Asthma 101

Introduction

- Updated clinical guidelines for asthma are developed and disseminated on a regular basis by
  - "The National Asthma Education and Prevention (NAEPP): Expert Panel Report 3, Guidelines for the Diagnosis and Management of Asthma—Full Report," and
  - the Global Initiative for Asthma (GINA).

Evidence Based Medicine

Evidence category	Sources of evidence
A	▪ Well-designed RCTs or meta-analyses ▪ Consistent pattern of findings in the population for which the recommendation is made ▪ Substantial numbers of large studies
B	▪ Limited number of patients, *post hoc* or sub-group analyses of RCTs or meta-analyses ▪ Few RCTs, or small in size, or differing population, or results somewhat inconsistent
C	▪ Uncontrolled or non-randomized studies ▪ Observational studies
D	▪ Panel consensus based on clinical experience or knowledge

National Asthma Education and Prevention Program (NAEPP)

- The first evidence-based asthma guidelines were published in 1991 by:
  - National Asthma Education and Prevention Program (NAEPP)—under the coordination of the:
    - National Heart, Lung, and Blood Institute (NHLBI) of the National Institutes of Health.

NAEPP (Cont.)

- Today, the NAEPP guidelines are structured around the following four components:
  1. Assessment and monitoring of asthma
  2. Patient education
  3. Control of factors contributing to the asthma severity
  4. The pharmacologic treatments

Global Initiative for Asthma (GINA)

- The Global Initiative for Asthma (GINA) was launched in 1993 in collaboration with the following organizations:
  - National Heart, Lung, and Blood Institute (NHLBI) of the National Institutes of Health, and the
  - World Health Organization (WHO)

GINA (Cont.)

- GINA's specific goals are the following:
  - Increase awareness of asthma and its public health consequences
  - Promote identification of reasons for the increased prevalence of asthma
  - Promote study of the association between asthma and the environment

GINA (Cont.)

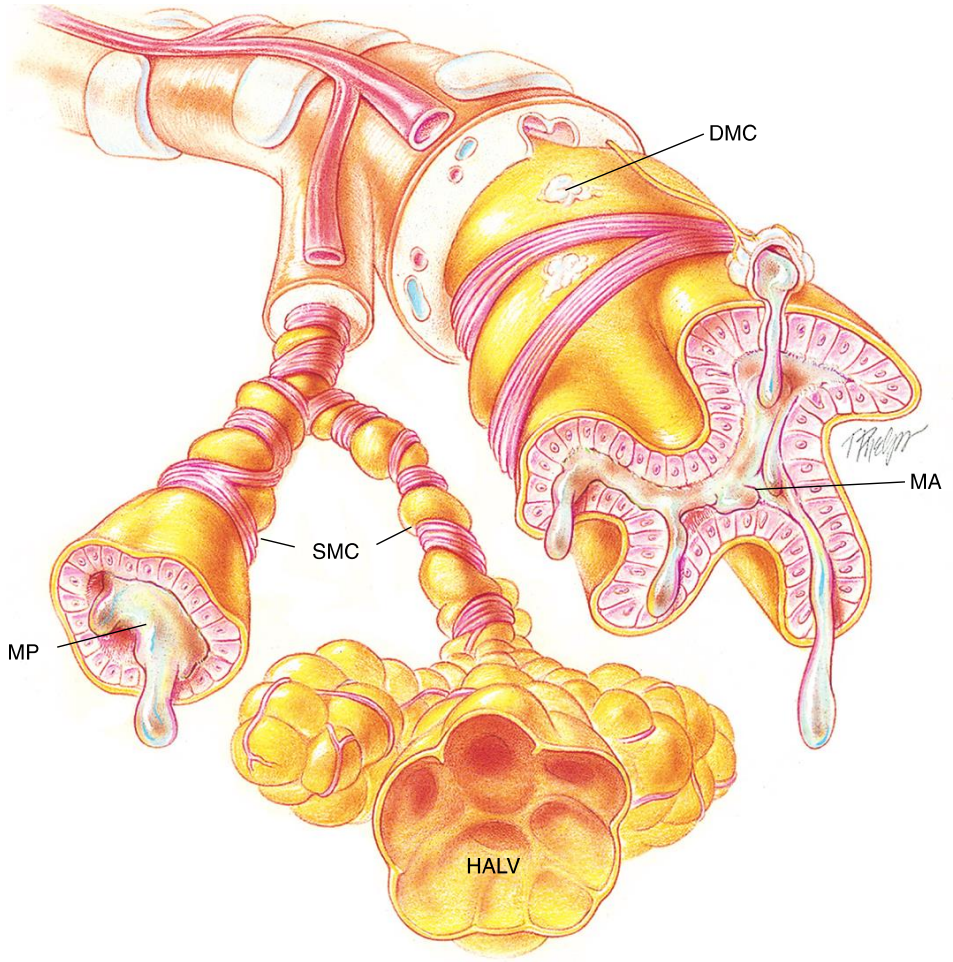
- Reduce asthma morbidity and mortality
- Improve management of asthma
- Improve availability and accessibility of effective asthma therapy

Introduction (Cont.)

Collectively, by using the evidence-based guidelines provided by NAEPP, along with resources gathered worldwide from asthma experts and researchers, GINA now provides a user friendly, evidence-based program for the management of asthma.

Anatomic Alterations of the Lungs

- Smooth muscle constriction of bronchial airways (bronchospasm)
- Excessive production of thick, whitish bronchial secretions
- Mucous plugging
- Hyperinflation of alveoli (air trapping)
- In severe cases, atelectasis caused by mucous plugging
- Bronchial wall inflammation leading to fibrosis (in severe cases, caused by remodeling)



Asthma.

Etiology and Epidemiology

- According to the CDC/NCHS, the prevalence of asthma in the United States has increased from 7.3% in 2001 to 8.4% in 2010.
- Approximately 1 in 11 children have asthma; and 1 in 12 adults have asthma.
- It is estimated that 25.7 million people suffer from asthma.

Etiology and Epidemiology (Cont.)

- The World Health Organization (WHO) estimates that about 235 million people worldwide suffer from asthma.

