

## PedsCases Podcast Scripts

This is a text version of a podcast from PedsCases.com on the “**Acute Asthma Exacerbation.**” These podcasts are designed to give medical students an overview of key topics in pediatrics. The audio versions are accessible on iTunes or at [www.pedsCases.com/podcasts](http://www.pedsCases.com/podcasts).

### **Acute Asthma Exacerbations**

Developed by Colin Siu and Dr. Melissa Chan for PedsCases.com.  
March 8, 2016.

Hi everyone, my name is Colin Siu and I’m a medical student at the University of Alberta. This podcast was developed with Dr. Melissa Chan, a pediatric emergency physician and Clinical Lecturer at the University of Alberta and Stollery Children’s Hospital in Edmonton, Alberta, Canada.

This podcast will focus on diagnosis and management of acute asthma exacerbations in the pediatric patient with a known previous diagnosis of asthma.

But first, let’s start with a case. You are starting your elective in pediatric emergency and you are asked to see an 11 year old boy that has just presented at the Emergency Department with wheezing, increased work of breathing, an oxygen saturation of 88% on room air, and a known history of asthma. As you run to the resuscitation room, you try to think about what you need to do once you arrive. What are your main priorities with this patient? What treatments should you offer? Should you admit this patient once he is stabilized? Just remember, stay calm and PedsCases on.

The objectives of this podcast are to:

- 1) Classify the presentation of an acute asthma exacerbation as mild, moderate or severe.
- 2) Identify history, physical exam and diagnostic studies that are indicated for each presentation
- 3) Develop a management plan for a patient with an acute asthma exacerbation
- 4) Understand criteria for hospital admission after patient stabilization and the components of discharge planning for patients with asthma

### Introduction

Let’s start off by looking at the definition of asthma. Asthma is a result of reversible bronchospasm, airway obstruction and airway inflammation within the lungs. An acute asthma exacerbation is defined as an acute or subacute deterioration of asthma symptoms to the point of requiring a visit to a health care practitioner or the administration of systemic corticosteroids. Asthma exacerbations are one of the leading causes of hospitalizations in children. The differential diagnosis for an acute asthma exacerbation includes foreign body aspiration, pneumonia, croup, bronchiolitis, anaphylaxis, heart failure and aspiration pneumonia. It should be noted that most children under 6 with wheezing illnesses do not have asthma and thus a formal diagnosis of asthma for children under 6 requires stringent evaluation. A diagnosis of asthma may be considered in children under 6 if they have asthma-like symptoms more than 8 days per month or more than 2 acute exacerbations. The patient must have signs of airway obstruction such as wheezing, the airway obstruction must show improvement when the patient

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is treated with short-acting beta agonists with or without oral corticosteroids, and there is no clinical suspicion of alternative diagnoses.

### Classifying Asthma Exacerbations

In determining the management plan for a pediatric patient, the first task is to classify their presentation as being one of four severity levels: mild, moderate, severe, or impending respiratory failure. A patient with a mild exacerbation presents with exertional dyspnea, minimal intercostal retractions, moderate wheezing, and over 94% oxygen saturation on room air. Signs and symptoms of a moderate exacerbation include decreased activity and feeding, hunched over posture, speech in phrases, intercostal and substernal retractions, loud wheezing, and an O<sub>2</sub> sat at 91 to 94%. A patient with a severe exacerbation may present with agitation, decreased activity and feeding, speech in single words only, accessory muscle use, nasal flaring, paradoxical thoraco-abdominal movement, audible wheeze without a stethoscope and/or an O<sub>2</sub> sat less than 91%. Impending respiratory failure should be suspected if the patient presents with drowsiness or confusion (due to cerebral hypoxemia), central cyanosis, is unable to eat or talk, a silent chest due to minimal air entry that no longer elicits wheezing, and/or an O<sub>2</sub> sat below 90%. The Pediatric Respiratory Assessment Measure also known as PRAM score has been created and validated to help stratify the severity of asthma and also guide management.

### History, Physical and Diagnostic Studies

Prior to seeing any patient, always check the initial triage vital signs which include respiratory rate, heart rate, oxygen saturation, blood pressure and temperature to help you assess whether the patient is medically stable enough for you to take a history or requires immediate treatment. History and physical exam should be conducted for a patient with mild or moderate exacerbations but may be delayed in patients with more severe exacerbations until the patient has been treated and is medically stable. Medical stabilization revolves around the principles of maintaining an airway and ensuring adequate respiration and circulation. The history should focus initially on the symptoms preceding the current exacerbation, such as infectious symptoms like rhinorrhea, fever, or cough; possible precipitants, and the time of onset of exacerbation. Then, do a focused asthma history including details about previous medications; recent exacerbations; current medications, including beta-agonists; and allergies. Patients who are at a high risk of asthma-related deaths include those with previous severe exacerbations, ICU admissions, exacerbations requiring intubation or mechanical ventilation, 2 or more hospitalizations or 3 or more emergency department visits for asthma in the past year, a hospitalization or emergency department visit for asthma in the past month, those who required more than 2 canisters of short-acting beta-agonists in the past month, and those with illicit drug use or major comorbidities.

