



Case 29: Wheezing

- **Chief complaint**
 - 8-year old-female presents with wheezing
 - EMS Report (if requested): Child was at recess when she complained to a teacher about shortness of breath. Albuterol MDI was given en route. School alerted mother, mother is en route.
- **Vital signs**
 - **HR: 155** BP: 92/50 **RR: 20** **Sat: 90% on RA** T: 37°C Wt: 30 kg
- **Patient appearance**
 - Patient is alert, but sitting with hands on her knees in moderate respiratory distress
- **Primary survey**
 - Airway: speaking, but in short sentences
 - Breathing: moderate respiratory distress, using accessory muscles, wheezing bilaterally with prolonged expiration, speaking in short sentences
 - Circulation: warm skin, 2+ distal pulses
- **Action**
 - Place patient on the monitor
 - Oxygen by NC vs NRB
 - Peripheral IV line (can be placed later if causing delay in respiratory management)
 - Optional: Peak flow (If asked: 90 L/minute, normal for age 200L/min)
 - Get parental consent to treat (nurse to call mother) though do not delay emergent treatment
- **History**
 - Source: Patient
 - HPI: an 8-year-old female presents with the complaint of feeling short of breath/wheezy for the past 2-3 days, but has worsened in the past 3-4 hours. Symptoms have not improved despite using her albuterol nebulizer at home or using her albuterol inhaler q2hrs while in school. She has had nasal congestion with a dry cough for the past 3 days with no fevers. Previous asthma exacerbations have been triggered by seasonal changes (if asked, it is transitioning from summer to fall). Immunizations are UTD, no known sick contacts or recent travel. Otherwise ROS is negative.
 - PMHx: asthma (if asked: hospitalized 3 times in past year, no intubations), seasonal allergies

- PSHx: none
- Allergies: seasonal, no medication/food allergies
- Meds: albuterol nebulizer/MDI
- Social: attends school, there is no smoking in the home
- FHx: mother had asthma as a child
- PMD: Dr. Wheeze

- **Physical Exam**

- **General:** awake and alert, moderate distress
- **HEENT:** bilateral nasal turbinate swelling, tearing from both eyes, otherwise normal
- Neck: normal
- **Chest:** intercostal and suprasternal retractions
- **Heart:** sinus tachycardia
- **Lungs:** diffuse inspiratory and expiratory wheezing with prolonged expiration, poor air movement, speaking 1-2 words at a time
- Abdomen: normal
- Extremities: normal
- Back: normal
- Neuro: normal
- Skin: normal
- Lymph: normal

- **Action**

- Order Labs (optional)
 - CBC, BMP, VBG
- Order Meds
 - Albuterol 2.5 mg/3mL nebulizer q20 min as needed
 - Ipratropium 0.02%, 250-500mcg nebulizer every 20 minutes x 3 doses
 - OR continuous breathing treatment with Albuterol and Ipratropium
 - Oral or IV steroid (consider Decadron 0.6 mg/kg PO, Prednisolone 1-2 mg/kg PO or Methylprednisolone 1-2 mg/kg IV or similar)
 - Consider magnesium IV (50 mg/kg)
 - May consider 10-20cc/kg IVF bolus (300-600cc)
- Order Imaging
 - CXR (optional)

- **Response/Results**

- Patient denies any improvement after the above treatments
- Patient reevaluation and repeat vitals:
 - Still with significant work of breathing and continued wheezing
 - Vitals after initial intervention: HR: 110 **O2: 89% on 2L NC RR: 36**
- CXR, if ordered ([Figure 29.1](#)- pulmonary hyperinflation, bronchial wall thickening with peribronchial cuffing, no infiltrate)