Risk Factors

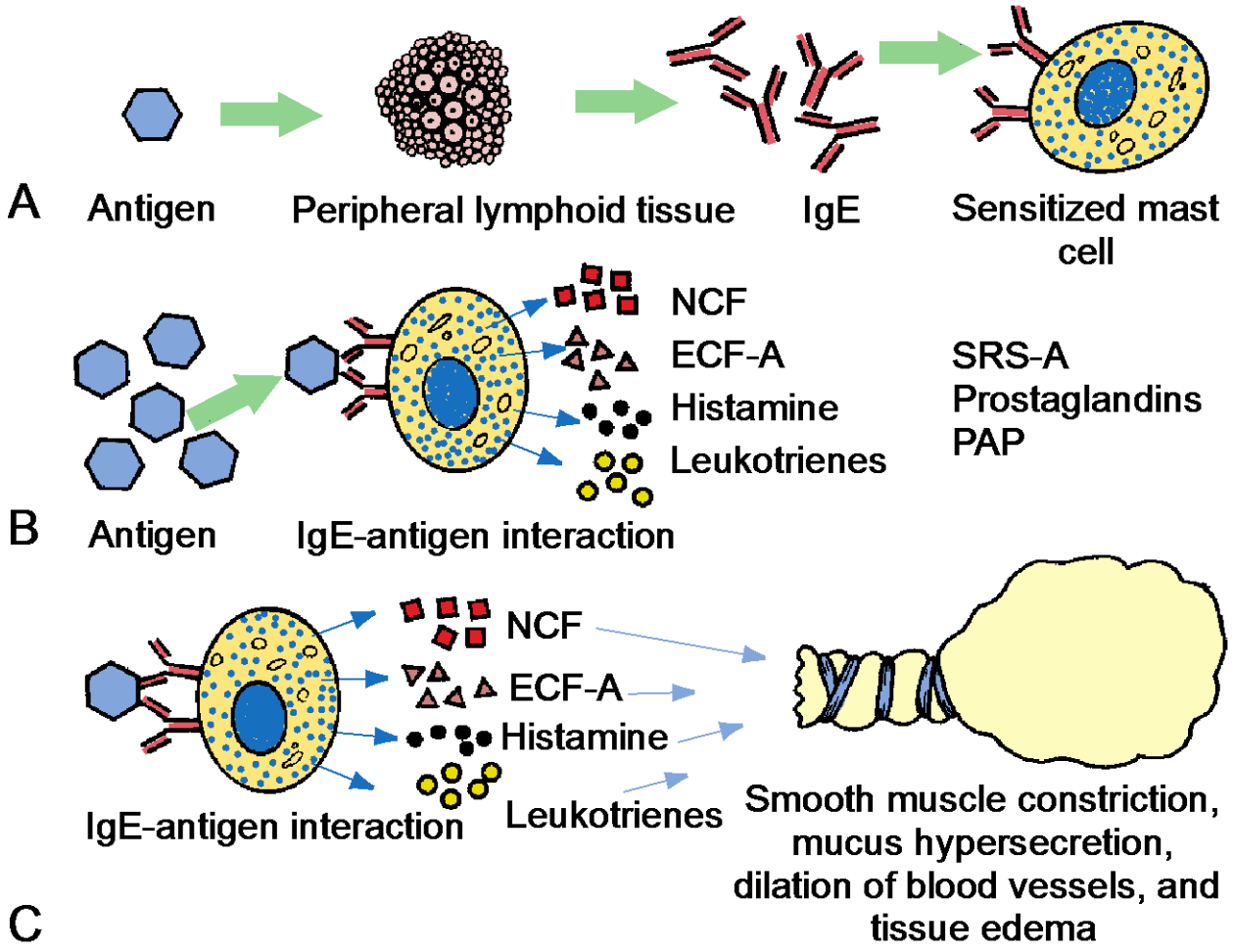
- Host factors
- Environmental factors

Risk Factors (Cont.)

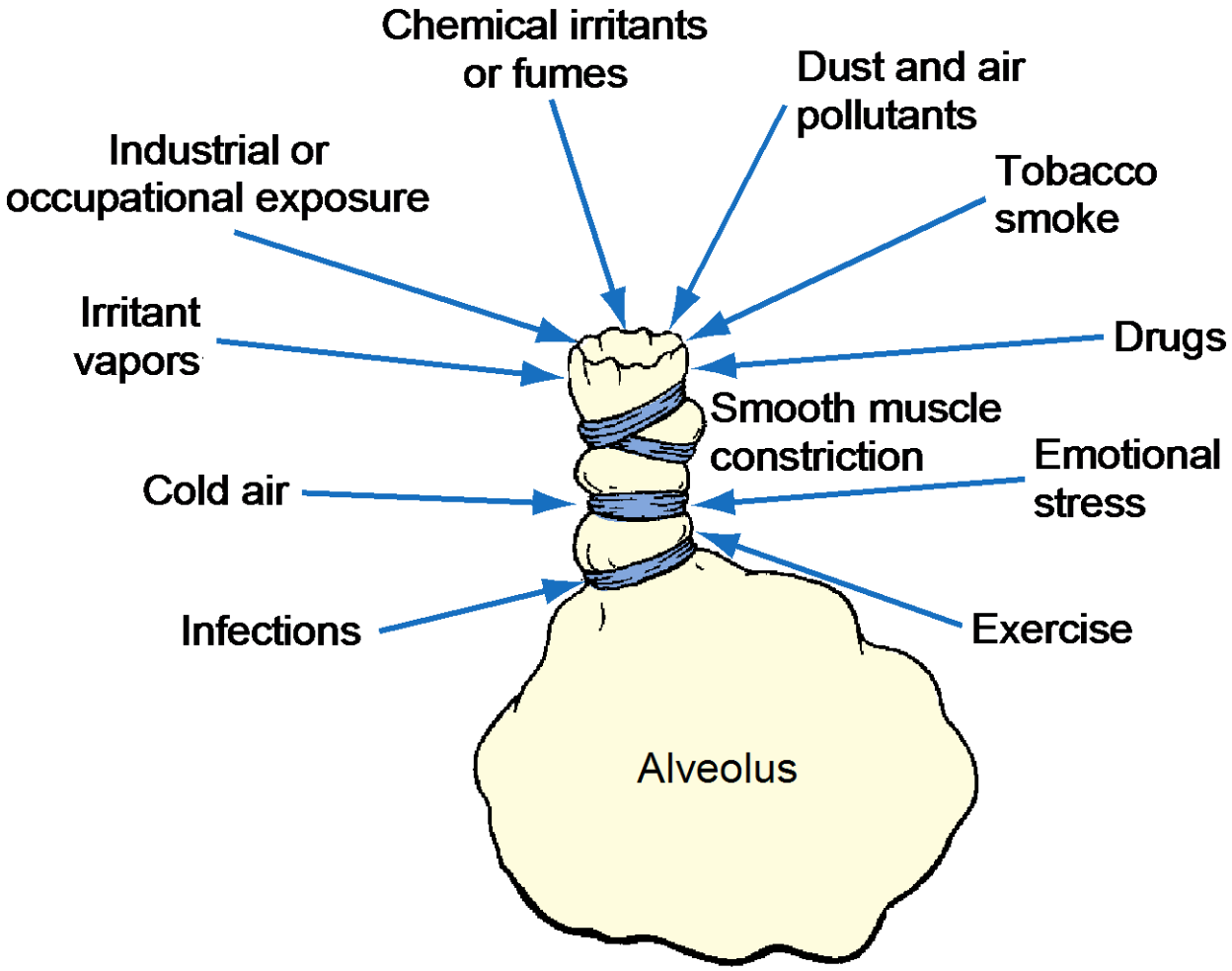
- Host Factors
  - Genetics
  - Obesity
  - Sex