The physical exam should allow you to assign a PRAM score for the exacerbation. The PRAM score is a cumulative score which assesses 5 signs including suprasternal indrawing, scalene retractions, wheezing, air entry and oxygen saturation on room air. If suprasternal indrawing is present, a score of 2 is given for this component. If absent, a score of 0 is given. If scalene retractions are present, a score of 2 is given and once again is absent, a score of 0 is given. In regards to wheezing, absence of wheezing is given a 0, the presence of only expiratory wheezing is given a 1, inspiratory and expiratory wheezing is given a 2, and wheezing audible without a stethoscope or a silent chest with minimal air entry is given a 3. Regarding air entry, normal air entry is given a 0, decreased air entry at the bases is given a 1, widespread decrease in air entry is given a 2 and absent or minimal air entry is given a 3. An oxygen saturation above

93% on room air is given a 0, between 90 -93% is given a 1 and less than 90% is given a 2. The scores from each of these 5 categories is summed up for the cumulative PRAM score. A cumulative PRAM score of 0-4 is mild, a cumulative score of 5-8 is moderate, and a score of 9-12 is a severe exacerbation. Regardless of the cumulative PRAM score, any patient with any lethargy, cyanosis, decreasing respiratory effort or rising pCO<sub>2</sub> should be classified as impending respiratory failure.

A chest x-ray is only indicated in patients with localized crackles or dullness that is refractory to bronchodilator treatment, presence of foreign body, suspicion of a pneumothorax, or respiratory distress out of proportion to the degree of airflow limitation found on physical examination. In addition, an arterial blood gas is only needed in patients with severe exacerbations.

### Management

Treatment of the pediatric patient with an acute exacerbation of asthma depends on the severity of the exacerbation. For mild exacerbations, use a nasal cannula or face mask to ensure oxygen saturation is above 94%. Furthermore, give inhaled salbutamol 1-3 doses every 20 min. For moderate exacerbations, start oral corticosteroids early, ensure O<sub>2</sub> sat are above 94%, give inhaled salbutamol 3 doses every 20 minutes also known as 'back-to-back' salbutamol, and consider giving ipratropium.

In severe exacerbations, similarly start oral corticosteroids early or consider IV steroids, consider giving 100% oxygen which may require a different mask, give continuous aerosolized salbutamol and back-to-back ipratropium 3 doses every 20 minutes, keep the patient NPO and consider IV magnesium sulphate. Finally, in patients with impending respiratory failure, use a non-rebreather mask to deliver 100% oxygen, give continuous aerosolized salbutamol and back-to-back ipratropium 3 doses every 20 minutes, get IV access, keep the patient NPO, give IV methylprednisolone and IV magnesium sulphate and consider IV salbutamol or aminophylline. With impending respiratory failure, pediatric ICU should be notified, blood gases should be drawn and a Bilevel Positive Airway Pressure or BiPAP machine and intubation kit should be prepared.

We will now briefly review more details about some of the medications that were mentioned above. Firstly, if possible salbutamol should be used with a metered-dose inhaler (MDI) as opposed to a nebulizer, as the inhaler is more efficient in medication delivery and less likely to induce hypoxemia and tachycardia. However, nebulizers should be used for those patients with severe episodes, a high oxygen requirement or if they are unable to inhale. As salbutamol may cause tachycardia, hyperglycemia, hypokalemia and reversible arrhythmias, patients who receive large doses of salbutamol should have their electrolytes, glucose and heart rhythms monitored. Ipratropium, in combination with salbutamol, has been shown to improve lung function and decrease admission rates in moderate to severe exacerbations of asthma when given early in the course. Ipratropium should be given every 20 minutes for the first hour; there is little evidence of its utility beyond the initial hour of use and outside of the emergency department setting. IV magnesium sulphate can be given in severe refractory asthma however its adverse effects of hypotension and bradycardia should be noted. IV salbutamol is an option in impending respiratory failure although continuous cardiac monitoring is required to monitor for arrhythmias.

Lastly, patients should be frequently re-assessed after each medication delivery, in particular after the first dose of salbutamol and again after 3 doses of salbutamol, if needed. If a patient

fails to progress after 12 hours of treatment, reasons for failure should be considered including poor salbutamol response, underlying pneumonia, and suboptimal steroid dose or frequency of administration. A chest x-ray and blood gas may be ordered to tease out the reason behind the lack of response.

