

Asthma Guidelines

Goals of Medical Care for Adults and Children with Asthma

Source: National Institutes of Health, National Heart Lung, and Blood Institute, National Asthma Education and Prevention Program Clinical Practice Guidelines 2004 (No change on annual review, 2007)

Asthma Definition

Asthma is a chronic inflammatory disorder of the airways

- May develop at any time in life
- Most common chronic childhood disease
 - Atopy frequently present, which is the genetic susceptibility to produce IgE antibodies
- Adult-onset Factors
 - Allergens may play role
 - IgE antibodies are not detected
 - Coexisting sinusitis, nasal polyps, and sensitivities to aspirin, or non-steroidal anti-inflammatory related drugs
 - Occupational exposure to workplace materials (animal products, biological enzymes, plastic resin, wood dusts, metals) may cause airway inflammation
- Results from complex interactions among inflammatory cells, mediators, tissues and other cells in the airways
- Evidence indicates that subbasement membrane fibrosis may occur and these changes contribute to persistent abnormalities in lung function
- Inflammatory disorder causing
 - Episodes of wheezing, breathlessness, chest tightness and coughing, particularly at night or in early morning
 - Episodes associated with reversible airflow obstruction, either spontaneously or with treatment
 - Associated increase in existing bronchial hyperresponsiveness to a variety of stimuli
- Airflow obstruction/limitations caused by airway changes includes
 - Acute bronchoconstriction (allergen-induced)
 - Airway edema
 - Chronic mucous plug formation
 - Airway Remodeling

Asthma Immunohistopathologic Features Include:

- Airway epithelium denudation
- Collagen deposition beneath basement membrane
- Edema
- Mast cell activation
- Inflammatory cell infiltration
 - Neutrophils (especially in sudden-onset, fatal asthma exacerbations)
 - Eosinophils
 - Lymphocytes (TH2-like cells)

* Atopy is the genetic predisposition for the development of an IgE-mediated response to common aeroallergens and is the strongest identifiable predisposing factor for the development of asthma

Relationship of Airway Inflammation and Lung Function

Airway Hyperresponsiveness

- Important feature of asthma
- Is bronchoconstrictor response to multiple stimuli
- Symptoms include wheezing and dyspnea after allergen exposure
- Level of airway responsiveness correlates with clinical severity
- Measured by inhalation challenge testing with methacholine or histamine, exposure to cold dry air, inhalation of hypotonic or hypertonic aerosols or after exercise
- Variability between morning and evening peak expiratory flow (PEF) appears to reflect airway hyperresponsiveness

Initial Assessment and Diagnosis of Asthma

Establish diagnosis

- Exclude Alternative diagnosis
- Determine presence of episodic airflow obstruction symptoms
- Establish airflow obstruction is at least partially reversible

Suggested Mechanisms Recommended to Establish Diagnosis:

Detailed medical history

Symptoms

- Cough
- Shortness of breath
- Chest tightness
- Sputum production

Pattern of symptoms

- Perennial, seasonal, or both
- Continual, episodic, or both
- Onset, duration, frequency (Number of days or nights per week or month)
- Diurnal variations, especially nocturnal and on awakening in early morning

Family history in close relatives

- Asthma
- Allergies
- Sinusitis
- Rhinitis
- Nasal polyps

Assess severity of asthma

- Symptom frequency
- Exercise tolerance
- Hospitalizations
- Current medications

Identify potential precipitating/aggravating factors

- Viral respiratory infections
- Environmental allergens
 - Indoor (Mold, house-dust/mites, cockroach, animal dander or secretory products)
 - Outdoor (Pollen)
- Exercise
- Occupational chemicals or allergens
- Environmental change (Moving to new home, vacation, alteration of workplace or materials used)
- Changes in weather (Exposure to cold air)
- Emotional expression (Fear, anger, frustration, hard crying or hard laughing)
- Exposure home, work, day care or school to inhalant allergens or irritants (Tobacco smoke, strong odors, gases and aerosols)
- Drugs (Aspirin, beta-blockers, including eye drops, nonsteroidal anti-inflammatory drugs (NSAID), others)
 - Adult patients with severe persistent asthma, nasal polyps, or a history of sensitivity to aspirin or NSAID should be counseled regarding risk of severe and even fatal exacerbations from using these drugs
- Sulfite sensitivity (Processed potatoes, shrimp, dried fruit, beer or wine)
- Endocrine factors (Menses, pregnancy, thyroid disease)

