

# Emergency Department Management of Acute Asthma Exacerbations: Review Questions

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*In October 2007, the National Heart, Lung, and Blood Institute (NHLBI) issued an update on the diagnosis and management of asthma (EPR-3 2007), including emergency management of acute asthma exacerbations. The following questions are intended as a review of the recommendations provided in this report.*

## QUESTIONS

Choose the single best answer for each question.

### Questions 1 to 3 refer to the following case.

A 10-year-old boy with mild persistent asthma presents to the emergency department (ED) with cough and wheezing. He has no signs of significant respiratory distress. On examination, the patient has loud bilateral expiratory wheezing with no inspiratory wheezes, is able to speak in phrases, and is mildly tachypneic at rest.

#### 1. What is the most appropriate initial step in this patient's management?

- (A) Administer subcutaneous terbutaline
- (B) Obtain a chest radiograph, complete blood count, and blood cultures
- (C) Perform rapid-sequence intubation
- (D) Provide oxygen, check pulse oximetry, and administer 3 nebulized short-acting  $\beta$ -blockers in 20-minute intervals

#### 2. After an hour of appropriate treatments, the patient's status is reassessed. The patient's mother states that his personal best peak flow is 280 L/min. Currently, his best peak flow out of 3 attempts is 140 L/min. The patient appears to be in no respiratory distress, and his oxygen saturation is 96% on 2 L via nasal cannula. He has some mild expiratory wheezes bilaterally. How would you classify this patient's exacerbation using the current NHLBI definitions<sup>1</sup>?

- (A) Mild
- (B) Moderate
- (C) Severe
- (D) Life-threatening

#### 3. What is the next best step in the management of this patient?

- (A) Add theophylline to the medical regimen
- (B) Administer oral systemic corticosteroids and continue treatment with albuterol in the ED
- (C) Admit to the hospital
- (D) Discharge home

#### 4. All of the following statements about response to emergency therapy in children are correct EXCEPT

- (A) Repeated pulse oximetry below 92% to 94% after 1 hour of treatment is predictive of the need for hospitalization
- (B) Children aged 2 to 5 years are generally not able to perform spirometry or peak flow measures when coached
- (C) If the child responds poorly to initial therapy and requires admission, ipratropium should be continued in the inpatient setting
- (D) Infants have a higher risk of respiratory failure from asthma exacerbations, and response to short-acting  $\beta_2$ -agonist (SABA) therapy is unpredictable

#### 5. A 27-year-old woman who currently is at 18 weeks of gestation and has a history of mild intermittent asthma presents to the ED with cough and wheezing. She was unable to relieve her symptoms with her albuterol inhaler. Her peak flow at her last 2 prenatal care visits was 460 L/min, but at home it was 200 L/min. How should this patient be managed?

- (A) Administer both inhaled and oral systemic corticosteroids
- (B) Administer inhaled corticosteroids only

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- (C) Administer terbutaline
- (D) No course of action is indicated at this time

**6. Which of the following diagnostic studies should be obtained initially for a patient who presents to the ED with an acute asthma exacerbation?**

- (A) Arterial blood gas
- (B) Chest radiography
- (C) Complete blood count
- (D) No initial laboratory studies are required

**7. Based on the most recent NHLBI report,<sup>1</sup> all of the following are risk factors for death from asthma EXCEPT**

- (A) Chronic use of inhaled corticosteroids
- (B) Low socioeconomic status
- (C) Prior intubation or intensive care unit admission for asthma exacerbation
- (D) Three or more visits to the ED in the past year

**ANSWERS AND EXPLANATIONS**

**1. (D) Provide oxygen, check pulse oximetry, and administer 3 nebulized short-acting  $\beta$ -blockers in 20-minute intervals.** Appropriate interventions for mild to moderate asthma exacerbations include SABA therapy and oxygen to maintain oxygen saturation ( $\text{Sao}_2$ ) at 90% or greater.<sup>1</sup> Systemic corticosteroids would be indicated if the patient had previously been on steroids, did not respond to initial therapy, or had signs or symptoms of respiratory distress. Additionally, inhaled ipratropium would be indicated for more severe exacerbations of asthma. Injectable  $\beta_2$ -agonists (eg, terbutaline) have not been demonstrated to have greater efficacy than inhaled  $\beta_2$ -agonists.<sup>1</sup>

**2. (B) Moderate.** The patient is at 50% of his personal best peak flow. Based on the NHLBI guidelines, the patient would be categorized as having a moderate asthma exacerbation (40%–69% of personal best peak flow).<sup>1</sup> A peak flow of 70% or greater indicates a mild exacerbation, whereas less than 40% is classified as severe and less than 25% is classified as life-threatening.<sup>1</sup>

**3. (B) Administer oral systemic corticosteroids and continue treatment with albuterol in the ED.** The treatment of patients with moderate asthma exacerbations who have a peak flow (personal best) of 40% to 69% after the first hour of appropriate treatment includes oral corticosteroids and an hourly SABA (eg, albuterol) for 1 to 3 hours.<sup>1</sup> The decision to admit to the hospital should be made if the pa-

tient has not responded well to this regimen within no more than 4 hours after presentation.

