Asthma: a brief summary

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Asthma: What is it?

- Chronic inflammatory disease of the airways in which many cells play a role.
- In susceptible individuals this inflammation causes recurrent episodes of wheezing, breathlessness, chest tightness, and cough.
- Symptoms associated with widespread, but variable airflow limitation that is partially reversible either spontaneously or with treatment.

U.S. Burden of Asthma

- **Current prevalence**: 20.5 million Americans, 6.2 million children

- **Annual burden**: 497,000 hospitalizations, 1.8 million ED visits, approximately 4,000 deaths/year, 14 million lost school and work days, 16.1 billion in health care costs.

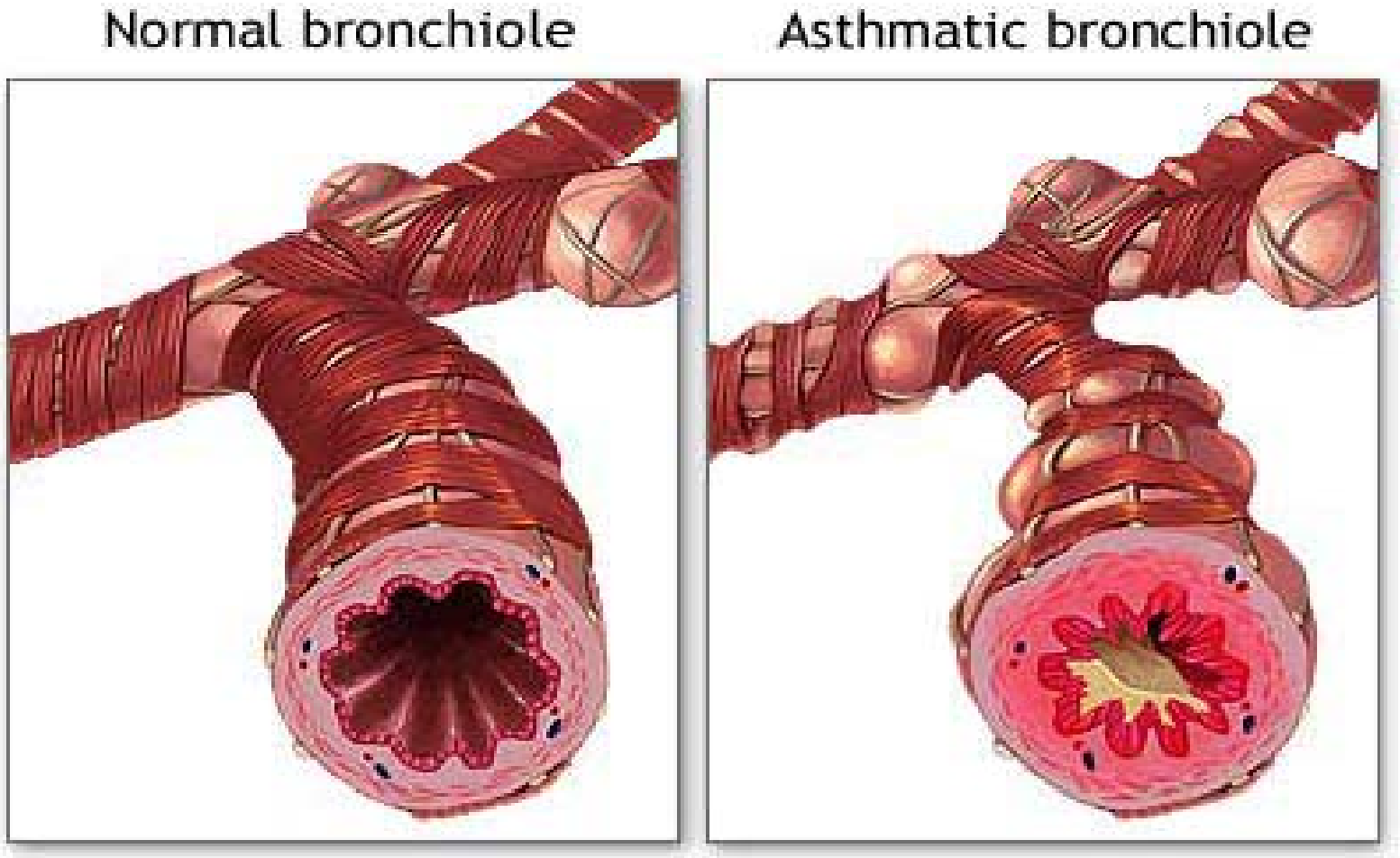
Pathology of Asthma

- Caused by a complex interaction of cells, mediators and cytokines that results in inflammation.
- Symptoms are due to airflow obstruction resulting from the cumulative effects of:
  - Smooth muscle constriction around airways
  - Airway wall edema
  - Intraluminal mucus accumulation
  - Inflammatory cell infiltration of the submucosa
  - Basement membrane thickening
  - Microvascular leak

Physiology of Asthma

- Reduction in airway luminal diameter.
- Three defining components:
  - Inflammation
  - Reversible bronchoconstriction
  - Increased airways hyperresponsiveness

Airway Pathology in Asthma



Risk Factors for Developing Asthma

- Genetics
- Sex and Race
- Environmental Factors
- Air Pollution

Genetics

- Atopy- body's predisposition to development of IgE (antibody) in response to exposure to inhaled aeroallergens.
- IgE, the class of antibody responsible for the most common form of respiratory allergy.

