Severe Asthma in the ED: What Would You Do?

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How To Vote via Texting

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2. We have no access to your phone number
3. Capitalization doesn’t matter, but spaces and spelling do

TIPS
I have no real or perceived conflict of interest that relates to this presentation. Any use of brand names is not in any way meant to be an endorsement of a specific product, but to merely illustrate a point of emphasis.
Objectives

• Define acute severe asthma (status asthmaticus)
• Discuss treatment options for acute severe asthma
• Review current literature support for known therapies used in acute severe asthma
• *Hope that our poll software works correctly!*
Acute Severe Asthma (status asthmaticus)

• **Defined:** *severe asthma unresponsive to repeated courses of beta-agonist therapy such as inhaled albuterol, levalbuterol, or subcutaneous epinephrine*¹

• **This is a medical emergency!**

• Accounts for 2 million ED visits, 500,000 hospitalizations, and > **4,000 deaths per year** in the U.S.²
• ~50% of acute severe asthma (SA) patients have a concomitant respiratory tract infection

• Other factors leading to SA:
  – Medical noncompliance
  – Nonsteroidal anti-inflammatory exposure in aspirin-allergic patients
  – Allergen exposures (especially pets)
  – Irritant inhalation (paint, smoke, etc)
  – Exercise
  – Insufficient use of inhaled or oral corticosteroids
  – Genetic polymorphisms can be associated with asthma severity
Autopsy reports of patients that died of asthma shows:

- Anatomic changes
  - Airway narrowing
  - Mucous plugging
  - Hyperinflation
  - Atelectasis
- Pulmonary infiltrates contained eosinophils, neutrophils, plasma cells, and lymphocytes
General Patient Assessment

• History
  – Past hospitalizations
    • ED visits
    • ICU admissions
    • Intubations
  – Frequency of albuterol use
  – Current medications
    • Illicit drug use
  – Exposure of allergens/irritants
  – Significant medical conditions
• **Physical Exam**
  – Main Focus
    • Severity
      – Accessory muscle use
      – Pulsus paradoxus
      – Refusal to recline below 30°
      – Heart rate > 120 beats/min
    • Causative/complicating conditions
      – Pneumonia
      – Pneumothorax
      – Pneumomediastinum
      – Atelectasis
• Physical Exam
  – Clinicians aren’t great at assessing the degree of actual airway obstruction
  – Peak flow or FEV1 may be useful for objectivity
    • Good luck!
  – Pulse oximetry
  – Arterial blood gas analysis
    • Useful if any questions of oxygenation/ventilation exist
## Arterial Blood Gas Stages in SA

<table>
<thead>
<tr>
<th>Stage</th>
<th>pH</th>
<th>PaCO₂</th>
<th>PaO₂</th>
<th>Clinical Implications</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Respiratory Alkalosis</td>
<td>↓</td>
<td>Normal</td>
<td>Asthma exacerbation</td>
</tr>
<tr>
<td>II</td>
<td>Respiratory Alkalosis</td>
<td>↓↓</td>
<td>↓</td>
<td>Common ED finding</td>
</tr>
<tr>
<td>III</td>
<td>Normal</td>
<td>Normal</td>
<td>↓↓</td>
<td>Impending failure</td>
</tr>
<tr>
<td>IV</td>
<td>Respiratory Acidosis</td>
<td>↑↑</td>
<td>↓↓↓</td>
<td>Impending respiratory arrest</td>
</tr>
</tbody>
</table>
Signs of a SEVERE attack

- **Adult**
  - Severe agitation
  - Hunched sitting position (tripod position)
  - Limited ability to speak
  - Use of accessory muscles
  - Tachypnea (RR > 30/min)

- **Infant**
  - Use of accessory muscles
  - Supraclavicular and intercostal retractions
  - Nasal flaring
  - Paradoxical breathing
  - Cyanosis
  - Tachypnea (RR > 60/min)
Signs of impending respiratory arrest²

- Lethargy or confusion
- Silent chest
- Paradoxical thoracoabdominal movement
- Bradycardia
Case

• 30 y/o female with significant history of asthma
  – Intubated last year for asthma at OSH
  – Admitted in ICU X 2 days
• Heart Rate: 122
• Respiratory rate: 32
• Breath sounds: Wheezing bilaterally
• Speaking in short sentences
• $\text{SpO}_2$ 89% on RA in triage
• Diaphoretic
Inhaled Bronchodilators (adults)

- Albuterol 2.5 – 5.0 mg every 20 minutes as needed for 3 doses\(^2\)
- Levalbuterol 1.25 – 2.5 mg every 20 minutes as needed\(^2\)
- Ipratropium bromide (Atrovent\(^\text{®}\)) should be given with albuterol in severe exacerbations in the ED\(^3\)
- Albuterol vs. Levalbuterol\(^4\)
  - No real difference in side effects
  - Levalbuterol not superior to albuterol in safety and efficacy
• ~ 1 hour later
• Patient given nebulizers X 3 and I.V. corticosteroids
• Patient still seems extremely short of breath, vital signs same as previous
• Not worse, not better
Magnesium Sulfate

