



Chapter 073 – Asthma

Episode Overview

1. 10 different causes of a wheeze.
2. List 8 risk factors for death from asthma
3. List 6 objective findings of severe asthma
4. 10 therapies for an acute severe asthma exacerbation
5. Discuss a ventilation strategy for the critically-ill asthmatic patient
6. Discuss disposition and discharge planning for an acute asthma exacerbation presenting to the ER

Wise Cracks

1. What is delayed sequence intubation? Can it be used for severe Asthma exacerbation?
2. What about pregnancy and Asthma is so important?

Rosens in Perspective

Basic Principles:

- Reverse Obstruction
- Treat Hypoxia
- Treat Inflammation

Basic definition:

- A chronic airway inflammatory disorder
- Recurrent episodes of wheezing, breathlessness, chest tightness, and coughing
- Variable airflow obstruction (with varying degrees of reversibility) either spontaneously or with treatment.

According to UpToDate: The basic steps of care:

- a) Assess the severity of the attack
- b) Assess potential triggers (eg. animal dander, pollen, mold, respiratory infection, beta blockers, NSAIDs, cigarette smoking, non-adherence)
- c) Use inhaled short-acting beta agonists early and frequently, and consider concomitant use of ipratropium for severe exacerbations
- d) Start systemic glucocorticoids if there is not an immediate and marked response to the inhaled short-acting beta agonists
- e) Make frequent (every one to two hours) objective assessments of the response to therapy until definite, sustained improvement is documented
- f) Admit patients who do not respond well after four to six hours to a setting of high surveillance and care
- g) 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

Know how to interpret how bad your patient's asthma is at baseline!!!

Major characteristics

- Treatment with continuous or near-continuous ($\geq 50\%$ of year) oral corticosteroids
- Requirement for treatment with high-dose intravenous corticosteroids

Minor characteristics

- Requirement for additional daily treatment with a controller medication (e.g., long-acting beta-agonist, theophylline, or leukotriene antagonist)
- Asthma symptoms requiring short-acting beta-agonist use on a daily or near-daily basis
- Persistent airway obstruction ($FEV_1 < 80\%$ predicted, diurnal peak expiratory flow variability $> 20\%$)
- One or more urgent care visits for asthma per year
- Three or more oral steroid bursts per year
- Prompt deterioration with $\leq 25\%$ reduction in oral or intravenous corticosteroid dose
- Near-fatal asthma event in the past

Figure 73-6. American Thoracic Society workshop consensus for definition of severe or refractory asthma (requires one or both major and two minor criteria and that other conditions have been excluded, exacerbating factors have been treated, and patient is generally compliant).

Looking for more info: check out

<https://lifeinthefastlane.com/ccr/acute-severe-asthma/>

<https://emergencymedicinecases.com/pediatric-asthma/>

<http://rebelem.com/rebelcast-crashing-asthmatic/>

<http://www.emdocs.net/critical-asthma-patient-pearlspitfalls-of-management/>

<https://emcrit.org/?s=asthma>

<https://coreem.net/core/basic-asthma-management/>

<https://coreem.net/tag/crashing-asthmatic/>

[1] 10 different causes of a wheeze

Box 73-2 The Differential Diagnosis of Asthma

- Cardiac conditions
 - Valvular heart disease
 - Congestive heart failure
- COPD exacerbation
 - Pulmonary infection
 - Pneumonia
 - Allergic bronchopulmonary aspergillosis
 - Löffler's syndrome
 - Chronic eosinophilic pneumonia
- Upper airway obstruction
 - Laryngeal edema
 - Laryngeal neoplasm
 - Foreign body
 - Vocal cord dysfunction
- Endobronchial disease
 - Neoplasm
 - Foreign body
 - Bronchial stenosis
- Pulmonary embolus
- Carcinoid tumor
- Allergic or anaphylactic reaction
- Miscellaneous conditions
 - GERD
 - Noncardiogenic pulmonary edema
 - Addison's disease
 - Invasive worm infection

COPD, chronic obstructive pulmonary disease; *GERD*, gastroesophageal reflux disease.