**4. (C) If the child responds poorly to initial therapy and requires admission, ipratropium should be continued in the inpatient setting.** Although inhaled ipratropium has been demonstrated to be beneficial in the ED setting, the NHLBI guidelines<sup>1</sup> reviewed 2 studies in children that have failed to demonstrate any benefit of adding ipratropium once the patient is hospitalized. Children with a pulse oximetry reading below 92% to 94% often require hospitalization.<sup>1</sup> Children younger than 5 years are generally unable to perform spirometry or peak flow testing. Infants have a higher risk of respiratory failure, and their response to inhaled  $\beta_2$ -agonist therapy is more unpredictable, so careful monitoring is essential.

**5. (A) Administer both inhaled and oral systemic corticosteroids.** Maternal asthma has been shown to increase the risk of perinatal mortality, preeclampsia, preterm birth, and low birth weight.<sup>2</sup> The risk of asthma exacerbations associated with pregnancy can be reduced and lung function can be improved with the use of inhaled corticosteroid therapy. No studies to date, including studies of large birth registries, have related inhaled corticosteroid use to an increased risk of congenital malformations or other adverse perinatal outcomes. Patients with mild to moderate asthma exacerbations can be managed as outpatients if their peak expiratory flow is 70% or greater, their response is sustained at least 1 hour after the last treatment, they have a normal physical examination, are in no distress, and have reassuring fetal status.<sup>2</sup> If peak flow is less than 50%, as seen in the case patient, the exacerbation is classified as severe. The patient should be treated initially with a nebulized  $\beta_2$ -agonist and ipratropium every 20 minutes for the first hour and be given oxygen to maintain the  $\text{Sao}_2$  above 95% as well as oral systemic corticosteroids.<sup>2</sup> Albuterol, not terbutaline, is the preferred  $\beta_2$ -agonist in pregnancy.<sup>2</sup>

**6. (D) No initial laboratory studies are required.** Most patients with asthma exacerbations do not require any initial laboratory or radiographic testing. Chest radiography is indicated in febrile patients and should be obtained for patients with productive cough and those with suspected cardiac or pulmonary disease, such as congestive heart failure, pneumothorax, pneumomediastinum, pneumonia, or atelectasis. A complete blood count could be

helpful in patients with fever, although leukocytosis is common with asthma exacerbations, and steroids can also cause elevations in neutrophils within 1 to 2 hours of administration. Arterial blood gas analysis should be performed in patients with carbon dioxide retention, suspected hypoventilation, severe exacerbations, or a predicted peak flow of 25% or less after initial treatment.<sup>1</sup> A normal carbon dioxide level is actually a poor prognostic indicator, as patients usually have a decreased carbon dioxide level from an increased respiratory drive.

7. (A) **Chronic use of inhaled corticosteroids.** The NHLBI recommends identifying patients at higher risk of asthma death, counseling these patients to seek early medical care, and providing them with intensive education about their disease, including instruction in the availability of ambulance care. Risk factors for death from asthma include prior intubation or intensive care unit admission for asthma, 2 or more hos-

pitalizations in the past year, 3 or more ED visits for asthma in the past year, hospitalization or ED visit for asthma in the past month, use of more than 2 SABA canisters per month, difficulty perceiving symptoms or identifying exacerbations, low socioeconomic status, drug use or other major psychosocial problems, and chronic heart, lung, or psychiatric problems. Long-term use of inhaled corticosteroids has not been identified as a risk factor for death from asthma.

#### REFERENCES

1. National Asthma Education and Prevention Program. Expert panel report 3: guidelines for the diagnosis and management of asthma (EPR-3 2007). NIH Publication No. 08-4051. Bethesda (MD): U.S. Department of Health and Human Services; National Institutes of Health; National Heart, Lung, and Blood Institute; 2007. Available at [www.nhlbi.nih.gov/guidelines/asthma/asthgdln.htm](http://www.nhlbi.nih.gov/guidelines/asthma/asthgdln.htm). Accessed 22 Jul 2008.
2. National Asthma Education and Prevention Program. Working Group Report on managing asthma during pregnancy: recommendations for pharmacologic treatment—update 2004. NIH Publication No. 05-5236. Bethesda (MD): U.S. Department of Health and Human Services; National Institutes of Health; National Heart, Lung, and Blood Institute; 2005. Available at [www.nhlbi.nih.gov/health/prof/lung/asthma/astpreg/astpreg\\_full.pdf](http://www.nhlbi.nih.gov/health/prof/lung/asthma/astpreg/astpreg_full.pdf). Accessed 22 Jul 2008.

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