Management of acute exacerbation asthma in children

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A girl patient 11 years old admitted to Bach mai Hospital at 4h15, 12\textsuperscript{nd} November because of difficult breathing

- She has been asthmatic for 3 years. At night, 11\textsuperscript{st} Nov she felt tired, fever, sneezing, running nose, so went to bed early.
- At 1:00 AM, 12\textsuperscript{nd} Nov, wake up because of breathless, so took 2 puffs of Ventolin pMDI 100 mcg.
- After 30 minutes, still felt uncomfortable, and taking 2 more puffs then went back to bed. However, She had to wake up because of breathless. She took 2 more puffs then going to Bach Mai hospital.
Physical examination

- Wheeze, Breathless and has to sit. Severe intercostal, supraclavical and suprasternal retractions and cyanosis.
- Could not talk in sentence, only in words, and chest tightness.
- Heart rate 130/min. Blood pressure 110/85 mmHg. Respiratory rate 38/min. Temperature 37°C.
- Her lung exam revealed rhonchi

Lab
- Normal X-ray of lung
- Arterial blood gas pH 7.35. PaCO2 37 mmHg, HCO3- 19mmol/L. PaO2 62 mmHg. SpO2 87%
1. What is your diagnosis? Choose one option and explain why?

A. Acute Respiratory Distress
B. Mild acute asthma
C. Moderate acute asthma
D. Severe acute asthma
E. Other…
1. What is your diagnosis? Choose one option and explain why?

A. Acute Respiratory Distress
B. Mild acute asthma
C. Moderate acute asthma
D. Severe acute asthma
E. Other…
An exacerbations of asthma (asthma attacks or acute asthma) are episodes of progressive increase in shortness of breath, cough, wheezing, or chest tightness, or some combination of these symptoms.
MODELING AN ACUTE ASTHMA

Intensity

Time

Uncontrolled

An Acute Attack
ASSESSMENT AND CLASSIFICATION
SEVERITY OF ASTHMA EXACERBATIONS

GINA 2011
<table>
<thead>
<tr>
<th>Symptoms</th>
<th>Mild</th>
<th>Moderate</th>
<th>Severe</th>
<th>Respiratory Arrest imminent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Breathless</td>
<td>Walking</td>
<td>Talking</td>
<td>At rest</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Can lie down</td>
<td>Infant: softer shorter cry; difficult feeding</td>
<td>Infant: stops feeding</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Prefers sitting</td>
<td>Hunched forward</td>
<td></td>
</tr>
<tr>
<td>Talks in</td>
<td>Sentences</td>
<td>Phrases</td>
<td>Words</td>
<td></td>
</tr>
<tr>
<td>Alertness</td>
<td>May be agitated</td>
<td>Usually agitated</td>
<td>Usually agitated</td>
<td>Drowsy or confused</td>
</tr>
<tr>
<td>Respiratory rate</td>
<td>Increase</td>
<td>Increase</td>
<td>Often&gt;30/min</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Normal rate of breathing in awake children:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>&lt;2 months: &lt;60/min; 2-12 months: &lt;50/min; 1-5 y: &lt;40; 6-8y: &lt;30</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Accessory muscles and suprasternal retraction</td>
<td>Usually not</td>
<td>Usually</td>
<td>Usually</td>
<td>Paradoxical thoraco-abdominal movement</td>
</tr>
<tr>
<td>Wheeze</td>
<td>Moderate, often only end respiratory</td>
<td>Loud</td>
<td>Usually loud</td>
<td>Absence of wheeze</td>
</tr>
<tr>
<td>Heart Rate</td>
<td>&lt;100</td>
<td>100-120</td>
<td>&gt;120</td>
<td>Bradycardia</td>
</tr>
<tr>
<td></td>
<td>Limitation of normal pulse rate in children:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2-12 months: &lt; 160/min; 1-2 years: &lt; 120/min; 2-8 years : &lt; 110/min</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Symptoms</td>
<td>Mild</td>
<td>Moderate</td>
<td>Severe</td>
<td>Respiratory Arrest imminent</td>
</tr>
<tr>
<td>-------------------------------------------</td>
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<td>------------------------------</td>
</tr>
<tr>
<td>Pulsus paradoxus</td>
<td>Absent &lt;10 mm Hg</td>
<td>May be present 10-25 mm Hg</td>
<td>Adult &gt; 25mmHg Child 20-40 mmHg</td>
<td>Absence suggests</td>
</tr>
<tr>
<td>PEF after initial bronchodilator</td>
<td>Over 80%</td>
<td>60-80%</td>
<td>&lt;60% predicted or personal best (&lt;100L/min adults or response lasts &lt; 2 hours)</td>
<td></td>
</tr>
<tr>
<td>PEF after initial bronchodilator %</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>predicted or % personal best</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PaO2 (on air)</td>
<td>Normal</td>
<td>&gt;60mmHg</td>
<td>&lt;60mmHg</td>
<td></td>
</tr>
<tr>
<td>And/or PaCO2</td>
<td>Test not usually necessary</td>
<td>&lt;45mmHg</td>
<td>Possible cyanosis</td>
<td></td>
</tr>
<tr>
<td>And/or PaCO2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SaO2 (on air)</td>
<td>&gt;95%</td>
<td>91-95%</td>
<td>&lt;80%</td>
<td></td>
</tr>
</tbody>
</table>