Physical exam focusing on the upper respiratory tract, chest, skin

- Hyperexpansion of thorax (Especially in children)
- Accessory muscle use
- Appearance of hunched shoulders
- Chest deformity
- Wheezing sounds during normal breathing, or prolonged phase of forced exhalation
- Increased nasal secretion
- Mucosal swelling
- Nasal polyps
- Atopic dermatitis/eczema or any other manifestation of an allergic skin condition

Key Indicators for considering a Diagnosis of Asthma

- Wheezing
 - Lack of wheezing and a normal chest examination do not exclude asthma
- History of any of the following
 - Cough, worse particularly at night
 - Recurrent wheeze
 - Recurrent difficulty breathing
 - Recurrent chest tightness
- Reversible airflow limitation and diurnal variation as measured by using a peak flow meter
 - Example: Peak expiratory flow (PEF) varies 20 percent or more from PEF measurement on arising in the morning (before taking an inhaled short-acting beta2-agonist) to PEF measurement in early afternoon (after taking an inhaled short-acting beta2-agonist)
- Symptoms worsen at night, awakening patient
- Symptoms occur or worsen in the presence of:
 - Exercise
 - Viral infection
 - Animals with fur or feathers
 - House-dust mites (in mattresses, pillows, upholstered furniture, carpets)
 - Mold
 - Smoke (wood, tobacco)
 - Pollen
 - Changes in weather
 - Strong emotional expression (laughing or crying hard)
 - Airborne chemicals or dust
 - Menses

Differential Diagnostic Possibilities of Asthma

Infants and Children

- Upper airway diseases
 - allergic rhinitis, sinusitis
- Obstructions involving large airways
 - Foreign body in trachea or bronchus
 - Vocal cord dysfunction
 - Vascular rings or laryngeal webs
 - Laryngotracheomalacia, tracheal stenosis, or bronchostenosis
 - Enlarged lymph nodes or tumor
- Obstructions involving small airways
 - Viral bronchiolitis or obliterative bronchiolitis
 - Cystic fibrosis
 - Bronchopulmonary dysplasia
 - Heart disease
- Other causes
 - Recurrent cough, not asthma related, aspiration from swallowing dysfunction or gastroesophageal reflux

Adults

- Chronic obstructive pulmonary disease (chronic bronchitis or emphysema)
- Congestive heart failure
- Pulmonary embolism
- Laryngeal dysfunction
- Mechanical obstruction of the airways (benign and malignant tumors)
- Pulmonary infiltration with eosinophilia
- Cough secondary to drugs (angiotensin converting enzyme [ACE] inhibitors)
- Vocal cord dysfunction

Additional Considerations

- Recurrent cough and wheezing are almost always due to asthma in both children and adults
- Infancy wheezing - Two types:
 - ❖ Nonallergic – present with acute upper respiratory viral infection; disappears, as airway grows larger
 - ❖ Allergic – wheezing also present with viral infections; more likely to have asthma continue throughout childhood
- Vocal cord dysfunction mimics asthma
 - Symptoms: recurrent severe shortness of breath and wheezing
 - More common in young adults with psychological disorders
 - May cause alveolar hypoventilation with increased PCO₂ requiring urgent intubation and mechanical ventilation
 - Suspect when physical examination reveals monophonic wheeze heard loudest over glottis
 - Inspiratory flow limitation via Flow-volume curve evaluation strongly supports vocal cord dysfunction diagnosis
 - Definitive diagnosis includes exclusion vocal cord limitation from organic causes *and* direct visualization of vocal cords
 - Treatment with speech therapy teaching techniques for relaxed throat breathing is often effective

