PER
Asthma management
- Acute care settings

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Figure 4.4-1. Severity of Asthma Exacerbations*

	Mild	Moderate	Severe	Respiratory arrest imminent
Breathless	Walking Can lie *down*	Talking Infant—softer shorter cry; difficulty feeding Prefers sitting	At rest Infant stops feeding Hunched forward	
Talks in	Sentences	Phrases	Words	
Alertness	May be agitated	Usually agitated	Usually agitated	Drowsy or confused
Respiratory rate	Increased	Increased	Often >30/min	
	Normal rates of breathing in awake children: *Age* — *Normal rate* < 2 months — < 60/min 2-12 months — < 50/min 1-5 years — < 40/min 6-8 years — < 30/min			
Accessory muscles and suprasternal retractions	Usually not	Usually	Usually	Paradoxical thoraco-abdominal movement
Wheeze	Moderate, often only end expiratory	Loud	Usually loud	Absence of wheeze
Pulse/min.	< 100	100-120	>120	Bradycardia
	Guide to limits of normal pulse rate in children: Infants — 2-12 months—Normal Rate — < 160/min Preschool — 1-2 years — < 120/min School age — 2-8 years — < 110/min			

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Figure 4.4-1. Severity of Asthma Exacerbations*

	Mild	Moderate	Severe	Respiratory arrest imminent
Pulsus paradoxus	Absent < 10 mm Hg	May be present 10-25 mm Hg	Often present > 25 mm Hg (adult) 20-40 mm Hg (child)	Absence suggests respiratory muscle fatigue
PEF after initial bronchodilator % predicted or % personal best	Over 80%	Approx. 60-80%	< 60% predicted or personal best (< 100 L/min adults) or response lasts < 2hrs	
PaO_2 (on air)† and/or $PaCO_2$†	Normal Test not usually necessary < 45 mm Hg	> 60 mm Hg <45 mm Hg	< 60 mm Hg Possible cyanosis > 45 mm Hg; Possible respiratory failure (see text)	
SaO_2% (on air)†	> 95%	91-95%	< 90%	
	Hypercapnea (hypoventilation) develops more readily in young children than in adults and adolescents.			

*Note: The presence of several parameters, but not necessarily all, indicates the general classification of the exacerbation.
†Note: Kilopascals are also used internationally; conversion would be appropriate in this regard.

Figure 4.4-2: Management of Asthma Exacerbations in Acute Care Setting

Initial Assessment (see Figure 4.4-1)

- History, physical examination (auscultation, use of accessory muscles, heart rate, respiratory rate, PEF or FEV_1, oxygen saturation, arterial blood gas if patient in extremis)

Initial Treatment

- Oxygen to achieve O_2 saturation ≥ 90% (95% in children)
- Inhaled rapid-acting β_2-agonist continuously for one hour.
- Systemic glucocorticosteroids if no immediate response, or if patient recently took oral glucocorticosteroid, or if episode is severe.
- Sedation is contraindicated in the treatment of an exacerbation.

Reassess after 1 Hour

Physical Examination, PEF, O_2 saturation and other tests as needed

Criteria for Moderate Episode:

- PEF 60-80% predicted/personal best
- Physical exam: moderate symptoms, accessory muscle use

Treatment:

- Oxygen
- Inhaled β_2-agonist and inhaled anticholinergic every 60 min
- Oral glucocorticosteroids
- Continue treatment for 1-3 hours, provided there is improvement