Risk Factors (Cont.)

- Environmental factors
  - Allergens—outdoors and indoor air pollution
  - Infections
  - Occupational sensitizers
  - Tobacco smoke
  - Diet



The immunologic mechanisms in extrinsic asthma.



Some factors known to trigger intrinsic asthma.

Risk Factors (Cont.)

- Other Risk Factors
  - Drugs
  - Food additives and preservatives
  - Exercise-induced bronchoconstriction
  - Gastroesophageal reflux
  - Sleep (nocturnal asthma)
  - Emotional stress
  - Perimenstrual asthma (catamenial asthma)
  - Allergic bronchopulmonary aspergillosis

Diagnosis of Asthma

- The presence of any of these signs and symptoms should increase the suspicion of asthma:
- Wheezing—history of any of the following:
  - Cough
  - Recurrent wheeze
  - Recurrent difficult breathing
  - Recurrent chest tightness

Diagnosis of Asthma (Cont.)

- Symptoms occur or worsen at night, awakening the patient.
- Symptoms occur or worsen in a seasonal pattern.
- The patient also has eczema, hay fever, or a family history of asthma or atopic diseases.

Diagnosis of Asthma (Cont.)

- Symptoms occur or worsen in the presence of:
  - Animals with fur
  - Aerosol chemicals
  - Changes in temperature
  - Domestic dust mites
  - Drugs (aspirin, beta blockers)
  - Exercise

Diagnosis of Asthma (Cont.)

- Pollens
- Respiratory (viral) infections
- Smoke
- Strong emotional expression

Diagnostic and Monitoring Tests for Asthma

- FEV_1
- FEV_1/FVC ratio
- PEFR

Diagnostic and Monitoring Tests for Asthma (Cont.)

- FEV_1
  - An increase in FEV_1 of ≥ 12% (or ≥ 200 mL) after administration of a bronchodilator suggests reversible airflow limitation consistent with asthma.

Diagnostic and Monitoring Tests for Asthma (Cont.)

- FEV_1 /FVC ratio
  - Because many lung disorders can cause a reduction in the FEV_1, a better measure of airflow limitation is the ratio of FEV_1 to the FVC.
  - Normally, the FEV_1 /FVC ratio is greater than 0.75 to 0.80. Any value less than these values indicate airflow limitation, and asthma should be suspected.

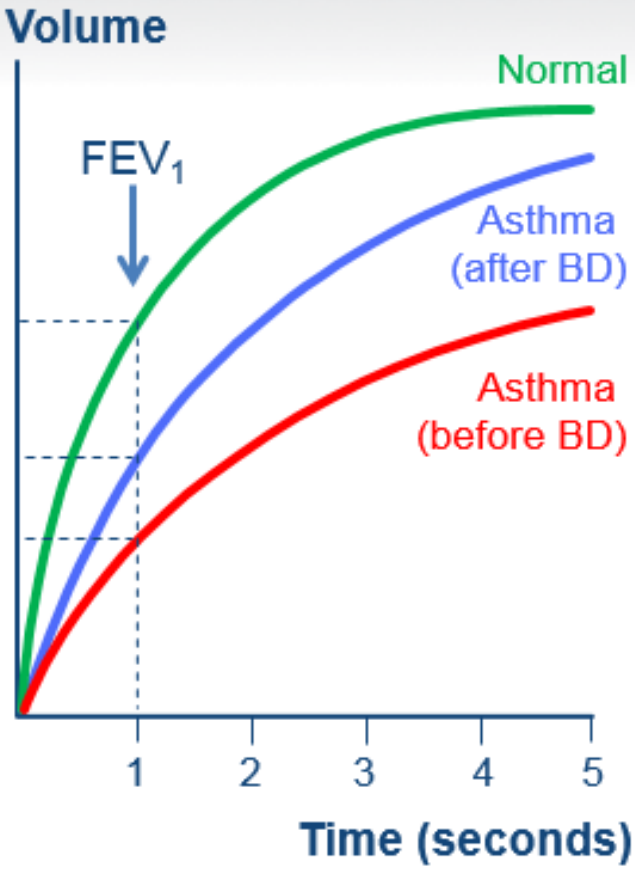
Diagnostic and Monitoring Tests for Asthma (Cont.)