- **Action**

- Trial of bilevel positive airway pressure (BiPAP) with in-line continuous nebulized albuterol
- May co-administer Ketamine 0.5mg/kg IV to assist tolerance of machine and for bronchodilation
- Should give 20cc/kg IVF bolus if not already completed
- May consider epinephrine 0.01 mg/kg IM (max 0.4 mg), repeat up to 3 doses
- May consider Terbutaline 0.01 mg/kg SQ or IM (max 0.4 mg) or 10 mcg/kg IV bolus then 0.4 mcg/kg/min gtt
- May consider inhaled 0.5 mL of 2.25% racemic epinephrine

- **Response/Results**

- Lab Results, if ordered (normal CBC, normal BMP; VBG with pH 7.45, CO2 52)
- If BiPAP started:
 - Patient has less accessory muscle use, more comfortable; RR: 24, Sat 96%
- If BiPAP not started:
 - Worsening respiratory distress requiring intubation (must describe) followed by hypotension requiring additional IVF bolus

- **Action:**

- Admit to ICU
- Update patient and parents

- **Diagnosis**

- Primary Diagnosis: Acute Asthma Exacerbation (Status Asthmaticus)

- **Critical actions**

- Obtain consent to treat a minor (but do not delay emergent treatment)
- Supplemental oxygen
- Administration of albuterol, ipratropium, and steroids
- Frequent reassessment for clinical improvement
- Adjunctive therapies for severe asthma (such as magnesium, epinephrine or terbutaline, BiPAP)
- Admit to ICU

- **Instructor Guide**

- This is a case of a severe asthma exacerbation triggered by the weather change/seasonal allergies. It is important to get consent to treat since the patient is a minor, though this should not delay emergent treatments. It is also important to obtain a thorough history from the family or patient regarding previous asthma exacerbations and home therapy. First-line therapies (nebulized B-agonists and anticholinergics in addition to steroids) were insufficient to provide rapid relief in this case; the learner should recognize this and

move to adjunctive therapeutic options (such as magnesium, BiPAP, terbutaline, epinephrine, heliox). If the patient is intubated, blood pressure should drop dramatically until fluid bolus +/- epinephrine is administered. If intubated, the learner should adhere to appropriate vent settings as described below.

- **Case Teaching Points**

- The differential for wheezing in a child should include asthma, allergies, airway foreign body, GERD, pneumonia, bronchitis, bronchiolitis, vocal cord dysfunction, laryngomalacia, tracheomalacia, and less commonly cardiac issues (including congenital cardiac disease) or cystic fibrosis. A focused history and physical exam will help narrow down this differential diagnosis and help guide the appropriate treatment.

- **What is asthma?**

- Chronic inflammatory disease of the airways characterized by recurrent episodes of airflow obstruction resulting from edema, bronchospasm, and increased mucus production.

- **How are asthma exacerbations managed in the pediatric population?**

- First and foremost, any patient in respiratory distress should have an airway assessment in addition to respiratory and circulation assessment (the “ABC’s”).
- Though it is important to obtain parental consent for treatment of minors in the ED, it is also important not to delay any emergent or life-sustaining treatments for parental consent.
- General guidelines are outlined in the case above and various references available online, such as the CHOP ED Pathway for Evaluation/Treatment of Children with Asthma ([Figure 29.4](#)), can be used as examples of asthma management pathways in pediatric patients. There are many different ways that pediatricians approach pediatric asthma.

- **At what age is asthma diagnosed?**

- An abnormal Pulmonary Function Test (PFT) showing an obstructive pattern in patients aged 5 years or older is typically used to diagnose asthma. A family history is also suggestive of asthma.
- Diagnosis of asthma in pediatric patients 1-5 years of age can be difficult, as it is hard for patients at younger ages to follow the complex commands needed to obtain accurate PFTs; however, can be attempted if they have >2 episodes of wheezing/airflow obstruction + showing reversibility with bronchodilators and +/- steroids.
- If a child with acute wheezing is less than 12 months old, it is more likely that bronchiolitis is causing the patient’s acute symptoms.