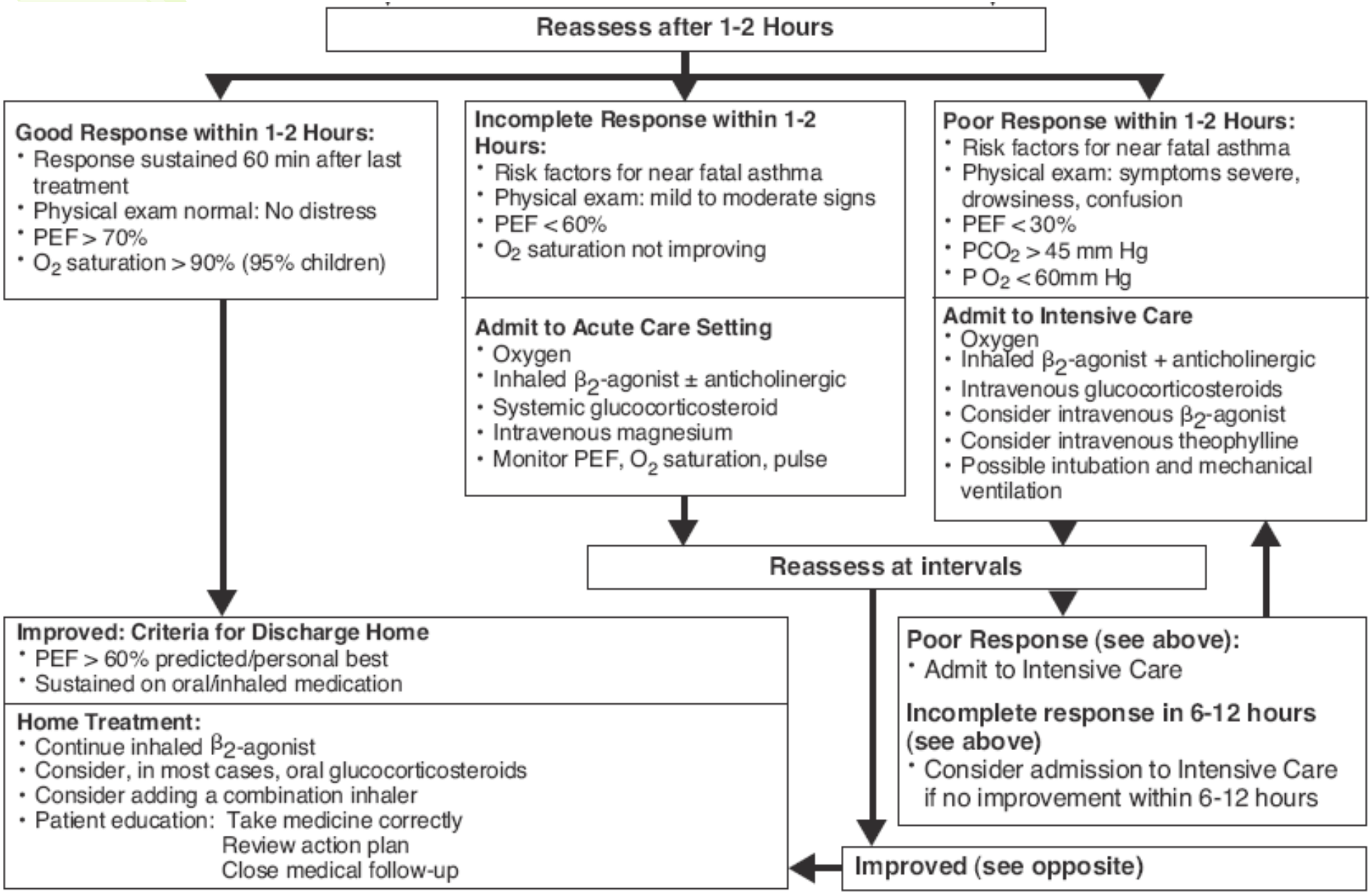
Criteria for Severe Episode:

- History of risk factors for near fatal asthma
- PEF < 60% predicted/personal best
- Physical exam: severe symptoms at rest, chest retraction
- No improvement after initial treatment

Treatment:

- Oxygen
- Inhaled β_2-agonist and inhaled anticholinergic
- Systemic glucocorticosteroids
- Intravenous magnesium

Reassess after 1-2 Hours



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Assessment

- In children routine chest X-rays are not recommended unless there are physical signs suggestive of parenchymal disease.
- Although arterial blood gas measurements are not routinely required they should be completed in patients with a PEF of 30 to 50% predicted, those who do not respond to initial treatment, or when there is concern regarding deterioration.
- The patient should continue on supplemental oxygen while the measurement is made.
- A PaO2 < 60 mm Hg (8 kPa) and a normal or increased PaCO2 (especially > 45 mm Hg, 6 kPa) indicates the presence of respiratory failure.

Treatment

Oxygen

- To achieve arterial oxygen saturation of ≥ 90% (≥ 95% in children).
- PaCO2 may worsen in some patients on 100 percent oxygen, especially those with more severe airflow obstruction.
- Oxygen therapy should be titrated against pulse oximetry to maintain a satisfactory oxygen saturation.
- Oxygen saturation less than 92% is a good predictor of the need for hospitalization.

Rapid-acting inhaled s2–agonists

- Rapid-acting inhaled 2-agonists should be administered at regular intervals.

- The long-acting bronchodilator formoterol, which has both a rapid onset of action and a long duration of effect, has been shown to be equally effective without increasing side effects, though it is considerably more expensive.

- Studies of intermittent versus continuous nebulized short acting 2-agonists in acute asthma provide conflicting results.

->No significant differences in bronchodilator effect or hospital admissions between the two treatments.

->A reasonable approach to inhaled therapy in exacerbations, therefore, would be the initial use of continuous therapy, followed by intermittent on-demand therapy for hospitalized patients.

- There is no evidence to support the routine use of intravenous 2-agonists in patients with severe asthma exacerbations.

Epinephrine

- A subcutaneous or intramuscular injection of epinephrine (adrenaline) may be indicated for acute treatment of anaphylaxis and angioedema, but is not routinely indicated during asthma exacerbations.

Additional bronchodilators- Ipratropium bromide

- A combination of nebulized 2-agonist with an anticholinergic (ipratropium bromide) may produce better bronchodilation than either drug alone and should be administered before methylxanthines are considered.