Pulmonary Function Testing

Spirometry to demonstrate reversibility, if considering the diagnosis of asthma

- Measurements (FEV₁, FVC, FEV₁/FVC) should be taken before and after the patient inhales a short-acting bronchodilator
(Determines if there is airflow obstruction and whether it is reversible over the short term)
- Valuable in children over age four
(Note: some children cannot conduct the maneuver properly until after age 7)
- Measures maximal volume of air forcibly exhaled from the point of maximal inhalation (forced vital capacity, FVC) and the volume of air exhaled during the first second of the FVC (forced expiratory volume in 1 second, FEV₁)
- Air-flow obstruction is indicated by reduced FEV₁ and FEV₁/FVC values relative to reference or predicted values
- Significant reversibility is indicated by an increase of = 12 percent and 200mL in FEV₁ after inhaling a short-acting bronchodilator
(A two to three week oral corticosteroid therapy trial may be required to demonstrate reversibility)
- Abnormalities of lung function are categorized as restrictive and obstructive defects
 - Severity of abnormal spirometric measurements is evaluated by comparison of the patient's results with reference values based on height, sex, age, and race.
 - Reduced ratio of FEV₁/FVC (< 65 %) indicates obstruction to the flow of air from the lungs
 - Reduced FVC with a normal FEV₁/FVC ratio suggests a restrictive pattern
 - Asthma is typically associated with an obstructive impairment that is reversible
 - Recommended over measurements by peak flow meter in the clinician's office
(Peak flow meters are designed for monitoring, not as diagnostic tool)

Peak Flow Meters

- Peak flow monitoring can be used for short-term or daily for long-term monitoring
- Patient's measured personal best is the most appropriate reference value
- Use with moderate-to-severe persistent asthma
 - Educate patient on PFM five step use
 - 1) Move indicator to the bottom of the number scale
 - 2) Stand up
 - 3) Take a deep breath, filling lungs completely
 - 4) Place the mouth piece in your mouth and close your lips around it
Do not put your tongue inside the hole
 - 5) Blow out as hard and fast as you can in a single blow
 - Record number, repeat if cough or make a mistake (do not record number with cough/mistake)
 Repeat steps 1 through 5 two more times and record the best of the three blows in your asthma diary
 - Personal best
Is the highest peak flow number you can achieve over 2-3 week period when asthma is under good control
To find personal best values:
 - Take peak flow readings twice a day for 2-3 weeks
 - Upon awakening and between noon and 2:00 p.m.
 - Before and after taking short-acting inhaled beta2-agonist for quick relief, if you take this medication
 - Or as instructed by your physician
 - Understand peak flow zone system
 - Physician instructs patient once personal best values are established
 - Peak flow numbers are placed in 'zones'
Green Zone (more than ___L/min [80% of your personal best number]) signals *good* control
Yellow Zone (more than ___L/min and ___L/min [50 to < 80% of personal best]) signals *caution*
Red Zone (below ___L/min [50 percent of your personal best number]) signals a *medical alert*
 - Maintain diary
 - Measure peak flow upon awakening, *before* taking medication
 - Record peak flow number in diary every day, or as instructed by physician
 - Action to take when peak flow numbers change
 - PEF goes between ___L/min and ___L/min (50 to less than 80% of personal best, yellow zone)
ACTION: Take a short-acting inhaled beta2-agonist (quick relief medicine) as prescribed by your physician
 - PEF increases 20 percent or more when measured before and after taking a short-acting inhaled beta2-agonist (quick relief medicine)
ACTION: Talk to your doctor about adding more medicine to control your asthma better
(Example: an anti-inflammatory medication)
- Monitor PFM during exacerbation of asthma for moderate to severe persistent asthma
 - Determines severity
 - Guides therapeutic decisions

Additional Studies for Consideration:

- Lung volumes and inspiratory and expiratory flow volume loops
 - If suspect coexisting chronic obstructive pulmonary disease
(Restrictive defect or possible central airway obstruction potential)
- Diffusing capacity test
 - Differentiates between asthma and emphysema in patients at risk for both illnesses (Smokers and older patients)
- Assessment of diurnal variation in peak expiratory flow over 1 to 2 weeks
 - If asthma symptoms present *and* normal spirometry
 - PEF is lowest on first awakening and highest several hours before the midpoint of the waking day
(Optimal times to assess are between noon and 2 p.m.)

