



## **Asthma Controversies: A Literature Review**

Asthma remains a difficult problem for the emergency physician when the patient does not respond to initial  $\beta$ -agonist treatment. How important are IV, oral, or inhaled steroids in the acute management phase? Is there a role for IV catecholamine or ketamine infusions to possibly avert elective intubation? Is Bi-PAP or heliox ever a therapeutic adjunct? What is the role of magnesium and aminophylline in the management algorithm? The lecturer will present an evidence-based medical approach to a difficult clinical problem.

- Discuss state-of-the-art management of the acute asthmatic.
- Explain the use of new therapeutic regimens.
- List the advantages and disadvantages of different treatment regimens.
- Discuss the controversies in admission criteria for the asthmatic patient.

TU-65  
Tuesday, October 12, 1999  
5:00 PM - 5:55 PM  
Room # N219  
Las Vegas Convention Center

## **FACULTY**

Peter M DeBlieux, MD, FACEP

Assistant Clinical Professor,  
Pulmonary and Critical Care  
Medicine; Residency Director,  
Emergency Medicine; Director,  
Medical Student Rotations,  
Emergency Department; Course  
Director, Emergency Medicine  
Written Board Review Course,  
Louisiana State University Medical  
School, New Orleans, Louisiana

## Asthma Controversies: A Literature Review

Peter DeBlieux, MD, FACEP

The prevalence of asthma continues to rise along with the mortality of this disease. As the front line of medical care for asthma, emergency medicine physicians are compelled to keep abreast of treatment and literature advances.

### II. Objectives: Using a case-based format, participants will be able to:

- A. Discuss state-of-the-art management of the acute asthmatic.
- B. Explain the use of new therapeutic regimens.
- C. List the advantages and disadvantages of different treatment regimens.
- D. Discuss the controversies in admission criteria for the asthmatic patient.

### III. Target Audience

The target audience is emergency medicine physicians with a working knowledge of assessment and treatment of acute asthma

### IV. Course Outline

#### CASE THREE

**A 40-year-old male presents complaining of progressive dyspnea associated with cough and wheeze. He states that this is a typical presentation of his asthma exacerbations.**

**What should initial ED management include?**

- A. Rapid Assessment
1. Airway-patency, protection
    - Distinguishing upper (stridor) vs lower (wheeze)
  2. Breathing-air movement, wheezing
    - **Expiratory** wheeze initially
    - Progressing to inspiratory and expiratory
    - Most ominous clinical finding is “silent chest” – no air **movement**
  3. Circulation-hemodynamic stability
    - Pulsus paradoxus
    - Hypotension due to reduction in venous return
- B. Rapid Treatment
1. Oxygen-reversing hypoxia is essential
    - Hypoxia may worsen with beta-agonist therapy
    - Fear of rising PCO<sub>2</sub>, should not preclude administration of oxygen therapy in **hypoxic** patients
  2. IV access not routinely indicated for all patients
    - Medication administration
    - Fluid administration – all patients are not considered dehydrated, but duration and severity of illness need to be considered

**What should initial aerosol management include?**

- c. Aerosol **management**
1. Combined beta agonist and ipratropium bromide therapy
    - **Improve** airway obstruction in adults and children, of questionable significance. Stoodley et al, Osmond et al.

- Questionable effect on admission rates. Plotnick et al, Lin et al.
- Pharmacological sense - prolongs the duration of bronchodilation of beta-agonists from 3-4 hrs to 6-8 hrs.

## 2. High dose beta agonist therapy

- Safety well studied. Newhouse et al, Reisner et al.
- FEV-1, PEFr, symptom results are arguable Emerman et al, Reisner et al.
- Decrease in  $K^+$  appears dose dependent and not linked to ectopy or sudden death Shrestha et al.

## 3. Continuous beta agonist therapy

- Controversial results regarding improved clinical outcomes measured as PEFr, admission rates and symptoms in children and adults Shrestha et al, Reisner et al. Khine et al.
- Improved respiratory therapists time constraints.

## 4. MDI vs nebulization therapy

- No difference in objective measures of clinical outcomes.
- Use of spacer is essential
- Dose equivalence 2.5 mg albuterol solution to 4-10 puffs MDI with spacer.

## 5. Beta agonists and mortality

- Frequent use linked to death.

- Suspected marker of disease severity.
- Decreases in  $K^+$  documented with suspicion of dysrhythmia, but no evidence to support this

6. IV and SQ beta agonists

- Albuterol IV vs nebulizer therapy – improved PEFR in neb group and lower  $K^+$  in IV group, Salmeron et al.
- Terbutaline IV vs nebulizer – no difference in PEFR, but small improvement in  $PaO_2$  in IV group, Van Renterghem et al.
- Epinephrine injection in those patients not responding to nebulizer therapy improved pulmonary function, Appel et al.
- Epinephrine given SQ safe in asthmatics of any age, Cydulka et al.