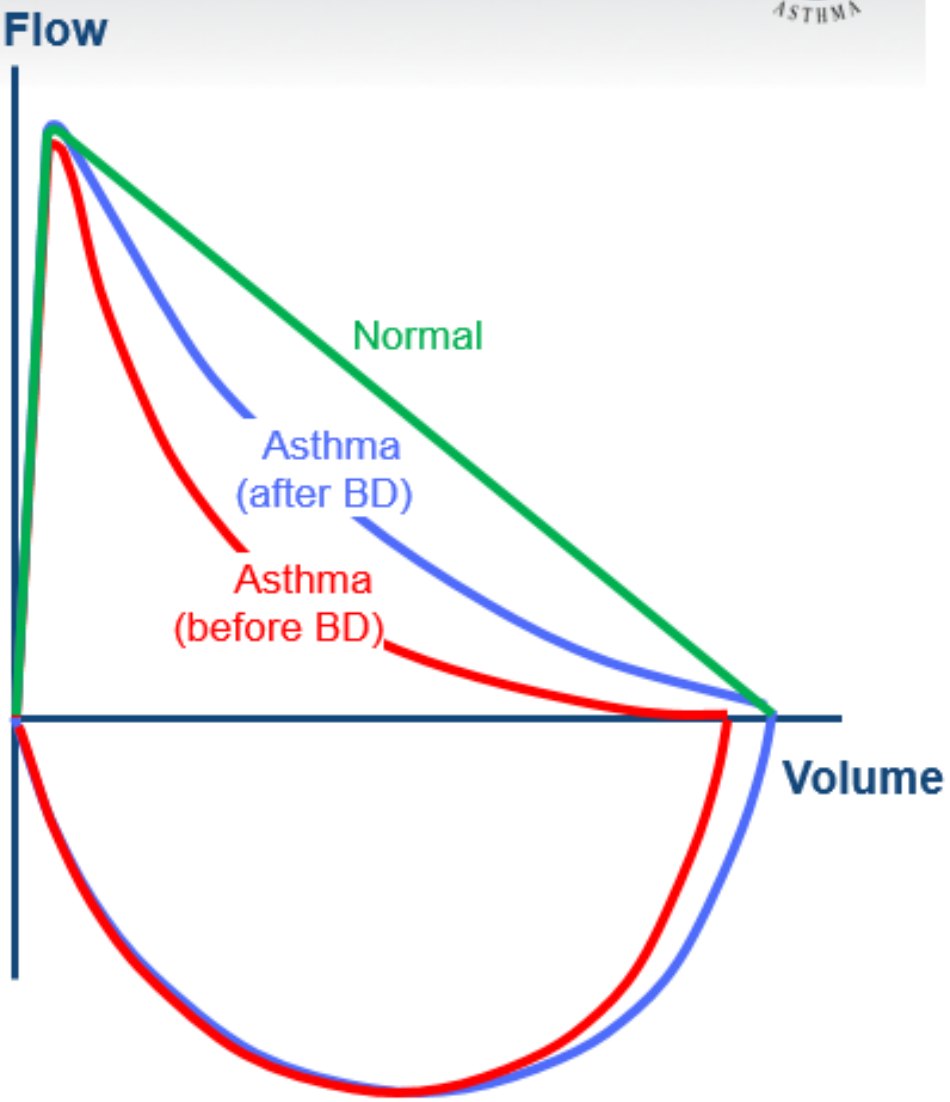
- PEFR
  - An improvement of 60 L/min (or ≥ 20% of the pre-bronchodilator [PEFR] after inhalation of a bronchodilator), or diurnal variation in PEFR of more than 20% (with twice-daily readings, more than 10%), suggests a diagnosis of asthma.

Other Diagnostic Tests for Asthma

- Inhaled methacholine or histamine
- Inhaled mannitol
- Exercise or cold air challenge
- Positive skin test allergens increases the probability of a diagnosis of asthma

Typical spirometric tracings





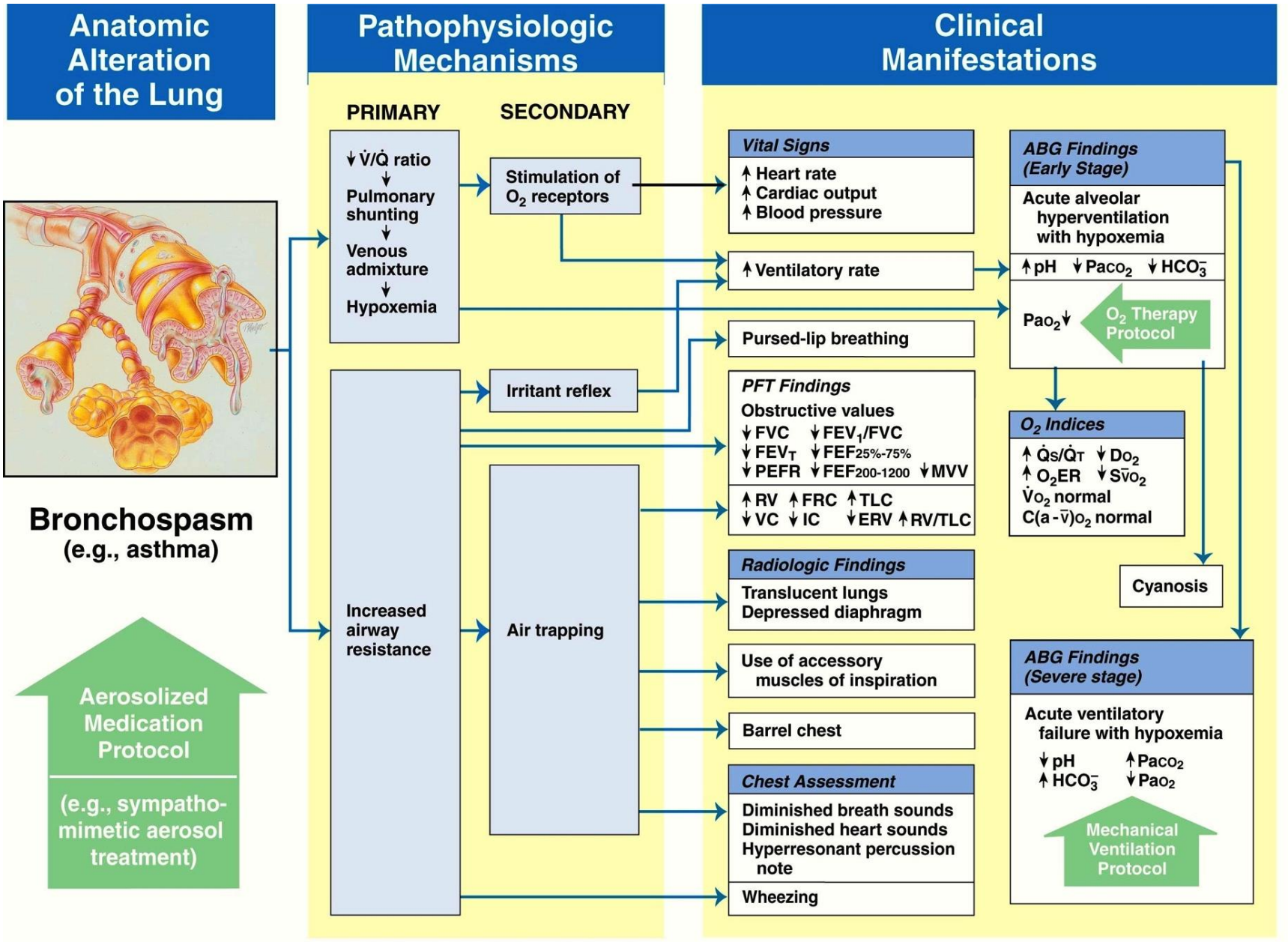
Note: Each FEV_1 represents the highest of three reproducible measurements