If a patient's respiratory status continues to deteriorate, BiPAP should be considered. BiPAP has been shown to reduce intubation requirements; however, BiPAP is unable to protect the airway from aspiration. Failing this, mechanical ventilation may be indicated. Ideally, intubation should be avoided at all costs in patients with an acute asthma exacerbation as it is very difficult to ventilate asthmatics. Mechanical ventilation has been associated with increased risk of death and has many complications including bronchospasms, pneumothorax, and hemodynamic instability due to increased intrathoracic pressures and poor venous return. The absolute indications for intubation include coma, respiratory arrest or worsening respiratory status despite maximal therapy.

#### Consideration for Admission of Patients

The decision to admit or discharge a patient to hospital is based on objective clinical information combined with clinical judgement. Patients should be admitted to hospital if they have an ongoing oxygen requirement, have persistently increased work of breathing, need beta-agonists more frequently than every 4 hours after 4 to 8 hours of treatment, or continue to deteriorate while on systemic steroids. ICU admission should be considered if the patient fails to improve on continuous nebulized salbutamol, requires IV salbutamol, or requires mechanical ventilation. Infants and younger children are also at increased risk of respiratory failure and should have a lower threshold for admission; they should be hospitalized if they do not respond to short-acting beta agonist therapy. Patients should be considered for discharge if they need beta-2 agonists less frequently than every 4 hours after 4 to 8 hours of treatment, if they have an O<sub>2</sub> sat reading of 92% or more at room air, if they have minimal signs of respiratory distress, have improved air entry, and they have a clear follow-up plan.

#### Discharge Planning

Discharge planning is a fantastic opportunity for student involvement. We will cover some important details to include in the discharge plan. First, every patient should be discharged with a short-acting beta-agonist along with an asthma action plan outlining how to manage symptoms. For the current illness families should be told to continue using the short acting beta-agonist until symptoms subside and to seek medical attention if the patient needs to use the beta-agonist more frequently than every 4 hours. Second, children with persistent asthma and a mild exacerbation should receive a prescription for an inhaled corticosteroid.

A very important, and often forgot about point, is inhaler technique. Techniques on how to properly use and clean inhalers and spacers should be reviewed with patients, ideally watching them show you how they use the inhalers. If an oral corticosteroid was given to the patient in the emergency department, the patient should be sent home with a single dose of dexamethasone, which has been shown to be non-inferior to a 3 to 5 day regiment of prednisone. Additionally, families should be informed about the impact of environmental control measures in preventing asthma exacerbations and should be informed of the early clinical signs and symptoms of relapses to prevent any delay in treatment. Lastly, patients should be counselled to follow-up with their primary care practitioner 3 to 5 days after discharge.

#### Conclusion

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Now let's review our clinical case. You arrive in triage, and see your patient, an 11 year old boy presenting with a wheeze, increased work of breathing, decreased oxygen saturation and a known history of asthma. You review the vitals: HR 130 beats per minute, respiratory rate 32 breaths per minute, blood pressure 120/78 with a temperature of 37.3 degrees Celsius. You note that the patient is in respiratory distress, demonstrates accessory muscle use, nasal flaring and has an audible wheeze. Oxygen saturation remains at 88% on room air. Recognizing the severity of the condition, you immediately proceed to stabilize the patient. You start the patients on oral corticosteroids, oxygen via nasal cannula and give 3 doses of inhaled salbutamol. You re-assess after 20 minutes and find that the patient's O<sub>2</sub> saturations are now at 97% on oxygen and there are no signs of respiratory distress. Repeat vital signs are stable, and the patient is responsive. You proceed to take a history and conduct your physical exam. It turns out that the patient has a history of poorly controlled asthma so you make a note to incorporate asthma control into your discharge planning. You monitor the patient for 3 to 4 hours after the last treatment and the patient continues to remain clinically stable. At time of discharge you ensure that the family has up to date medications and prescriptions, create an action plan and finish by asking the patient to follow up with their family doctor in 3 to 5 days.

Lastly, let's end by reviewing some key points from this podcast:

- 1) The differential diagnosis for an acute asthma exacerbation includes pneumonia, croup, bronchiolitis, anaphylaxis, heart failure and aspiration.
- 2) The classification of an acute exacerbation of asthma is important as it dictates management. Classify according to signs of respiratory distress and oxygen saturation. The PRAM score is one system that is commonly used for classification.
- 3) General principles of managing acute exacerbations include giving supplemental oxygen to keep O<sub>2</sub> saturations above 94%, giving oral corticosteroids early in moderate to severe exacerbations, and the use of inhaled salbutamol and ipratropium.
- 4) Patients should be admitted to hospital if they require supplemental oxygen, have persistently increased work of breathing, need beta-agonists more frequently than every 4 hours after 4 to 8 hours of treatment, or deteriorate while on systemic steroids.

Thanks for listening to this podcast.

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