

Acute asthma, prognosis, and treatment



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Asthma affects about 300 million people globally and accounts for 1 in every 250 deaths in the world. Approximately 12 million people in the United States each year experience an acute exacerbation of their asthma, a quarter of which require hospitalization. Acute asthma should be differentiated from poor asthma control. Patients with acute asthma will exhibit increasing shortness of breath, chest tightness, coughing, and/or wheezing. In contrast, poor asthma control typically presents with a diurnal variability in airflow and is a characteristic that is usually not seen during an acute exacerbation. The history should include a review of comorbidities, adherence to medications, previous episodes of near-fatal asthma, and whether the patient has experienced multiple emergency department visits or hospitalizations, particularly those requiring admission to an intensive care unit involving respiratory failure, intubation, and mechanical ventilation. Patient education is important to ensure that the patient understands that asthma is mostly a chronic disease and necessitates the avoidance of allergens, prevention of infections, adherence with routine vaccinations, management of comorbid conditions, and adherence to treatment regimens. This article is a structured review of the available literature regarding the diagnosis and management of acute asthma. (*J Allergy Clin Immunol* 2017;139:438-47.)

Key words: Asthma flare, acute asthma, asthma attack, wheezing, acute asthma diagnosis, acute asthma management

Asthma exacerbations are avoidable with appropriate regular therapy and patient education. Despite this, asthma affects about 300 million people globally and accounts for 1 in every 250 deaths.¹ In the United States alone, approximately 12 million people each year experience an acute exacerbation of their asthma, a quarter of which require hospitalization.² In Europe approximately 30 million people have asthma, and 15,000 people

Abbreviations used

COPD: Chronic obstructive pulmonary disease
EPR-3: Expert Panel Report 3
ICS: Inhaled corticosteroid
MDI: Metered-dose inhaler
NPPV: Noninvasive positive pressure ventilation
OCS: Oral corticosteroid
Paco₂: Partial pressure of arterial carbon dioxide
PEF: Peak expiratory flow
Pvco₂: Venous partial pressure of carbon dioxide
SABA: Short-acting β -agonist
SCS: Systemic corticosteroid

die yearly from this disease.³ This article is about acute asthma and its diagnosis, prognosis, and treatment.

Various clinical symptoms and signs can assist the clinician in determining the severity of acute asthma (Fig 1).^{2,4} To prevent severe asthma exacerbations, the goals for the physician managing subjects with asthma include (1) recognition of patients who are at a greater risk for near-fatal or fatal asthma; (2) education of the patient to recognize deterioration in their disease; (3) provision of an individual action plan for the patient to manage the exacerbation and to know when to seek professional help; and (4) management of comorbidities, such as rhinitis, sinusitis, obesity, gastroesophageal reflux disease, obstructive sleep apnea, chronic obstructive pulmonary disease (COPD), vocal cord dysfunction, and atopic dermatitis.⁵⁻⁹

PHYSICAL EXAMINATION

Clinical estimates of severity based on an interview and physical examination can result in an inaccurate estimation of disease severity; audible wheezing is usually a sign of moderate asthma, whereas no wheezing can be a sign of severe airflow obstruction. Symptoms of severe asthma include chest tightness, cough (with or without sputum), sensation of air hunger, inability to lie flat, insomnia, and severe fatigue. The signs of severe asthma include use of accessory muscles of respiration, hyperinflation of the chest, tachypnea, tachycardia, diaphoresis, obtundation, apprehensive appearance, wheezing, inability to complete sentences, and difficulty in lying down. Altered mental status, with or without cyanosis, is an ominous sign, and immediate emergency care and hospitalization are required. A detailed examination should include examining for signs and symptoms of pneumonia, pneumothorax, or a pneumomediastinum, the latter of which can be investigated by means of palpation for subcutaneous crepitations, particularly in the supraclavicular areas of the chest wall. Special attention should be paid to the patient's blood pressure, pulse, and respiratory rate. Tachycardia and tachypnea might be suggestive of a moderate-to-severe exacerbation, whereas

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	Mild	Moderate	Severe	Subset: Respiratory Arrest Imminent
Symptoms				
Breathlessness	While walking	While at rest (infant—softer, shorter cry, difficulty feeding)	While at rest (infant—stops feeding)	
	Can lie down	Prefers sitting	Sits upright	
Talks in	Sentences	Phrases	Words	
Alertness	May be agitated	Usually agitated	Usually agitated	Drowsy or confused
Signs				
Respiratory rate	Increased	Increased	Often > 30/minute	
		Guide to rates of breathing in awake children:		
		Age	Normal rate	
		< 2 mo	< 60/min	
		2–12 mo	< 50/min	
		1–5 yr	< 40/min	
		6–8 yr	< 30/min	
Use of accessory muscles; suprasternal retractions	Usually not	Commonly	Usually	Paradoxical thoracoabdominal movement
Wheeze	Moderate, often only end expiratory	Loud; throughout exhalation	Usually loud; throughout inhalation and exhalation	Absence of wheeze
Pulse/minute	< 100	100–120	> 120	Bradycardia
		Guide to normal pulse rates in children:		
		Age	Normal rate	
		2–12 mo	< 160/min	
		1–2 yr	< 120/min	
		2–8 yr	< 110/min	
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
Functional assessment				
PEF percent predicted or percent personal best	≥ 70 percent	~ 40–69 percent or response lasts < 2 hours	< 40 percent	< 25 percent (Note: PEF testing may not be needed in very severe attacks)
PaO ₂ (on air)	Normal (test not usually necessary)	≥ 60 mm Hg (test not usually necessary)	< 60 mm Hg: possible cyanosis	
and/or				
Pco ₂	< 42 mm Hg (test not usually necessary)	< 42 mm Hg (test not usually necessary)	≥ 42 mm Hg: possible respiratory failure	
SaO ₂ percent (on air) at sea level	> 95 percent (test not usually necessary)	90–95 percent (test not usually necessary)	< 90 percent	
	Hypercapnia (hypoventilation) develops more readily in young children than in adults and adolescents.			

FIG 1. Acute asthma severity: clinical signs and symptoms. Originally published as Fig 5-3 in EPR-3. PaO₂, Arterial oxygen pressure; Pco₂, partial pressure of carbon dioxide.

bradycardia might indicate impending respiratory arrest. Pulsus paradoxus is often present and might correlate with the severity of exacerbation (Fig 1).^{2,3,5,10}

cardiogenic pulmonary edema, noncardiogenic pulmonary edema, pneumonia, pulmonary embolus, chemical pneumonitis, and hyperventilation syndrome.^{3,5}

DIFFERENTIAL DIAGNOSIS OF ACUTE ASTHMA

The differential diagnosis of acute asthma includes COPD, vocal cord dysfunction, bronchitis, bronchiectasis, epiglottitis, foreign body, extrathoracic or intrathoracic tracheal obstruction,

ACUTE ASTHMA TRIGGERS

Risk factors for asthma exacerbations can be identified from the clinical history. The patient interview should include questions about recent events, including (1) upper or lower

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