- Combination 2-agonist/anticholinergic therapy is associated with lower hospitalization rates and greater improvement in PEF and FEV.

- Similar data have been reported in the pediatric literature.

- However, once children with asthma are hospitalized following intensive emergency department treatment, the addition of nebulized ipratropium bromide to nebulized 2-agonist and systemic glucocorticosteroids appears to confer no extra benefit.

Theophylline

- In view of the effectiveness and relative safety of rapid-acting 2-agonists, theophylline has a minimal role in the management of acute asthma

-> Associated with severe and potentially fatal side effects, particularly in those on long-term therapy with sustained-release theophylline, and their bronchodilator effect is less than that of 2-agonists.

- However, in one study of children with near-fatal asthma, intravenous theophylline provided additional benefit to patients also receiving an aggressive regimen of inhaled and intravenous 2-agonists, inhaled ipatropium bromide, and intravenous systemic glucocorticosteroids.

Systemic glucocorticosteroids

- Systemic glucocorticosteroids speed resolution of exacerbations and should be utilized in the all but the mildest exacerbations

-> Especially if:

- The initial rapid-acting inhaled 2-agonist therapy fails to achieve lasting improvement
- The exacerbation develops even though the patient was already taking oral glucocorticosteroids
- Previous exacerbations required oral glucocorticosteroids

- Oral glucocorticosteroids are usually as effective as those administered intravenously and are preferred because this route of delivery is less invasive and less expensive.
- If vomiting has occurred shortly after administration of oral glucocorticosteroids, then an equivalent dose should be re-administered intravenously.
- In patients discharged from the emergency department, intramuscular administration may be helpful, especially if there are concerns about compliance with oral therapy.
- Oral glucocorticosteroids require at least 4 hours to produce clinical improvement.

- Daily doses of systemic glucocorticosteroids equivalent to 60-80 mg methylprednisolone as a single dose, or 300-400 mg hydrocortisone in divided doses, are adequate for hospitalized patients, and 40 mg methylprednisolone or 200 mg hydrocortisone is probably adequate in most cases.

- An oral glucocorticosteroid dose of 1 mg/kg daily is adequate for treatment of exacerbations in children with mild persistent asthma.

- A 3- to 5-day course in children is usually considered appropriate.

- Current evidence suggests that there is no benefit to tapering the dose of oral glucocorticosteroids, either in the short-term or over several weeks.

Inhaled glucocorticosteroids

- Inhaled glucocorticosteroids are effective as part of therapy for asthma exacerbations.

- The combination of high-dose inhaled glucocorticosteroids and salbutamol in acute asthma provided greater bronchodilation than salbutamol alone.

- Inhaled glucocorticosteroids can be as effective as oral glucocorticosteroids at preventing relapses.
- Patients discharged from the emergency department on prednisone and inhaled budesonide have a lower rate of relapse than those on prednisone alone.
- A high-dose of inhaled glucocorticosteroid (2.4 mg budesonide daily in four divided doses) achieves a relapse rate similar to 40 mg oral prednisone daily.

Magnesium

- Intravenous magnesium sulphate (usually given as a single 2 g infusion over 20 minutes) is not recommended for routine use in asthma exacerbations

- It can help reduce hospital admission rates in certain patients, including adults with FEV1 25-30% predicted at presentation, adults and children who fail to respond to initial treatment, and children whose FEV1 fails to improve above 60% predicted after 1 hour of care.

- Nebulized salbutamol administered in isotonic magnesium sulfate provides greater benefit than if it is delivered in normal saline.

- Intravenous magnesium sulphate has not been studied in young children.

Leukotriene modifiers

- There is little data to suggest a role for leukotriene modifiers in acute asthma.

Sedatives

- Sedation should be strictly avoided during exacerbations of asthma because of the respiratory depressant effect of anxiolytic and hypnotic drugs.

Criteria for Discharge from the Emergency Department vs. Hospitalization

- Patients with a pre-treatment FEV1 or PEF < 25% percent predicted or personal best, or those with a post-treatment FEV1 or PEF < 40% percent predicted or personal best, usually require hospitalization.

- Patients with post-treatment lung function of 40-60% predicted may be discharged, provided that adequate follow-up is available in the community and compliance is assured.

- Patients with post-treatment lung function ≥ 60 % predicted can be discharged.

Patients discharged from the emergency department

- At a minimum, a shorter course (3-5 days) for children should be prescribed, along with continuation of bronchodilator therapy.
- The bronchodilator can be used on an as-needed basis, based on both symptomatic and objective improvement, until the patient returns to his or her preexacerbation use of rapid-acting inhaled 2-agonists.
- Ipratropium bromide is unlikely to provide additional benefit beyond the acute phase and may be quickly discontinued.
- Patients should initiate or continue inhale glucocorticosteroids.
- Patients discharged from the emergency department with a peak flow meter and action plan have a better response than patients discharged without these resources.