- Bronchoprovocations with methacholine, histamine, or exercise challenge
 - If asthma suspected *and* spirometry is normal or near normal
 - For safety reasons, testing should be by trained individual in a appropriate facility
 - Not recommended if FEV1 is < 65%
- Chest x-ray
 - To exclude other diagnosis
- Allergy testing
 - Skin testing recommended for patients with persistent asthma exposed to perennial indoor allergens
- Evaluation of the nose for nasal polyps and sinuses for sinus disease
- Evaluation for gastroesophageal reflux

Consider Consultation Referral or Care to an Asthma Care Specialist

- If patient has had a life-threatening asthma exacerbation
- Patient not meeting goals of asthma therapy after 3 to 6 months of treatment (Earlier referral if physician concludes patient is unresponsive to therapy)
- Signs and symptoms are atypical or there are problems in differential diagnosis
- Other conditions complicating asthma or its diagnosis
 - Sinusitis
 - Nasal polyps
 - Aspergillosis
 - Severe rhinitis
 - Vocal cord dysfunction
 - Gastroesophageal reflux
 - Chronic obstructive pulmonary disease
 - Additional testing is required (allergy skin testing, rhinoscopy, complete pulmonary function studies, provocative challenge, bronchoscopy)
 - Requires additional education and guidance on complications of therapy, problems with adherence, or allergen avoidance
 - Severe persistent asthma
 - Requires continuous oral corticosteroid therapy or high-dose inhaled corticosteroids or has required more than two bursts of oral corticosteroids in one year
 - Under age 3 and requires step 3 or 4 care of ‘Stepwise Approach’
 - Requires confirmation of a history that suggests that an occupational or environmental inhalant or ingested substance is provoking or contributing to asthma.
 - Significant psychiatric, psychosocial or family problems that interfere with asthma therapy

Goals of Therapy

- Prevent chronic and troublesome symptoms
 - Coughing or breathlessness at night, in the early morning or after exertion
- Maintain (near) “normal” pulmonary function
- Maintain normal activity levels
 - Including exercise and other activities
- Prevent recurrent exacerbations of asthma and minimize the need for emergency department visits or hospitalizations
- Provide optimal pharmacotherapy with minimal or no adverse effects
- Meet families’ and patients’ expectations of and satisfaction with asthma care

Clinician Assessment & Ongoing Monitoring Recommended to Determine Asthma Goal Therapy being met

Note: Clinician and patient self-assessment primary methods for monitoring asthma

- Use of Step-Wise approach tables (see attached)
- Signs and Symptoms of asthma
- Pulmonary function
 - Spirometry
 - Peak flow monitoring
- Quality of life/functional status
- History of Asthma exacerbations
- Pharmacotherapy

- Patient compliance
 - Inhaler technique
 - PRN inhaler usage of beta2-agonist
 - Frequency of oral corticosteroid therapy
 - Dose changes in inhaled anti-inflammatory or other long-term-control medications
 - Side Effects of medications
 - Appropriate step of pharmacotherapy Stepwise approach
 - Annual influenza vaccinations recommended for patients with persistent asthma
- Spirometry tests
 - 1) At time of initial assessment
 - 2) After treatment is initiated, symptoms and PEF have stabilized
 - 3) At least every 1-2 years
 - Written action plans based on signs and symptoms or PEF
 - Periodically review and revise
 (Important for patients with moderate-to-severe persistent asthma or history of severe exacerbations)
 - Train patients to recognize symptom patterns indicating inadequate asthma control and need for additional therapy
 - Recommendation on how and when to do peak flow monitoring
 - Discuss inconsistencies in measurements between peak flow meters
 - Emphasize use of individual's personal best PEF
 - Encourage more frequent peak flow monitoring if morning reading < 80%
 - Regular follow-up visits (at 1-to-6 month intervals)
 - To maintain control and consider appropriate step down in therapy
 - Patient-provider communication and patient satisfaction

Controlling Factors Contributing to Asthma Severity

- Identify allergen sensitivity exposure
- Use patient history to assess seasonal allergens
- Use skin testing or in vitro testing to assess sensitivity to perennial indoor allergens
 - Recommended for patient's with persistent asthma exposed to perennial indoor allergens
- Correlate significance of positive tests to patient's medical history

At any level of asthma patients should:

Avoid

- Exposure to allergens
- Environmental tobacco smoke
- Exertion when levels of air pollution are high
- Use of beta-blockers
- Sulfite-containing and other foods

And

- Receive treatment for rhinitis, sinusitis, and gastroesophageal reflux if present
- Receive annual influenza vaccination with persistent asthma

Pharmacologic Therapy

Stepwise approach to pharmacological therapy recommended (see NAEPP attached Stepwise tables)