Challenges in the Differential Diagnosis of Asthma

- Children 5 years and younger
- Older children and adults
- The elderly
- Cough-variant asthma
- Exercise-induced bronchoconstriction
- Occupational asthma
- Sick building syndrome
- Distinguishing asthma from COPD

Overview of the Cardiopulmonary Clinical Manifestations Associated with Asthma

- The following clinical manifestations result from the pathophysiologic mechanisms caused (or activated) by
  - Bronchospasm
  - Excessive bronchial secretions



Bronchospasm clinical scenario.

Clinical Data Obtained at the Patient's Bedside

The Physical Examination

- Vital Signs
  - Increased
    - Respiratory rate (tachypnea)
    - Heart rate (pulse)
    - Blood pressure

The Physical Examination (Cont.)

- Use of accessory muscles of inspiration
- Use of accessory muscles of expiration
- Pursed-lip breathing
- Substernal intercostal retractions

The Physical Examination (Cont.)

- Increased anteroposterior chest diameter
  - Barrel chest
- Cyanosis
- Cough and sputum production

The Physical Examination (Cont.)

- Pulsus paradoxus
  - Decreased blood pressure during inspiration
  - Increased blood pressure during expiration

The Physical Examination (Cont.)

- Chest Assessment Findings
  - Expiratory prolongation (I:E ratio > 1:3)
  - Decreased tactile and vocal fremitus
  - Hyperresonant percussion not
  - Diminished breath sounds
  - Diminished heart sounds
  - Wheezing
  - Crackles

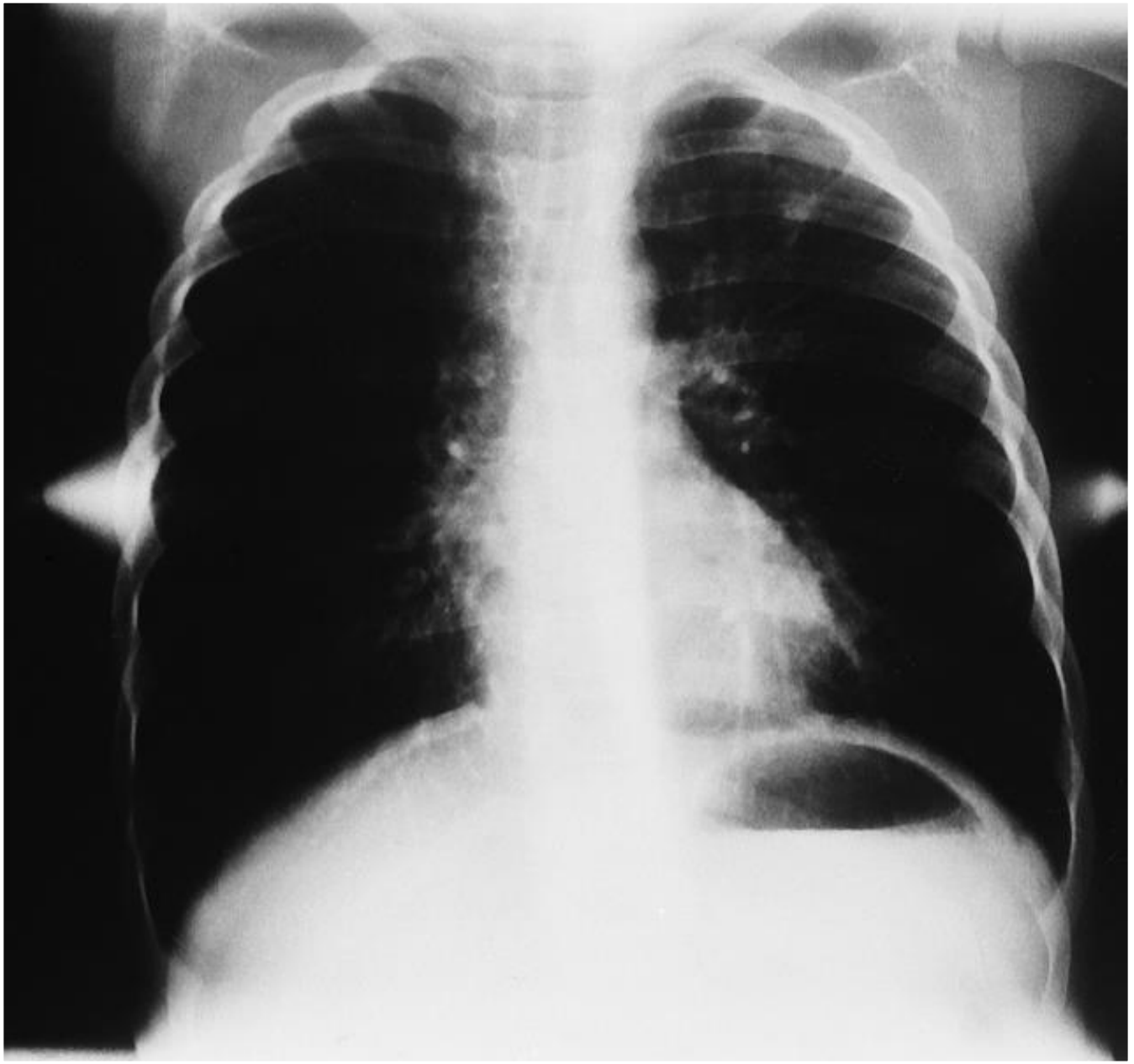
Abnormal Laboratory Tests and Procedures

