February 2015 Pulmonary Case of the Month: Severe Asthma

Suresh Uppalapu, MD
Sunil Santhanakrishnan, MD
Rajeev Saggar, MD

Banner Good Samaritan Medical Center
Phoenix, AZ

History of Present Illness

A 50-year-old African-American woman with a history of asthma presented to the emergency department with a chief complaint of shortness of breath for 2 weeks. She reported some chest tightness, wheezing and dry cough. She denied fever, chills, myalgias or arthralgias at the time of admission.

PMH, SH and FH

In addition to asthma, she has a past medical history of type 2 diabetes mellitus, hypertension, and multiple sclerosis. She admitted to social smoking but states she quit 6 to 7 months ago. She denies alcohol, recreational drug use, or a family history of early coronary artery disease, strokes or cancers.

Medications

- Montelukast 10 mg daily
- Salmeterol/fluticasone 250/50 inhaled twice a day
- Albuterol inhaler as needed for shortness of breath
- Metformin 500 mg bid.
- Dimethyl fumarate 240 mg bid.
- Omega 3 fish oil.
- Calcium carbonate 600 mg daily
- Naproxen 500 mg BID
- Lisinopril 10 mg daily
- Hydrochlorothiazide 25 mg daily.

Physical Exam

Vitals: Temperature 37.2º C, respiratory rate 33 breaths/min, heart rate 112 beats/min, blood pressure 152/80 mm Hg, SpO2 80% on room air but 98% on 3 liters/min by nasal cannula.
General: Mild respiratory distress.
Lungs: Diminished breath sounds diffusely with mild wheezing.
The rest of her exam was within normal limits.

Laboratory/EKG/Chest Radiography
White blood cells 8.1 X 10^3 cells/microliter, hemoglobin 13.9 g/dL, hematocrit 41.7, platelets 289,000 cells/microliter.
Electrolytes blood urea nitrogen, creatinine, glucose, troponin, and brain naturetic peptide were within normal limits
EKG showed sinus tachycardia but was otherwise normal.
Chest x-ray was interpreted as normal.
A thoracic CT scan showed wispy infiltrates but no evidence of pulmonary embolism or other abnormalities.

Which of the following is ***appropriate management*** at this time?

1. Bronchodilators
2. Discharge the patient to home
3. Intravenous corticosteroids
4. 1 and 3
5. All of the above

Correct!
4. 1 and 3

The basic principles of care for an acute exacerbation of asthma are the following (1):

- Assess the severity of the attack
- Use inhaled short-acting beta agonists early and frequently and consider concomitant use of ipratropium for severe exacerbations
- Start systemic glucocorticoids if there is not an immediate and marked response to the inhaled short-acting beta agonists
- Make frequent (every one to two hours) objective assessments of the response to therapy until definite, sustained improvement is documented
- Admit patients who do not respond well after four to six hours to a setting of high surveillance and care
- Educate patients about the principles of self-management for early recognition and treatment of a recurrent attack and develop an "asthma action plan" for recurrent symptoms

The patient was admitted to a general medical ward but did not do well. Non-invasive positive pressure ventilation (NIPPV) was considered but was not given due to clinical deterioration warranting ICU transfer for initiation of mechanical ventilation. Her initial ventilator settings were: assist/control 18, PEEP 0, FiO2 60%, tidal volume 350 ml. She had peak respiratory pressures of about 51 cm H_2O. Her arterial blood gases showed pH 7.15, PaCO2 81 mm Hg, and PaO2 114 mm Hg.

Which of the following ***should be considered*** at this time?

1. Begin oseltamivir, zanamivir, or peramivir
2. General anesthesia
3. Switch to pressure controlled ventilation
4. 1 and 3
5. All of the above

Correct!
5. All of the above

The principles of mechanical ventilation in asthma are (2):

- Avoid further dynamic hyperinflation.
- Reduce auto PEEP
- Enough sedation and consider neuromuscular blockade
- Allow permissive hypercapnia

Pressure controlled ventilation is the preferred mode of mechanical ventilation with a tidal volume of 6-8 ml/kg, a respiratory rate of 10-14 breaths/min, PEEP of 0-5 cm H_2O, with a plateau pressure of <30 cm H_2O.

At this time the Centers for Disease Control is recommending oseltamivir, zanamivir, or peramivir for patients suspected of potentially having influenza (3). Our patient eventually proved to be influenza A + and was treated with oseltamivir for 5 days.

The patient underwent a trial of general anesthesia with isoflurane (4,5). Unfortunately, this made little difference. The arterial blood gases remained poor with a pH 7.09, pCO2 109 mm Hg, and pO2 113 mm Hg on 60% FiO2.

What additional ***therapies could be attempted*** for severe asthma?

1. Extracorporeal membrane oxygenation (ECMO)
2. Heliox
3. Ketamine
4. 1 and 3
5. All of the above

Correct!
5. All of the above

Ketamine IV anesthesia has also been tried for severe asthma with some success (6). Heliox, a mixture of helium and oxygen, is less dense than air which is predominately nitrogen and oxygen. Because it is less dense, heliox lowers upper airway resistance and has also been successfully used in severe asthma (7). Similarly, successes have also been reported with ECMO (8-10).

In our patient, a trial of ECMO resulted in improvement in her arterial blood gases to pH 7.475, pCO2 of 33 mm Hg, and pO2 of 508 mm Hg on a FiO2 of 100% within 4 hours of initiation. She slowly improved, was extubated and eventually discharged to home.

No rescue therapy has been proven to be superior to another and there are no controlled trials comparing therapies. Early ECMO may be life-saving although when to initiate ECMO has not been standardized yet.

References

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