- Amount and frequency of medication is dictated by asthma severity and directed toward suppression of increasing airway inflammation
- Initiate therapy at a higher level at the onset to establish prompt control and then step down
- Continual monitoring is essential to ensure that asthma control is achieved
- Step down therapy done cautiously once control is achieved and sustained
- Step down therapy is necessary to identify the minimum medication necessary to maintain control
- Regular follow-up visits (1 to 6 month intervals) to ensure control is maintained and step down therapy considered

Long-term Control Medications

- Corticosteroids
 - Most potent and effective anti-inflammatory medication
 - Inhaled form used in long-term control
 - Systemic form used to gain prompt control when initiating long-term therapy
- Cromolyn sodium and nedocromil
 - Mild- to- moderate anti-inflammatory medication
 - May be used as initial choice for long term control for children
 - Can be used as preventive treatment prior to exercise or unavoidable exposure to known allergies
- Long-acting beta2-agonists
 - Long-acting bronchodilator used concomitantly with anti-inflammatory medications for long-term control of symptoms (especially nocturnal)
 - Prevents exercise induced bronchospasm
- Methylxanthines
 - Mild- to- moderate bronchodilator
 - Sustained-release theophylline
 - Used primarily as adjuvant to inhaled corticosteroids for prevention of nocturnal asthma symptoms
- Leukotriene modifiers
 - May be considered alternative therapy to low doses of inhaled corticosteroids or cromolyn or nedocromil for patients = age 12 with mild- to- persistent asthma

Quick-Relief Medications

- Short-acting beta2-agonists
 - Therapy of choice for acute symptom relief and prevention of exercise induced bronchospasm
- Anticholinergics
 - May provide additive benefit to inhaled beta2-agonists in severe exacerbations
 - May be alternative bronchodilator for patients who do not tolerate inhaled beta2-agonists
- Systemic corticosteroids
 - Moderate-to-severe exacerbations to speed recovery and prevent recurrence of exacerbations

Managing Asthma Exacerbations

Best strategy – early treatment

- Written action plan to guide patient self-management
- Teach recognition of signs and symptoms
 - To include FEV1 or PEF indicators
- Appropriate adjustment of therapy
- Prompt communication between patient and physician
 - worsening symptoms
 - decreased peak flow or decreased responsiveness
 - decreased duration of effect
- Appropriate intensification of therapy
 - May include short course of systemic corticosteroids
- Removal from irritants or environment that may be contributing to the exacerbation
- High Risk patients for asthma-related death require intensive counseling
 - Education
 - Monitoring and care
 - Advise to seek medical care early during exacerbation

Managing exacerbations

- Include inhaled beta2-agonist for prompt airflow obstruction relief
- Systemic corticosteroids to suppress and reverse airway inflammation
 - Patients who fail response to beta2-agonist
 - Patient with moderate to severe exacerbations
- Oxygen to relieve hypoxemia
 - Patients with moderate to severe exacerbations
- Monitoring response to therapy
 - Serial lung function measurements

Treatment Goal

- Correction of significant hypoxemia
 - Supplemental oxygen
 - Rarely, mechanical ventilation
- Rapid airflow obstruction reversal
 - Administration of beta2-agonists, repetitive or continuous
- Administration of systemic corticosteroids
 - Patients who fail response to beta2-agonist
 - Patient with moderate to severe exacerbations
- Reduce recurrence potential
 - Intensify therapy

Infant Consideration

Assessment dependent upon physical exam not objective measurements

Key signs of physical distress

- Use of accessory muscles
- Paradoxical breathing
- Cyanosis
- Respiratory rate > 60