Hypercapnea develops more rapidly in young children than in adults and adolescents

A few parameters*
Having 4 or more symptoms**

*GINA – Updated 2010*
**Asthma Guideline of MoH 2010; Page.30
2. Patient has been diagnosed severe acute asthma. What are the treatment approach that you prefer and Why?

A. Oxygen delivered by nasal canulae
B. pMDI Ventolin
C. Nebulizer of Ventolin
D. Prednisolone (oral) or IV Methylprednisolon™ or Budezonide (Nebulizer)
E. Oral Seduxen or IV Phenobarbital
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Oxygen is administered as the first-line treatment.  

Should be administered if SaO2 ≤ 91% in room air.  

To achieve SaO2 ≥ 95%.  

Should be administered by mask or nasal cannulae.  

3. GINA 2011
Cochrane review including 2295 children and 614 adults from 27 trials indicated that MDIs used with spacer yielded outcome at least as good as nebuliser\(^1\)

In older children, if the attack is not severe enough to warrant treatment with oxygen, inhalers and spacer may be equally effective as nebulizer\(^2\)

In very young or severe children (SaO\(_2\) <92\%) nebulizer with oxygen is preferred method of administration, because of the uncertainty of delivery of MDIs\(^3\)

Use of corticosteroids within 1 hour of presentation to an ED significantly reduces the need for hospital admission in patients with acute asthma.

Benefits appear greatest in patients with more severe asthma, and those not currently receiving steroids.

Children appear to respond well to oral steroids.

Hospital admission rates are similar in children with moderate to severe asthma exacerbation given oral methylprednisolone and those given i.v. methylprednisolone\(^1\)

IM methylprednisolone (4 mg/kg) treatment combined with an adrenergic agent, given early during an acute asthmatic episode, significantly reduces the hospital admission rate of infants and toddlers\(^2\)

# Initial treatment for an acute asthma exacerbation

<table>
<thead>
<tr>
<th></th>
<th>Mild</th>
<th>Moderate</th>
<th>Severe</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Oxygen</strong></td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td><strong>Salbutamol</strong></td>
<td>Puff</td>
<td>Puff/Nebulizer</td>
<td>Nebulizer/Injection</td>
</tr>
<tr>
<td><strong>Ipratropium</strong></td>
<td>No</td>
<td>Puff/Nebulizer</td>
<td>Nebulizer</td>
</tr>
<tr>
<td><strong>Steroids</strong></td>
<td>Consider</td>
<td>Oral/Nebulizer/Injection</td>
<td>Nebulizer/IV</td>
</tr>
<tr>
<td><strong>Aminophylline</strong></td>
<td>No</td>
<td>No</td>
<td>IV</td>
</tr>
<tr>
<td><strong>Hospitalization</strong></td>
<td>No</td>
<td>Consider</td>
<td>Yes</td>
</tr>
<tr>
<td><strong>Observation/Evaluation</strong></td>
<td>After 20 minute</td>
<td>20 min/time in 1 hour</td>
<td>20 min/time in 2 hours or longer</td>
</tr>
<tr>
<td><strong>X-ray</strong></td>
<td>No</td>
<td>Consider</td>
<td>Yes</td>
</tr>
<tr>
<td><strong>Arterial blood gas</strong></td>
<td>No</td>
<td>No</td>
<td>Yes</td>
</tr>
</tbody>
</table>
3. What is the right dose of Corticosteroids?

A. Methylprednisolone 40 mg x 4 times/day
B. Methyprednisolone 500mg x 2 times/day
C. Prednisolone oral 10mg x 4 times/day
D. Budesonide 0.5mg nebulizer x 4-6 times/day
E. Budesonide 0.5mg nebulizer x 2 times/day
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Administration of a 500-mg dose of methylprednisolone offers no advantages over a 100-mg dose in the emergency department treatment of acute asthma\(^1\)

- Use a dose of 20mg prednisolone for children 2-5 years and\(^2\)
- 30-40mg for children >5 years and maximum dose of 60mg\(^2\)

2. BTS. British Guideline on the Management of Asthma. Revised May 2011
For moderate acute asthma

- Prednisolone 1-2mg/kg/day (maximum 60mg) or
- Dexamethasone 0.15-0.3 mg/kg/day (maximum 10mg)