Sputum examination

- Eosinophilia
- Charcot-Leyden crystals - are microscopic crystals found in people who have allergic diseases such as asthma
- Casts of mucus from small airways (Kirschman spirals)
- IgE level (elevated in extrinsic asthma)

Radiologic Findings

- Chest radiograph
  - Increased anteroposterior diameter (barrel chest)
  - Translucent (dark) lung fields
  - Depressed or flattened diaphragms



Chest x-ray of a 2-year-old patient during an acute asthma attack**.**

General Management of Asthma

- The primary goals of asthma management are to:
  - Attain and maintain “control” of the clinical manifestations associated with asthma
  - Maintain normal activity levels, including exercise
  - Maintain pulmonary function as close to normal as possible
  - Prevent asthma exacerbations
  - Avoid adverse effects from asthma medications
  - Prevent asthma mortality

General Management of Asthma (Cont.)

- Components of Asthma Management
  - Component 1: Develop Patient/Doctor Partnership
  - Component 2: Identify and Reduce Exposure to Risk Factors
  - Component 3: Assess, Treat, and Monitor Asthma
  - Component 4: Manage Asthma Exacerbations
  - Component 5: Special Considerations

General Management of Asthma (Cont.)

- Component 1: Develop Patient/Doctor Partnership
  - The effective management of asthma requires the development of a partnership between the professional(s)—and the patient or parents/caregivers, in case of young children with asthma.
  - The aim of this partnership is guided self-management—i.e., to give individuals with asthma the ability to control their own condition with guidance from health care professionals.

General Management of Asthma (Cont.)

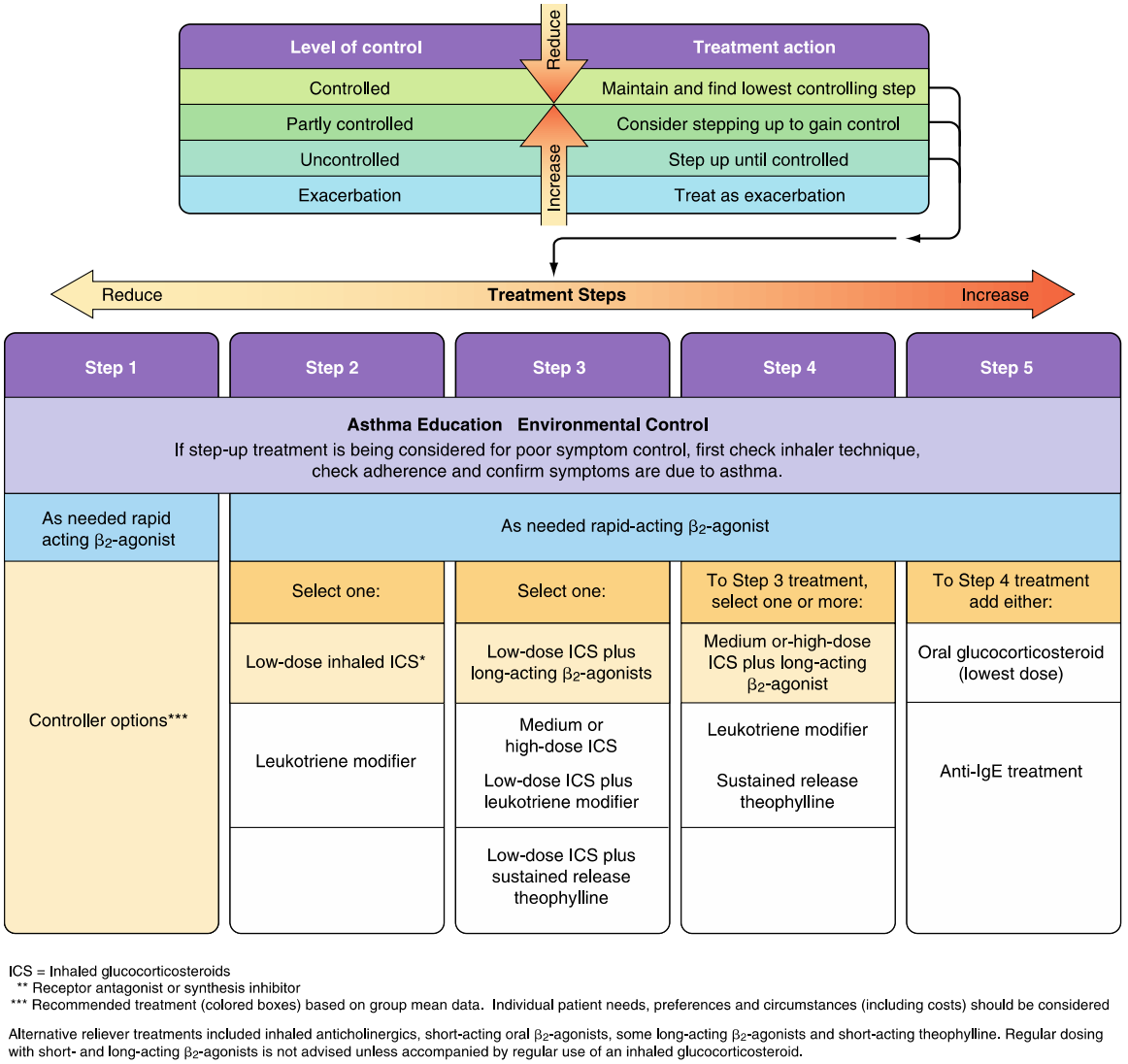
- Component 2: Identify and Reduce Exposure to Risk Factors
  - To improve the control of asthma and reduce medication needs, the patient should take the necessary steps to avoid or reduce exposure to the risk factors (commonly called “triggers”) that cause asthma.

General Management of Asthma (Cont.)

- Component 3: Assess, Treat, and Monitor Asthma
  - Achieve and maintain clinical control—can be reached by most patients by means of a continuous cycle that involves
    1. assessing asthma control,
    2. treating to achieve control, and
    3. monitoring and maintaining control.