- Thought to cause relaxation of bronchial smooth muscle
  - Inhibits calcium influx into smooth muscle cells
- *May* have anti-inflammatory effects
- Benefit shown in severe exacerbations of asthma"
Results are conflicting:

Intravenous or nebulised magnesium sulphate versus standard therapy for severe acute asthma (3Mg trial): a double-blind, randomised controlled trial

Steve Goodacre, Judith Cohen, Mike Bradburn, Alasdair Gray, Jonathan Benger, Timothy Coats, on behalf of the 3Mg Research Team*

Interpretation Our findings suggest nebulised MgSO₄ has no role in the management of severe acute asthma in adults and at best suggest only a limited role for intravenous MgSO₄ in this setting.
Results are conflicting:

Intravenous magnesium sulfate for treating adults with acute asthma in the emergency department (Review)

**Conclusion**

This review showed that IV MgSO₄ reduces hospital admissions and improves lung function in adults with exacerbations of asthma when other first-line medications have not relieved the acute symptoms (i.e. oxygen, inhaled short-acting medications and IV steroids). Evidence for other measures of benefit and safety was limited.
Magnesium Sulfate

- Dosage: 2 g infused over 20 minutes
- Excellent safety profile
  - Contraindicated in presence of renal insufficiency
  - May cause muscle weakness
• 2 hours after arrival
• Continuous bronchodilators being given (20 mg/hr)
• Magnesium sulfate given (patient tolerates well)
• Vitals slightly improved
• Patient continues to have increased WOB
  – States, “I’m getting tired”
Transient increases in serum lactate with or without lactic acidosis during acute asthma is well-known.

Not totally understood

What is currently known:
- Increase in serum lactate is common
- Most often NOT accompanied by a metabolic acidosis
- β-adrenergic agonists seems to be the dominant cause of elevated serum lactate
- Does not appear to affect the effectiveness of bronchodilator therapy and has no known clinical consequence
Heliox

• Colorless, odorless, tasteless inert gas
• No direct pharmacologic or biologic effect
  – Does not have bronchodilatory or anti-inflammatory properties
• 70:30 or 80:20 mixtures most common
• Decreased gas density transitions turbulence to a laminar flow state, decreases airway resistance
Heliox

- Data is conflicting$^{4,5}$
- Data supports using heliox in the care of patients with moderate-to-severe acute asthma as a nebulizer driving gas$^4$
- Use is based on sound principles, can be safely administered, and may provide benefits for patients with severe impairment of lung function$^5$
Noninvasive ventilation

• The role for NIV is not yet well defined\textsuperscript{6-8}

• In a recent analysis of a national review, Nanchal et al\textsuperscript{9} noted:
  – Increased use of NIV/decrease use of invasive MV for life-threatening asthma

• 5 studies using NIV in asthmatics\textsuperscript{10-14} w/hypercapnia and increased WOB
  – Of 112 NIV patients, 19 (17\%) were intubated
Noninvasive ventilation

• Scala\(^{17}\) suggests NIV might be applied in asthma:
  – As an alternative to intubation in patients who have failed a trial of standard treatment
  – To prevent intubation in patients with mild-moderate ARF who do not need immediate ventilatory support
  – To prevent ARF in patients who do not have substantial impairment of gas exchange
  – To accelerate bronchodilation in patients who do not need mechanical ventilation
Noninvasive Ventilation in Severe Acute Asthma

Jhaymie L Cappiello MSc RRT-ACCS and Michael B Hocker MD MHS

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Noninvasive ventilation

• 35 y/o male
• Responsive, diaphoretic, RR 35/min on $F_1O_2$ 1.0 oxygen, $SpO_2$ 88%
• NIV 12/5 cm $H_2O$, $F_1O_2$ 0.40
• Albuterol 40 mg/h
• ABG:
  – pH: 6.95
  – $PaCO_2$ 126 mm Hg
  – $PaO_2$ 316 mm Hg
Noninvasive ventilation

• After 90 minutes
  – PaCO$_2$ 63 mm Hg

• NIV stopped after 4 hours
  – NIV tolerance was supported with low-dose lorazepam
  – Patient transferred to ICU
  – D/C’d home in 3 days

➢ Authors attribute success to close monitoring in critical care setting and titration of lorazepam
Case Finale

- After an hour on NIV, your patient is doing no better.
- Still alert, awake, and oriented
- However, the ED attending really, really wants to avoid intubation at all costs.
Conclusion

• Severe asthma can be life-threatening
• The goal is prevention of morbidity and mortality
  – Rapid assessment
  – Initiation of therapy
• Ongoing assessment is key
• Teamwork is key
Your patient!
References

Questions?

Thank you!

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