### CASE THREE

**A 34-year-old female is receiving therapy for her asthma exacerbation. After two beta agonists aerosol treatments her peak expiratory flow rate is only 50% of predicted. A decision to administer steroids is made.**

**What route and dosage should be administered?**

D. Steroids

Inflammatory component of asthma must be addressed-beta agonists treat the symptoms and steroids treat the etiology of the disease.

1. Route of steroid administration

- Oral vs IV
  - Gastric irritation and tolerance are considerations.

- Onset of action similar **enteral** vs pareneteral.
    - Time frame is controversial 6 hours in adults and 4 hours in children are earliest estimates for onset.
  - IV vs po admission rates and pulmonary function are not different, Bamett et al, Rowe et al.
2. Dosage of steroid
- IV Solumedrol (methylprednisolone) relatively equipotent to po prednisone.
  - Comparing low, medium and high dose administration of steroids reveals no difference in pulmonary function, side effects, or respiratory failure, **Manser** et al.
  - 1 **mg/kg** vs 6 mg/kg no difference in pulmonary function, Marquette et al.
3. When to administer steroids
- Early **vs** late administration reveals that early administration may prove helpful, Lin et al.
4. Steroids at discharge
- Considered a mainstay of therapy by **NIH**.
  - Should move to **aerosolized** steroids as a maintenance medication decreasing relapse rates, Blais et al.
  - Consideration of high dose **acrosolized** steroids in **severe**, oral steroid dependent cases.

- Taper is not necessary to prevent adrenal suppression, reduction in PEFr, or symptoms, Cydulka et al.
- Low dose (<30 mg prednisone) may be less effective than higher dosages at discharge

## CASE FOUR

**A 40 year-old male with acute asthma exacerbation remains symptomatic with wheeze and tachypnea following two hours of aggressive medical therapy.**

**Are there indicators that predict a need for admission in these cases?**

E. Risk factors for relapse

- Historical clues increasing relapse include multiple allergic triggers, home nebulizer, numerous ED visits, difficulty performing work or daily activity, long duration of symptoms, discontinuing hospital based therapy without achieving at least 50% predicted PEFr, Emerman et al.
- PEFr is not a predictor of relapse, Emerman et al.

## CASE FIVE

**A 27-year-old female has failed to respond to aerosol treatments and early steroid administration. She is alert and cooperative, but continues to use accessory muscles of respiration and her respiratory rate is consistently greater than 35.**

**What type of mechanical ventilation should be used?**

F. Mechanical ventilation

1. Non-invasive positive pressure ventilation (NIPPV)

- A. Continuous positive airway pressure (CPAP)
- Decreases work of breathing, admission rates, and ICU admissions, Meduri et al.
  - Nasal or full face mask can be utilized.
  - Similar to positive end expiratory pressure (PEEP).
  - Start at 5 cm H<sub>2</sub>O and titrate up by 2 cm H<sub>2</sub>O increments.
- B. Bilevel positive airway pressure (BiPAP)
- Decreases work of breathing, admission rates, and ICU admissions, Pollack et al.
  - **Inspiratory** component is similar to pressure support.
  - Expiratory component is similar to PEEP.
  - Start with **Inspiratory** component of 10 cm H<sub>2</sub>O and **Expiratory** component of 5 cm H<sub>2</sub>O.

## 2. Invasive Positive Pressure Ventilation (IPPV)

- Volume cycled ventilators superior to pressure cycled ventilators to diminish dynamic hyperinflation.
- Decrease dynamic hyperinflation by prolonging expiratory time; permits release of trapped lung volumes.
- Decrease **baro/volutrauma** by maintaining **plateau pressures** < 35 cm H<sub>2</sub>O.



- Prolonged **expiratory** time is the goal by:
  - Decreased respiratory rate 6-8 bpm.
  - Reduced tidal volume 6-X **cc/kg** ideal body weight.
  - Increased **inspiratory** flow rate 80 – 120 **L/min.**
- Permissive hypercapnea, Levy et al, Jain et al
  - Prolonged **I/E** ratio
  - Slowly increased PCO, < 90 mm Hg
  - ABG **pH** > 7.25
  - May require sedation and paralysis

3. Hemodynamic compromise associated with mechanical ventilation

- Positive pressure ventilation decreased venous return and can limit cardiac output.
- **Crystalloids** 1 liter bolus prior to intubation in asthmatics-time permitting.
- Follow plateau pressures for prediction of **baro/volutrauma**, maintaining values < 35 cm **H<sub>2</sub>O.**

G. **Lagniappe**

1. Magnesium

- Improved clinical signs, symptoms, PEFr, Rowe et al, Devi et al.

2. Ketamme

- Low dose IV administration no benefit compared to standard therapy, **Howton** et al
- IV continuous infusion in mechanically ventilated asthmatics with refractory bronchospasm resulted in

improved gas exchange and dynamic compliance,  
Ahmed et al.

3. Heliox nebulizer gas

- Nebulizer gas driving beta agonist delivery yields no advantage to standard delivery, Henderson et al, Verbeek et al.

4. Aminophylline

- No improvement, but side effects are increased, Murphy et al.

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