- **What are some differential diagnoses to consider when evaluating wheezing in the pediatric population?**

- Large airway obstruction:
 - Foreign body aspiration

- Vocal cord dysfunction
 - Laryngomalacia
 - Tracheomalacia
 - Laryngeal webs or vascular rings
- Small airway obstruction:
 - Asthma
 - Bronchiolitis
 - Cystic Fibrosis
 - Bronchopulmonary Fibrosis
 - Cardiac Disease (“cardiac wheeze” seen with pulmonary edema)
- **What is cardiac asthma?**
 - Cardiac asthma is caused by the backup of fluid in the left side of the heart. This can be caused by poor heart contractility or a leaky valve that could be present at birth.
 - Can cause a “wheeze” heard on physical exam, but must distinguish if cardiac asthma vs bronchial asthma as treatments are different.
 - Depending on the reason (CHF vs valve dysfunction), may need positive pressure ventilation, diuretics, medications to decrease preload/afterload or surgery if a valve issue.
- **POCUS Pearls**
 - POCUS can often be used in adult patients presenting with shortness of breath and wheezing; particularly to help distinguish between a broad differential including CHF and pneumothorax, etc. If this case involved an adult patient, the following POCUS images could be obtained.
 - POCUS to assess for pulmonary edema or pneumothorax (**Figure 29.2 A-C, Video 29.3**)
 - [Figure 29.2 A](#)- Thoracic- normal lung sliding, no pneumothorax
 - [Figure 29.2 B](#)- Thoracic- M-mode of anterior chest wall showing seashore sign, no PTX
 - [Figure 29.2 C](#)- Thoracic- A-lines, no pulmonary edema
 - [Video 29.3](#)- Thoracic- normal lung sliding bilaterally, no pneumothorax
 - POCUS is more sensitive than CXR for diagnosing pulmonary edema and pneumothorax and takes less time to complete.
 - Differentiating acute COPD/Asthma exacerbation from CHF/Flash Pulmonary Edema can be difficult, as both patients can present significantly SOB and hypoxic with wheezing on exam.
 - Patients with asthma or COPD will typically have an A-line pattern bilaterally on lung ultrasound. A-lines are horizontal artifacts of the pleural line that occur in normal or hyper-inflated lung. In contrast, pulmonary edema can be diagnosed by identifying bilateral B-lines on US (>3 B-lines in >2 lung fields). B-lines occur secondary to increased lung density (fluid, blood, pus). They are vertical comet-tail like reverberation artifacts that arise from the pleural line and extend the depth of the screen without fading; they move with ventilation and lung sliding. B-lines will erase A-lines. This exam is typically

performed with lower frequency curvilinear probe in order to visualize the entire depth of the lung

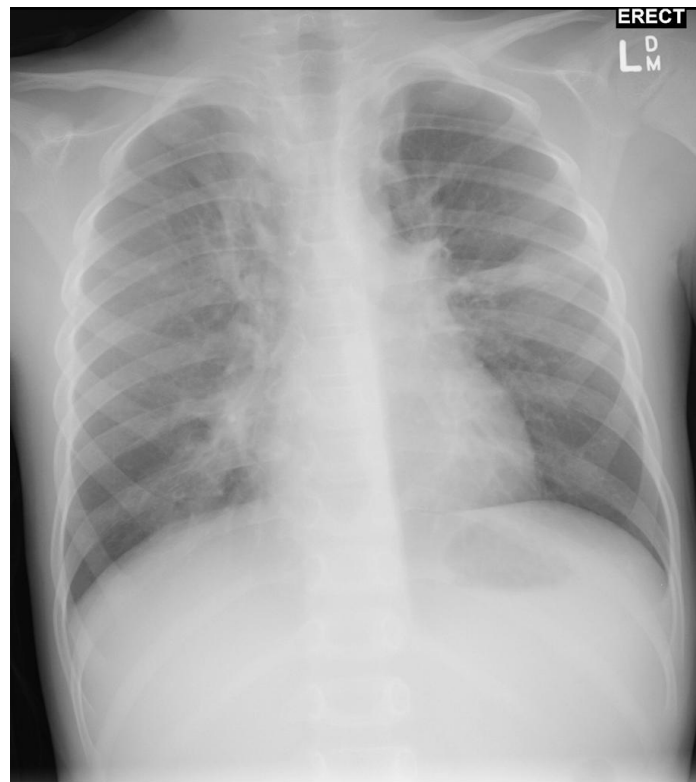
- To assess for a PTX, scan the least dependent portions of the anterior chest wall, where air will typically collect first. You can decrease your depth or switch to the high frequency linear probe to better visualize sliding at the pleural line.
- The presence of lung sliding or any comet tail artifact originating from the pleural line rules out a pneumothorax in the visualized rib space.