Component 3: Assess, Treat, and Monitor Asthma (Cont.)

- Treating to achieve control
  - The Notion of “Step Therapy”



Management Approach Based on Control for Children Older than 5 years, Adolescents and Adults..

Asthma Action Plan

Prepared for: _____ Date: _____ Doctor's name: _____ Doctor's phone number: _____

1

Good control

Child has ALL of these:
- Breathing is good
- No cough or wheeze
- Can work/play
- Sleeps at night

DAILY MEDICINES - USE EVERY DAY

Controller medication considered
Use to be determined at follow-up appointment

20 minutes before sports, use this medicine:
Albuterol MDI (Proventil/ProAir/Ventolin) 90 mcg 2 puffs (inhalations) with spacer

2

Be careful

Child has ANY of these:
- Cough
- Wheeze
- Tight chest
- Wakes up at night

TAKE DAILY MEDICINES AND ADD THESE MEDICINES:

1. Albuterol Sulfate (Proventil/ProAir/Ventolin) 90 mcg MDI 4 puffs with spacer every 4 hours times 24 hours.
2. If getting worse after treatment, **go to the red zone.**
3. If getting better, continue 4 puffs with spacer every 6 hours as needed.
4. Call doctor if not better in 1-2 days or rescue medicine is used for more than two times a week.

3

Danger, call doctor now!

Child has ANY of these:
- Medicine not helping
- Breathing hard and fast
- Nose opens wide
- Can't walk or talk well
- Ribs show

TAKE THESE MEDICINES

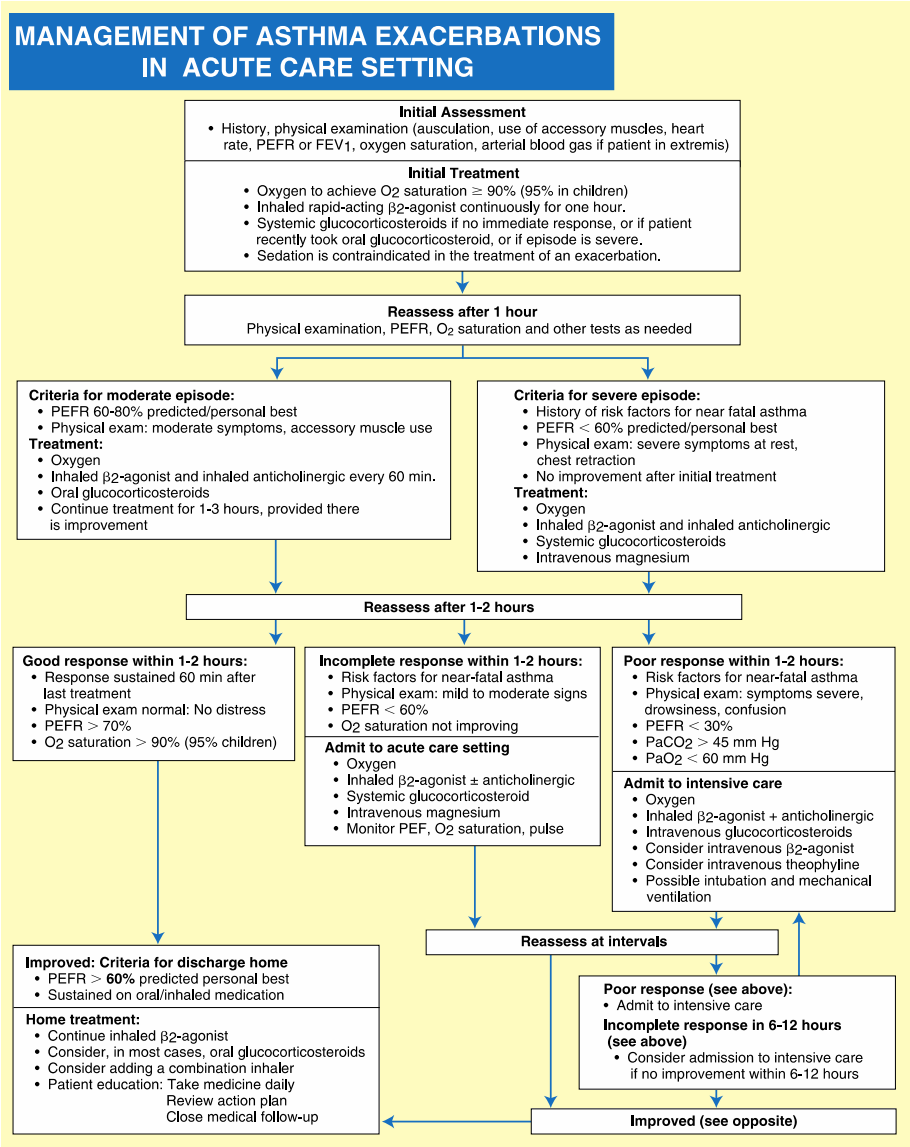
1. Albuterol Sulfate (Proventil/ProAir/Ventolin) 90 mcg MDI 6 puffs with spacer now.
2. Repeat every 20 minutes two more times.
3. If not getting better or getting worse, go to the hospital or **call 911 now** and continue albuterol every 20- 30 minutes.
4. If getting better, call the doctor to make an appointment and continue the albuterol every 4 hours.
5. Start prednisone/prednisolone now as instructed by your doctor if you have a prescription on hand.

CALL 911 Lips are bluish • Getting worse fast • Struggling to breathe
Can't talk or cry because of hard breathing • Has passed out

Asthma Action Plan.

General Management of Asthma (Cont.)

- Component 4: Manage Asthma Exacerbations
  - The primary therapies for asthma exacerbations include the
    - Repetitive administration of rapid-acting inhaled bronchodilators,
    - Early introduction of systemic glucocorticosteroids,
    - Oxygen therapy
    - Continuous nebulization of short-acting Beta2 agents in status asthmaticus.
  - The primary goals of the treatments are to relieve airflow obstruction and hypoxemia as quickly as possible, and to plan the prevention of future exacerbations.



Management of Asthma Exacerbation in Acute Care Setting.

General Management of Asthma (Cont.)