[2] List 8 risk factors for death from asthma

Box 73-1 Risk Factors for Death from Asthma

Asthma History

Previous severe exacerbation (intubation or ICU admission for asthma)
Two or more hospitalizations for asthma in the past year
Three or more ED visits for asthma in the past year
Hospitalization or an ED visit for asthma in the past month
Use of more than two MDI short-acting β_2 -agonist canisters per month
Current use of or recent withdrawal from systemic corticosteroids
Difficulty perceiving asthma symptoms or severity of exacerbations

Social History

Low socioeconomic status or inner-city residence
Serious psychosocial problems
Illicit drug use, especially inhaled cocaine and heroin

Comorbidities

Cardiovascular disease
Other chronic lung disease
Chronic psychiatric disease

ED, emergency department; ICU, intensive care unit; MDI, metered-dose inhaler.

[3] List 6 objective findings of severe asthma

Table 73-1 Objective Findings in Asthma Assessment

FACTOR	SEVERE ASTHMA ($FEV_1 < 1.0$ L)
Pulse rate (beats/min)	≥ 120 but may be less with equally severe asthma
Respiratory rate (breaths/min)	≥ 40 but most are > 20 , therefore nondiscriminating
Pulsus paradoxus (mm Hg)	≥ 10 but may be absent with equally severe asthma in 50% of cases
Pulse rate ≥ 120 , respiratory rate ≥ 20 , pulsus paradoxus ≥ 10	If all three abnormal, 90% with severe asthma, but only 40% with $FEV_1 < 1.0$ L have all three abnormal
Use of accessory muscles of respiration	If present, may indicate severe asthma; if absent, may have equally severe asthma in 50% of cases
ABG analysis (mm Hg)	$PaO_2 \leq 60$ or $Paco_2 \geq 42$ indicates severe asthma; all other values difficult to interpret unless PEF or FEV_1 known
Pulmonary function studies	PEFR and FEV_1 measure directly the degree of airflow obstruction; most useful in assessing severity and guiding treatment decisions

ABG, arterial blood gas; FEV_1 , forced expiratory volume in 1 second; $Paco_2$, partial pressure of carbon dioxide in arterial blood; PaO_2 , partial pressure of oxygen in arterial blood; PEF, peak expiratory flow rate.



[4] 10 therapies for an acute severe asthma exacerbation

Let us break this down into treatments supported with good evidence, sketchy evidence, and no evidence/not recommended

Good Evidence

Our work-horses are:

- O₂ for sat titrated >90% or >95% in pregnant woman or known heart disease
- Short acting Beta Agonist (eg ventolin)
- Anticholinergics (eg Atrovent or ipratropium)
- Corticosteroids (eg prednisone or methylprednisolone) - no taper necessary if not pre-existing use or not used for >14days
- Magnesium sulfate - calcium channel– blocking properties, inhibition of cholinergic neuromuscular transmission, stabilization of mast cells and T lymphocytes, and stimulation of NO and prostacyclin.

Table 73-2 Initial Severity Assessments and Therapies in the Emergency Department

	MILD TO MODERATE	SEVERE
FEV ₁ or PEFR (% predicted/personal best)	≥40%	Unable or <40%
Oxygen therapy	Maintain Sao ₂ ≥90%	Maintain Sao ₂ ≥90%
Nebulized albuterol solution		
Levalbuterol (optimal)	1.25 mg q20min for up to three doses	1.25 mg q20min for three doses Continuous for 1 hr if severe
Racemic albuterol	2.5 mg q20min for up to three doses	5.0 mg q20min for three doses Continuous for 1 hr if severe
Albuterol MDI with VHC		
Levalbuterol (45 µg/puff) (optimal)	6-12 puffs q20min for up to three doses WS	Same for three doses (if able to do), WS
Racemic albuterol (90 µg/puff)	6-12 puffs q20min for up to three doses WS	Same for three doses (if able to do), WS
Ipratropium therapy		
Nebulized solution	If previous response (same dose as for severe)	0.5 mg q20min for three doses (may mix with albuterol solution)
MDI (18 µg/puff) with VHC	If previous response (same dose as for severe)	8 puffs q20min for three doses
Systemic corticosteroids		
Oral (preferred)	40-80 mg of prednisone or prednisolone per day if no immediate response to albuterol	40-80 mg of prednisone or prednisolone per day
Intravenous (unable to take orally or absorb)	40-80 mg of methylprednisolone per day	40-80 mg of methylprednisolone per day
Intravenous magnesium sulfate	Not indicated	2-3 g over 20 min (or at rates of up to 1 g/min) if FEV ₁ ≤ 25% predicted

FEV₁, forced expiratory volume in 1 second; MDI, metered-dose inhaler; PEFR, peak expiratory flow rate; Sao₂, oxygen saturation in arterial blood; VHC, valved holding chamber; WS, with supervision.

