## **Managing the uncontrolled: A case based approach to severe pediatric asthma**

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# **Introduction to Pediatric Asthma Management**

This document provides a detailed case-based approach to the management of severe and uncontrolled asthma in pediatric patients, designed to guide healthcare professionals in handling asthma exacerbations in children effectively.

# **Case Study: Severe Asthma Exacerbation in a Child**

A five-year-old child with a known history of asthma presents to the emergency department after three days of increasing cough and difficulty breathing. The symptoms worsened during the night, and the child became unable to lie flat or speak in full sentences. The child’s history of asthma, along with the current symptoms, indicates a severe asthma exacerbation.

Differential diagnoses include viral bronchitis, pneumonia, and foreign body aspiration, but these are unlikely due to the gradual onset and the known asthma. Further evaluation through clinical examination and vital sign monitoring is crucial to confirm the diagnosis.

# **Physical Examination and Vital Signs**

Upon examination, the child exhibits signs of significant respiratory distress. The vital signs show an elevated respiratory rate, and oxygen saturation of 94% on room air, indicating hypoxemia. Physical findings such as audible wheezing, subcostal, and intercostal retractions suggest moderate to severe asthma exacerbation. These clinical signs confirm the need for immediate intervention to stabilize the child’s condition.

# **Severity Assessment and Classification of Asthma**

Asthma exacerbations are classified based on severity:

* **Mild asthma**: Symptoms appear with physical exertion, the child can speak in full sentences, and there are minimal signs of distress.
* **Moderate asthma**: The child has difficulty lying down, speaks in phrases, and shows signs of tachypnea and muscle use for respiration.
* **Severe asthma**: The child cannot lie flat, speaks in words, shows loud wheezing, tachycardia, and decreased oxygen saturation, which fits this case.

Assessing the severity is essential for determining the appropriate treatment approach.

# **Initial Management of Severe Asthma Exacerbation**

The initial management of severe asthma includes:

1. **Oxygen therapy**: To correct hypoxemia, oxygen saturation should be maintained above 95%.
2. **Bronchodilators**: Nebulized salbutamol (or other beta-agonists) is administered to reverse bronchoconstriction and improve airflow.
3. **Corticosteroids**: Systemic steroids, either oral prednisone or IV hydrocortisone/ Methyl Prednisolone, are given to reduce inflammation in the airways.

These interventions help reverse airway obstruction and improve lung inflammation, addressing the primary concerns of severe asthma exacerbation.

# **Home Management and Action Plan**

For pediatric asthma patients, a home management plan (Asthma Action plan) is critical. The action plan should include instructions for using a short-acting beta-agonist (SABA) MDI, such as salbutamol, via an inhaler with a spacer or nebulizer( remember hypoxia can worsen if nebulization given without Oxygen source). Proper inhaler technique is important to ensure effective drug delivery. Parents should be trained on the correct usage, including administering 4-10 puffs of Salbutamol(50 mcg) every 20 minutes during an exacerbation for up to one hour and oral prednisone should be initiated, and the child should be brought to the emergency department.

# **Differential Diagnosis and Other Considerations**

Difficult asthma cases require careful differential diagnosis to rule out other conditions. These include bronchiectasis, cystic fibrosis, and allergic rhinosinusitis, which may mimic asthma symptoms. It is important to confirm the diagnosis of asthma using objective measures such as spirometry ( age more than 6 years ) and bronchodilator reversibility. If asthma is confirmed, but treatment is ineffective, it may indicate medication non-adherence and the presence of comorbidities like GERD, Obesity or factors like environmental pollutants exposure.

# **Advanced Treatments and Biological Agents**

In severe, therapy-resistant asthma cases, biological treatments such as anti-IgE and

anti-IL-5 therapies are used. These treatments are typically reserved for patients who do not respond to standard asthma management. Bronchial thermoplasty, which involves using radiofrequency energy to reduce airway smooth muscle, is another option for severe asthma cases.

# **Managing Complications and Severe Episodes**

Severe asthma exacerbations may require more intensive interventions, such as:

* High-flow oxygen and Continuous nebulization with salbutamol/ Ipratropium, along with oxygen support.
* IV Magnesium Sulfate( 25-50 mg/ kg/ dose) to relax bronchial smooth muscle.
* In cases of respiratory worsening, non-invasive positive pressure ventilation (e.g., BiPAP) is preferred to avoid complications from intubation.

Monitoring vital signs, including heart rate, blood pressure is specially monitored while on MgSO4 infusion and oxygen saturation, is an essential vital to monitor during critical periods.