● **Attributions**

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- Image references
 - POCUS images courtesy of Northwestern Emergency Medicine POCUS Image Bank and Emory Emergency Ultrasound Archive
 - CXR from Radiopaedia.org, rID: 17996
 - ED Pathway for Evaluation/Treatment of Children with Asthma (used with permission):
<http://www.chop.edu/clinical-pathway/asthma-emergent-care-clinical-pathway>
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Figure 29.1- CXR



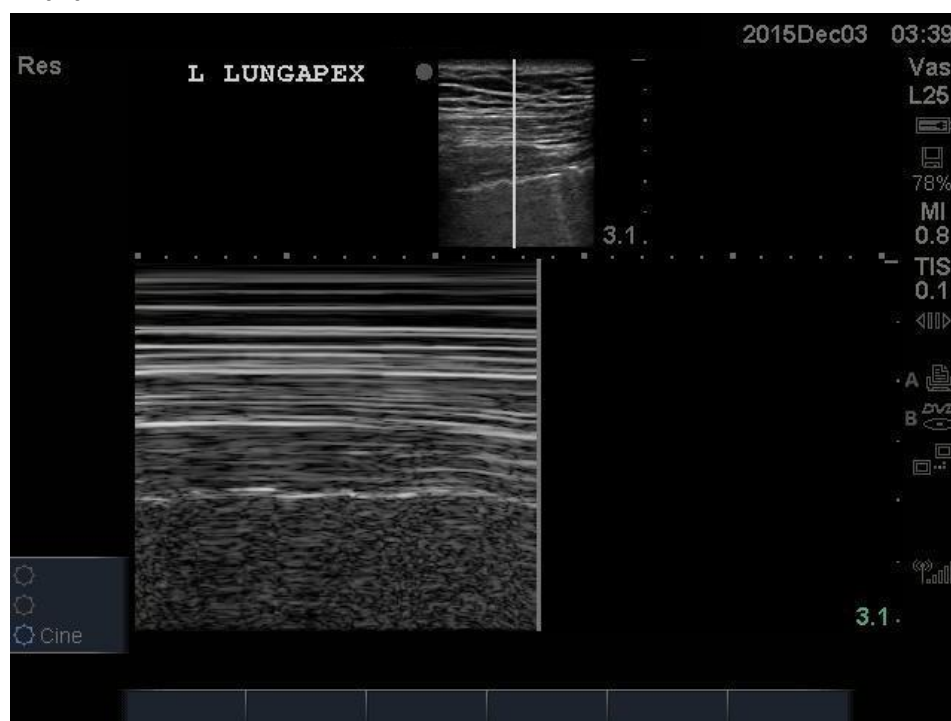
[Back to case](#)

Figure 29.2 (A)- POCUS Thoracic Lung



[Back to case](#)

Figure 29.2 (B)- POCUS Thoracic M mode



[Back to case](#)