Sketchy Evidence

- Inhaled Anesthetic agents (like sevo or desflurane). Note: be careful of hypotension seen with concurrent use of volatile anesthetics, acidosis, beta agonists and theophylline.
- Intravenous Ketamine initial bolus 0.5-1mg/kg followed by infusion of 0.5-3mg/kg/hr
- Enoximone - only in europe: selective phosphodiesterase III inhibitor
- Parenteral beta-agonists - evidence that inhaled beta agonists are superior to IV: exception is severe anaphylaxis requiring epinephrine (IM or IV)
- High-dose inhaled glucocorticoids: opposing evidence for effect: net recommendation is PO intake in exacerbations
- Helium-oxygen: heliox. The good ole last ditch attempt. Conflicting evidence: not recommended



- g) Leukotriene receptor antagonists: Basically not recommended to work in exacerbations except those induced by aspirin or NSAID use. Some small evidence that their use (eg montelukast or zafirlukast)

No evidence

- a) Methylxanthines (eg theophylline) - stop using it! Increase adverse events when mixed with beta agonists. Only recommended to maintain people on it if they are on it in the community
- b) Empiric antibiotics - you guessed it. With signs of overt infection (eg lobular pneumonia) not helpful. Possible that high procalcitonin levels may reflect bacterial infection
- c) Nebulized furosemide - thought to help exercised induced asthma, but no data to support its use

[5] Discuss a ventilation strategy for the critically-ill asthmatic patient

- a) Induction agent: Ketamine/Propofol/Etomidate. No benefit superiority proven yet, but ketamine and propofol have proven bronchodilation. Use Paralysis : succs or roc
- b) Vent mode: VC! : control mode as they are paralysed! Volume over pressure limited modes in patients with airflow obstruction issues.
- c) Tidal volume 6-8cc/(ideal body weight in kg): lung protective strategy
- d) Minute ventilation (respiratory rate multiplied by tidal volume): less than 115 mL/kg/min
- e) Allow increased expiratory time by decreasing I:E ratio (1:3 or 1:4 up to 1:5)
- f) Low PEEP (start approx 5 or 80% intrinsic PEEP)
- g) Start FIO2 at 100 percent then titrate downwards for SpO2 above 90% or PaO2 above 60 mmHg

For more see **EMRAP's** vent strategy here: <https://www.emrap.org/episode/shockasthmaand/criticalcare>

[6] Discuss disposition and discharge planning for an acute asthma exacerbation presenting to the ER

Emergency Department Disposition Decision-Making Guidelines			
Table 73-4	GOOD RESPONSE	INCOMPLETE RESPONSE	POOR RESPONSE
FEV ₁ or PEFR (% predicted/personal best)	≥70%	≥40% but <69%	<40%
Disposition site			
Home	Yes	Individualized decision (see text)	No, continue therapy
Clinical decision unit	No	Yes, if available	Yes, if available and appropriate
Hospital ward	No	Yes, if no CDU	Yes, if appropriate and available
Critical care unit	No	No	Yes, if with respiratory insufficiency or failure

CDU, clinical decision unit; FEV₁, forced expiratory volume in 1 second; PEFR, peak expiratory flow rate.



Wise Cracks

[1] What is delayed sequence intubation? Can it be used for severe Asthma exacerbation?

As Rosen's cover's NIPPV has shown to prevent intubation of ASTHMA in the ICU setting. In this line, the prolific crew at EMCRIIT and Dr. Weingart himself has come up with a different approach to approaching the patient in respiratory extremis.

[http://www.annemergmed.com/article/S0196-0644\(14\)01365-1/abstract](http://www.annemergmed.com/article/S0196-0644(14)01365-1/abstract)

[2] What about pregnancy and asthma is so important?

Pregnant woman have increased O₂ demand, decreased FRC, and baseline hyperventilation that is compensated for by a metabolic acidosis. ABGs in pregnancy normally show a pH 7.4-7.45 with a p_aCO₂ of 28-32. So easy to miss the tiring, hypercapnia in pregnancy with a "normal" gas of 7.35 and PCO₂ of 35-45. Pay attention to the CLINICAL PICTURE!