# **Conclusion and Take-Home Messages**

Effective management of pediatric asthma involves:

1. Proper diagnosis and severity assessment.
2. Timely administration of bronchodilators and corticosteroids.
3. Addressing environmental and psychosocial factors contributing to uncontrolled asthma.
4. Educating families on proper inhaler use and recognizing exacerbation symptoms.

By following these guidelines and utilizing a case-based approach, healthcare professionals can improve outcomes for children with severe asthma, reducing the frequency of hospitalizations and enhancing long-term asthma control.

This document emphasizes the importance of swift action, thorough assessment, and appropriate treatment to manage asthma exacerbations in children effectively.

# **FAQ: Frequently Asked Questions on Managing Severe Pediatric Asthma**

## **What are the signs that indicate a severe asthma exacerbation in children?**

Severe asthma exacerbations in children are typically characterized by:

* + Difficulty breathing and speaking in full sentences.
  + Tachypnea (rapid breathing) and tachycardia (increased heart rate).
  + Audible wheezing and visible signs of respiratory distress, such as subcostal and suprasternal retractions.
  + Decreased oxygen saturation (less than 95%).
  + Agitation or inability to lie flat due to shortness of breath.

## **How can I assess the severity of an asthma exacerbation?**

Severity can be assessed based on:

* + **Symptoms**: The child's level of distress and ability to speak or lie down.
  + **Signs**: The presence of wheezing, tachypnea, retractions, and the need for additional respiratory support.
  + **Functional assessment**: Measured oxygen saturation, respiratory rate, and other signs of respiratory compromise. Mild cases may involve symptoms during physical exertion, while moderate and severe cases will present with more pronounced distress and hypoxia.

## **What is the role of inhalers in asthma management?**

Inhalers are essential for delivering bronchodilators directly to the airways. Short-acting beta-agonists (SABA), like salbutamol, are typically used during exacerbations to relieve bronchoconstriction. It's crucial to use a spacer with the inhaler, especially for young children, to ensure proper drug delivery.

## **How do I manage asthma exacerbations at home?**

The home management plan for asthma exacerbations includes:

* + Administering short-acting beta-agonists (SABA) such as salbutamol via an inhaler with a spacer or nebulizer.
  + Giving oral corticosteroids, like prednisone, when symptoms worsen.
  + The child should use MDI SABA every 20 minutes during an exacerbation for 3 such and if symptoms persist, taking the child to the emergency department. Proper education on inhaler use and the action plan for asthma management is crucial to preventing severe exacerbations.

## **When should a child with asthma be brought to the emergency department?**

A child should be taken to the emergency department if:

* + Symptoms of asthma do not improve after using the prescribed medication (e.g., inhalers or nebulizers).
  + The child is unable to breathe comfortably, has a rapid breathing rate, or cannot speak in full sentences.
  + Oxygen saturation drops below 90% and does not improve with home treatment.
  + There are signs of severe distress, such as cyanosis (blue discoloration), confusion, or exhaustion.

## **What are some common triggers for asthma exacerbations in children?**

Common asthma triggers include:

* + Allergens such as pollen, pet dander, and dust mites.
  + Respiratory infections, including common colds or the flu.
  + Exposure to smoke (cigarette or passive smoke).
  + Strong odors or pollutants in the air.
  + Cold or dry air, especially during the winter months.

Identifying and avoiding these triggers can help prevent exacerbations.

1. **What are the benefits of using corticosteroids during an asthma exacerbation?** Corticosteroids help reduce inflammation in the airways, improving airflow and preventing further airway obstruction. Systemic steroids, like oral prednisone or IV hydrocortisone, Methyl Prednisolone are often required during moderate to severe asthma exacerbations to manage inflammation effectively.

## **How can physical activity affect asthma in children?**

Regular physical activity specially swimming is important for overall health and can improve cardiopulmonary fitness in children with asthma. However, some children may experience exercise-induced bronchoconstriction (EIB), where physical exertion triggers asthma symptoms. In such cases, pre-exercise use of a bronchodilator inhaler can help prevent symptoms.

## **When should advanced treatments like biologic agents be considered?**

Biologic agents, such as anti-IgE and anti-IL-5 therapies, are considered for children with severe, therapy-resistant asthma. These treatments are used when asthma does not respond to traditional therapies, such as inhaled corticosteroids and bronchodilators. They help target the specific mechanisms of asthma at a molecular level, offering an additional treatment option for difficult-to-control asthma.

## **What role do environmental factors play in asthma management?**

Environmental factors such as allergens, pollutants, and exposure to second-hand smoke can significantly worsen asthma symptoms. It is important to manage these factors by ensuring the home environment is free from common triggers. This may include using air purifiers, keeping windows closed during high pollen seasons, and encouraging parents to stop smoking around their children.