Figure 29.2 (C)- POCUS Thoracic Lung

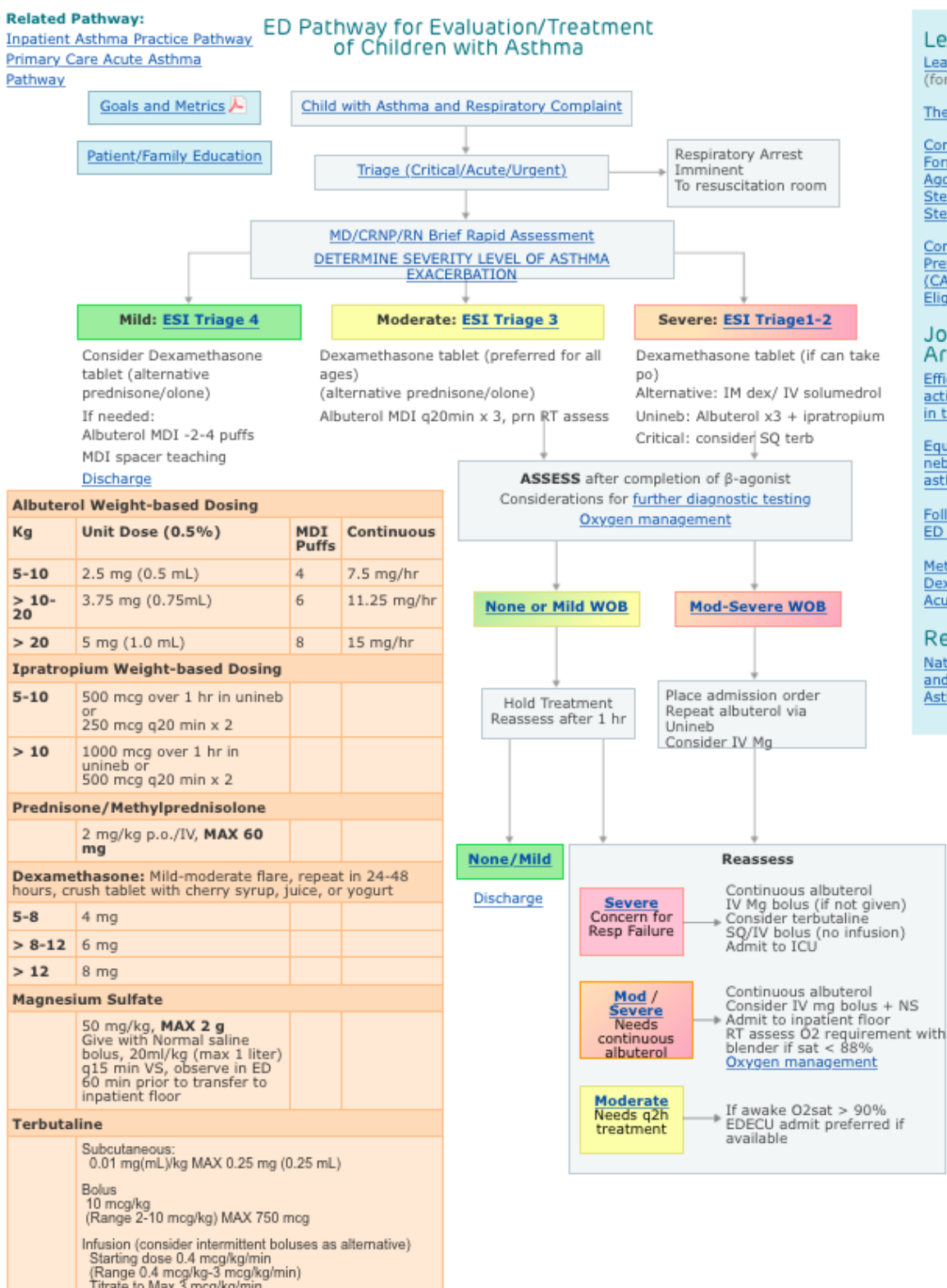


[Back to case](#)

Figure 29.3- [POCUS Thoracic](#)

[Back to case](#)

Figure 29.4- CHOP ED Pathway for Evaluation/Treatment of Pediatric Asthma



<http://www.chop.edu/clinical-pathway/asthma-emergent-care-clinical-pathway>

[Back to case](#)