- Component 5: Special Considerations
  - Pregnancy
  - Obesity
  - Surgery
  - Rhinitis, sinusitis, nasal polyps
  - Occupational asthma
  - Respiratory infection
  - Gastroesophageal reflux
  - Aspirin-induced asthma
  - Anaphylaxis and asthma

Rules of Two

- Have asthma symptoms or take your quick-relief inhaler more than Two times a week?
- Awaken at night with asthma symptoms more than Two times a month?
- Refill your quick-relief inhaler more than Two times a year?
- Measure your peak flow at less than Two times 10 (20%) with asthma symptoms?

ASTHMA, COPD, AND ASTHMA-COPD OVERLAP SYNDROME (ACOS)

BOX 13-5

Distinguishing Features of Asthma, COPD, and ACOS*			
Features	**ACOS**	**Favors Asthma**	**Favors COPD**
Age of onset	Usually age >40 years, but may have had symptoms in childhood or early adult.	○ Onset before 20 years	○ Onset after 40 years
Pattern of respiratory symptoms	Respiratory symptoms including exertional dyspnea are persistent, but variability may be prominent	○ Variation in symptoms over minutes, hours or days ○ Symptoms worse during the night or early morning ○ Symptoms triggered by exercise, emotions including laughter, dust or exposure to allergens	○ Persistence of symptoms despite treatment ○ Good and bad days but always daily symptoms and exertional dyspnea ○ Chronic cough and sputum preceded onset of dyspnea, unrelated to triggers
Lung function	Airflow limitation not fully reversible, but often with current or historical variability	○ Record of variable airflow limitation (spirometry, peak expiratory flow)	○ Record of persistent airflow limitation (post-bronchodilator $FEV_1/FVC < 0.7$)

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BOX 13-5—cont'd

Distinguishing Features of Asthma, COPD, and ACOS*			
Features	**ACOS**	**Favors Asthma**	**Favors COPD**
Lung function between symptoms	Persistent airflow limitation	○ Lung function normal between symptoms ○ Previous doctor diagnosis of asthma ○ Family history of asthma, and other allergic conditions	○ Lung function abnormal between symptoms ○ Previous doctor diagnosis of COPD, chronic bronchitis or emphysema ○ Heavy exposure to a risk factor: tobacco smoke, biomass fuels
Past history or family history	Frequently a history of doctor-diagnosed asthma (current or previous), allergies and a family history of asthma, and/or a history of noxious exposures		
Time course	Symptoms are partly but significantly reduced by treatment. Progression is usual and treatment needs are high	○ No worsening of symptoms over time. Symptoms vary either seasonally or from year to year ○ May improve spontaneously or have an immediate response to BD or to ICS over weeks	○ Symptoms slowly worsening over time (progressive course over years) ○ Rapid-acting bronchodilator treatment provides only limited relief
Chest X-ray	Similar to COPD	○ Normal	○ Severe hyperinflation

Key changes in GINA 2016 – stepwise treatment

- Step 3
  - Low-dose fluticasone furoate/vilanterol an option for Step 3
- Step 4
  - Tiotropium now an add-on option for adolescents (age ≥12 years) as well as adults, with a history of exacerbations
- Step 5: refer for expert investigation and add-on treatment, such as:
  - Add-on tiotropium by mist inhaler for patients age ≥12 years with a history of exacerbations
  - Add-on omalizumab (anti-IgE) for severe allergic asthma
  - Add-on mepolizumab (anti-IL5) for severe eosinophilic asthma (≥12 years)
  - Sputum-guided treatment, if available
- Low, medium and high ICS doses
  - Fluticasone furoate: 100mcg (low dose); 200mcg (high dose)
- Stepping down ICS when asthma well-controlled now Evidence A
  - *(Hagan et al, Allergy 2014)*

Key changes in GINA 2016 - low-resource settings

- Where?
  - Low-resource settings may be found not only in low and middle income countries (LMIC), but also in affluent nations
- Diagnosis in low-resource settings
  - Up to 50% asthma undiagnosed, up to 34% over-diagnosed *(José 2014)*
  - Ask about symptoms suggestive of chronic respiratory infections e.g. TB
  - Peak flow meters recommended by WHO as essential tools for Package of Essential Non-communicable Diseases Interventions (WHO-PEN)
- Management of asthma in low-resource settings
  - GINA strategy for stepwise treatment includes options for low-resource settings
  - Prioritize the most cost-effective approach; include ICS and SABA
  - Build capacity of primary health care teams, including nurses and pharmacist
  - WHO-PEN recommends inclusion of peak flow meters as essential tools, and oximeters if resources permit

Key changes in GINA 2016 - primary prevention

- Maternal diet in pregnancy
  - No firm evidence that ingestion of any specific foods in pregnancy increases risk for asthma
  - Instead, maternal intake of foods commonly considered allergenic (peanut, milk) is associated with a decrease in allergy and asthma in offspring *(Bunyavanich et al, JACI 2014; Maslova et al, JACI 2012, 2013)*
  - Therefore, no dietary changes are recommended during pregnancy for prevention of allergies or asthma
- Maternal obesity in pregnancy
  - Maternal obesity and maternal weight gain in pregnancy are associated with an increased risk for asthma in children *(Forno et al, Pediatrics 2014)*
  - However, no recommendations can be made at present, as unguided weight loss in pregnancy should not be encouraged
- Dampness and mold
  - For children at risk of asthma, dampness, visible mold and mold odor in the home are associated with increased risk of developing asthma *(Quansah et al, PLoS ONE 2012)*

Other changes in GINA 2016

- Non-pharmacological strategies for people with asthma
  - Remediation of dampness or mold in homes reduces asthma symptoms and medication use in adults (Evidence A) *(Sauni et al, Cochrane 2015)*
- Other therapies
  - In randomized controlled trials, Vitamin D supplementation has not been associated with improvement in asthma symptom control or reduction in exacerbations
    - This statement was included in the GINA report because there had been wide expectation from cross-sectional studies that Vitamin D supplementation would be beneficial for asthma control
  - Sections on allergen immunotherapy, vaccinations and bronchial thermoplasty have been included in the main report (previously only in Appendix)
- Methodology
  - More details provided about GINA methodology, including the number of articles identified at each step

Certified Asthma Educator

- www.naecb.com