Death cases%</th>
<th>Near fatal attacks cases%</th>
</tr>
</thead>
<tbody>
<tr>
<td>mild</td>
<td>5</td>
<td>7</td>
</tr>
<tr>
<td>moderate</td>
<td>22</td>
<td>28</td>
</tr>
<tr>
<td>severe</td>
<td>73</td>
<td>65</td>
</tr>
</tbody>
</table>

All asthma severities are at risk

Campbell et al. ERJ 1994; 7:490-7
Acute severe asthma
Monitoring

Clinical condition
PEF or FEV$_1$

$P_aO_2$ and $P_aCO_2$
The responsible staff must be able to:

Assess asthma severity
Assess improvement and worsening
Treat properly
Guidance
Measurements for evaluation of severity and evolution improvement – worsening?

Ventilatory capacity - Movement of air

Respiratory capacity - gas exchange in alveoli

Spirometry

- FEV1 etc.

Arterial blood

- PaO2
- PaCO2
- SaO2
Measurements for evaluation of severity and evolution improvement – worsening?

<table>
<thead>
<tr>
<th>cardiac function and circulation</th>
<th>heart frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>chest x-ray</td>
<td>blood pressure</td>
</tr>
<tr>
<td></td>
<td>ekg</td>
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</tbody>
</table>

Pneumothorax                  Pneumonia      Left ventricle failure
# ACUTE ASTHMA – MONITORING CHART

<table>
<thead>
<tr>
<th>Time</th>
<th>Pulse rate</th>
<th>Respiratory rate</th>
<th>Use of accessory muscles</th>
<th>PEF</th>
<th>Pulse oximetry (SaO2)</th>
<th>Cyanosis</th>
<th>Exhaustion</th>
<th>Oxygen flow</th>
<th>Treatment</th>
</tr>
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<td>Salbutamol/Terbutaline Dose:</td>
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</table>
Acute severe asthma

Admission and close monitoring in hospital unit:

- Clinical stage 4
- PEF or FEV$_1$ < 30% of personal best
  (if unknown < 30% predicted)
- P$_{a}$CO$_2$ > 6 kPa
- P$_{a}$O$_2$ < 8 kPa
- Poor response to initial treatment
Acute severe asthma
differential diagnosis - complications

- Hyperventilation syndrome
- Vocal cord dysfunction
- Vaso-vagal reaction
- Anaphylactic reaction (urticaria, BP-pulse, etc)
- Aspiration - foreign body – pneumonia
- Pneumothorax
- Cardiac failure
- COPD exacerbation
Acute severe asthma treatment

Oxygen
Acute severe asthma treatment

Oxygen
Nebulised beta-2-agonist combined with anticholinergic, each 20 min first hour, then hourly as necessary
FEV$_1$ at presentation

30% (left panel) or > 30% (right panel)
Acute severe asthma treatment

Oxygen
Nebulised beta-2-agonist combined with anticholinergic each 20 min first hour, then hourly as necessary

Oral or i.v. corticosteroid
80 mg Methylprednisolone
repeat after 12 hours, following days usually
40 mg Methylprednisolone or equivalent
Acute severe asthma treatment

Oxygen
nebulised beta-2-agonist combined with anticholinergic
each 20 min first hour, then hourly as necessary

Oral or i.v. corticosteroid
80 mg Methylprednisolone
repeat after 12 hours, following days usually
40 mg Methylprednisolone or equivalent

Start inhaled high dose steroid as soon as possible
Acute severe asthma treatment

Dangerous or at least without effect

Sedation
Mucolytic
Physiotherapy
Antihistamine
Acute severe asthma treatment

Consider:
Infusion of β2-agonist
Infusion of theophylline
Antibiotic
Fluid
Change in FEV$_1$ in BPV group (BiPAP) and control group during 4 h
The graph shows the percent change from baseline over minutes after treatment dose. The lines represent different treatment groups:

- Black diamonds: Montelukast IV 7 mg
- Black squares: Montelukast IV 14 mg
- Black triangles: Placebo

The data points are accompanied by error bars to indicate variability. The graph includes markers for significant changes, indicated by †.
Influence of illness severity on response to magnesium
Acute severe asthma

- Treat the condition symptomatically
- Determine what caused the reaction
Acute severe asthma
Determine what caused the reaction

- inhalant allergen
- food allergen
- drug reaction (ASA, vaccination, etc)
- infection
- worsening of a chronic condition
  compliance
  treatment need adjustment
The health professional that care for patients with asthma exacerbation must be able to:

- Identify and diagnose asthma exacerbation
- Evaluate the severity of exacerbation
- Evaluate complications and co-morbidities
- Treat and monitor
Thank you for your attention