For severe acute asthma

- Methylprednisolone 1-2mg/kg/dose (maximum 60mg q.6h)
- Hydrocortisone 5-7mg/kg (maximum 400mg q.6h)

The Canadian Paediatric Society. Guideline of Managing the paediatric patient with acute asthma exacerbation. 2012
17 clinical studies qualified (470 adults and 663 children)
- Reduce hospitalization rate, especially in compared with placebo (OR = 0.30; 95% CI, 0.16 – 0.55).
- Improve clinical symptoms significantly faster than placebo and Systematic Corticosteroids.
- Increase significantly discharge from Hospital rate (OR, 4.70; 95% CI, 2.97 to 7.42; p = 0.0001)

Conclusion:
Multi-doses of Nebulizer Corticosteroids ≤ 30min/time in 1 hour will be effectiveness significantly in acute asthma

High dose ICS + Salbutamol in acute asthma provided greater bronchodilation than salbutamol alone (Evidence B).

High dose ICS conferred greater benefit than addition CS across all parameters, including hospitalizations, especially for patients with more severe attacks.

ICS can be as effective as Oral Corticosteroids at preventing relapses.

Inhaled Budesonide + Oral Prednisolon have lower rate of relapse than using prednisolon alone (Evidence B).

High does ICS (2.4mg Budesonide/day) achieves a relapse rate similar to 40mg oral Prednisolon daily (Evidence A).

Cost-effectiveness
Indication of ICS in acute asthma exacerbation

High dose Budesonide (2.4mg/day) in the following situations:

- Contraindications with Systematic Corticosteroids such as:
  - Gastritis
  - Gastric hemorrhage
  - High blood pressure
  - Diabetes...

- Unable to use injection Corticosteroids

B. Patient was diagnosed **a severe acute asthma** and treated with oxygen via nasal canullae. Nebulizer Ventolin continuously 20min/time, IV Solumedron, and monitoring carefully

- At 5:30 AM: Patient had improved a little bit but breathless again and cannot sleep. Heart rate 155/min. Blood pressure 115/82 mmHg. Respiratory rate 34/min. SpO2 90%.

- Arterial blood gas: pH 7.32 PaCO2 42mmHg; PaO2 70 mmHg; HCO3- 24 mmol/L
4. What is the additional treatment? Choose the additional treatment and explain the clinical reasons?

A. IV Sabutamol 15mcg/kg/10 minutes
B. Nebulized Ipratropine 250mcg/dose
C. Infusion of Natribicarbonat 1,4%
D. Digoxin
E. Other...
4. What is the additional treatment? Choose the additional treatment and explain the clinical reasons?

A. IV Sabutamol 15mcg/kg/10 minutes
B. Nebulized Ipratropine 250mcg/dose
C. Infusion of Natribicarbonat 1,4%
D. Digoxin
E. Other...
C. Continue nebulized Ipratropine and IV Salbutamol but patient was not improved

- 9:15 AM: Patient breathless and worsen cyanosis, cannot cough and very tired. Blood pressure 130/90 mmHg. Heart rate 185/min. Respiratory rate 13/min. Breath sounds decreased and absent of wheeze, SpO2 79%.

- Arterial blood gas pH 7.27. PaCO2 57 mmHg, HCO3- 24 mmol/L, PaO2 51 mmHg
5. What is the additional treatment? Choose the following options?

- A. Continuing IV Salbutamol
- B. IV Solumedron one more dose
- C. Test of electrolyte in the blood
- D. Infusion of Ringerlactat
- E. Intubation and ventilation
5. What is the additional treatment? Choose the following options?

- A. Continuing IV Salbutamol
- B. IV Solumedron one more dose
- C. Test of electrolyte in the blood
- D. Infusion of Ringerlactat
- E. Intubation and ventilation
Doctor decided to give intubation and ventilation for patient.
Give one more dose of IV Solumedron.
Test electrolyte in the blood is normal.

Next day: patient was improved and taken out intubation and stop ventilation.
Patient was discharged after 7 days treatment in Bach Mai Hospital.
Summary acute asthma exacerbation treatment steps

- Oxygen for moderate and severe acute asthma
- Salbutamol pressures/puff or nebulizer
- Corticosteroids oral/injection or nebulizer
- Ipratropium puff or nebulizer
- Infusion of Aminophylline
- IV Salbutamol
- Intubation and Ventilation
Acute Asthma Exacerbation Treatment – Notable points

- Cannot under-evaluate the severity of an acute asthma
- Attention to asthma triggers
  - Historical severe asthmatic, intubation or ventilation
  - Hospitalize or emergency in the previous year
  - Taking or just stopped using Oral Corticosteroids
  - Not taking Inhaled Corticosteroids recent days
  - Dependent on SABA
  - Mental illness or have to take sedative
  - Low compliance with asthmatic pharmacology treatments

GINA 2011
3. GINA 2011