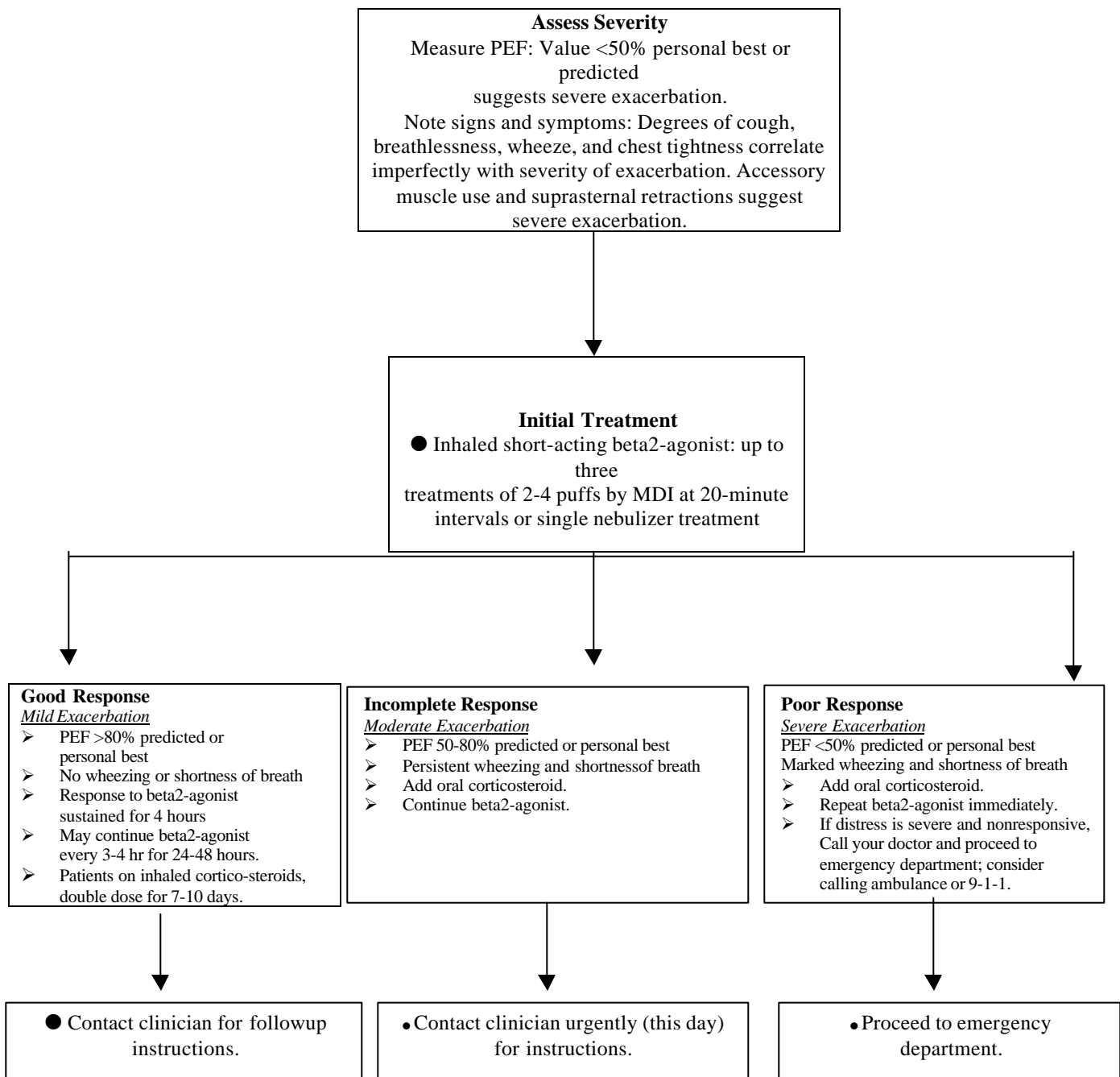
Objective measurement

- Oxygen saturation < 91% indicates serious distress

Other/infant:

- Response to beta2-agonist can be variable; not reliable indicator of good outcome
- Lack of response noted by physical exam or objective measures should be indication for hospitalization
(Rationale: infants are at greater risk for respiratory failure)
- Early use of oral corticosteroids essential along with careful physician assessment
- Wheezing episodes result from viral infections (may be accompanied by fever); antibiotics generally not required

Home Management Asthma exacerbation



Note: Patients at high risk of asthma related death should seek emergency care immediately

Source: National Institutes of Health, National Heart Lung, and Blood Institute, National Asthma Education and Prevention Program Clinical Practice Guidelines. NAEPP Expert Panel Report Guidelines for the Diagnosis and Management of Asthma—Update on Selected Topics 2004 Internet: www.nhlbi.nih.gov and <http://www.nhlbi.nih.gov/guidelines/asthma/excsum.pdf> (No change on annual review, 2007)