Sex and Race

- Clear cut gender differences
- Childhood asthma: predominantly boys
- After age 20 prevalence is equal until age 40.
- Women>Men
- African American > Caucasian

Environmental Factors

- Most important cause of asthma
- Epidemiologic studies have shown a correlation between allergen exposure and asthma prevalence and improvement with avoidance.
- Indoor Allergens: dust mites, animal allergens (cats, dogs, rodents), cockroach, and fungi (mold).
- Outdoor Allergens: pollens (trees, weeds, grasses), fungi, molds and yeasts.

Air Pollution

- Contribute to worsening asthma symptoms by triggering bronchoconstriction.
- Indoor: cooking and heating fuel exhausts, paints, varnishes, cleaning solutions, cigarette smoke.
- Outdoor: Industrial smog (sulfur dioxide particulate complex) and photochemical smog (ozone and nitrogen oxides).

Symptoms of Asthma

- Typical triad: wheezing, shortness of breath and cough with or without sputum production
- Not specific for asthma.
- Can be seen in other acute and chronic airway disease.
- Episodic, sudden onset, periods of prolonged remission.
- Provoked by known aeroallergens.

Physical Signs of Asthma

- Tachypnea
- Tachycardia
- Hyperinflation
- Prolonged exhalation

- Direct result of diffuse airway narrowing and hypersecretion of mucus.

- Indirect result of reflex influences from an increased work of breathing, increased metabolic demands on the body and diffuse sympathetic nervous discharge.

Objective Measures of Asthma: Diagnosis

- Presence of respiratory symptoms and demonstration of variable expiratory airflow obstruction.
  - Pulmonary Function Testing (PFTs)
  - Methacholine Inhalation Challenge
  - PEFR measurements with peak flow meter
  - Assessment of Atopy

Spirometry/PFTs

- Partially reversible airflow obstruction
- Increase in FEV1>200ml and > or = to 12% from baseline after inhalation of short acting beta 2-agonist.

Methacoline Inhalation Challenge

- May be helpful in the differential diagnosis of dyspnea and cough in patients with normal spirometry
- With normal baseline spirometry, side effects from Methacoline challenge are rare.

Peak Flow Meter

- Portable device for short term home monitoring
- Like a thermometer for asthma
- Monitors airflow, or peak expiratory flow rate (PEFR)
- Twice daily measurement for a couple weeks
- May help diagnose asthma in those with normal PFTs

Assessment of Atopy

- Presence of atopy makes asthma more likely than COPD.
- Determines sensitivity to indoor allergens
- Serologic testing:
  - IgE- elevations indicate the presence of allergic sensitization.
  - RAST
- Allergen skin testing
  - Guides interventions to reduce exposure.

Management of Asthma

NIH Goals of Asthma Therapy

- Minimal or no chronic day or night time symptoms
- Minimal or no exacerbations
- No limitations on activities; no missed school/work days
- Maintain (near) normal pulmonary function
- Minimal use of inhaled short-acting beta2-agonist
- Minimal or no adverse effects from medications

Four Components of Asthma Care

1. Assess and monitor asthma severity and control
2. Education
3. Control of environmental factors and comorbid conditions
4. Medications

1. Assessing and Monitoring Severity and Control

- Severity- used to guide clinical decisions for initiating appropriate medication
- Control- guides decisions to maintain or adjust therapy.

Assessing Severity

	Symptoms	Interference with normal activity	Lung Function
Intermittent	•<2 days/week •Exacerbations are brief	None	• Normal FEV1 between exacerbations •FEV1>80% predicted •FEV1/FVC normal
Mild	• >2 days/week •Exacerbations may affect activity	Minor Limitations	• FEV1 >80% predicted •FEV1/FVC normal
Moderate	• Daily •Affect Activity	Some Limitations	• FEV1>60% but<80% predicted •FEV1/FVC reduced 5%
Severe	• Continuous throughout the day •Frequent exacerbations	Extremely limited	• FEV1<60% predicted •FEV1/FVC reduced 5%

Assessing Control

- Symptom review
- Peak flow monitoring
- Asthma Control Test (ACT)
- Asthma Action Plan

Reviewed at each office visit

Symptom Review

- Wheezing
- Cough
- Shortness of breath
- Chest tightness
- Nighttime or early morning symptoms

Peak Flow Monitoring

- Measures air flow or peak expiratory flow rate
- Should be done twice daily for patients who have moderate or severe asthma
- Assists in:
  - Evaluate effectiveness of current treatment
  - Determine when to add or stop medications (or step up or down)
  - Recognize attack before symptoms appear

Asthma Control Test

- Helps providers and patients identify uncontrolled asthma
- Self administered, brief 5-question assessment for patients 12 years and older
- Reviews symptom control over 4 weeks
- Scale 1-5 (1=all of the time, not controlled…5=none of the time, completely controlled)
- Supported by the American Lung Association

2. Education

- Partnership between provider and patient
- Select treatment plan
- Self management education
  - Basic facts about asthma
  - Role of medications
  - Patient skills
    - Inhaler technique
    - Proper use of devices (peak flow meters)
    - Avoidance of irritants
    - Asthma action plan

Management of Asthma:
Asthma Action Plan

- Develop with Physician
- Tailor to meet individual needs
- Educate patients and families about all aspects of plan
- Review with patient at each visit

Asthma Action Plan

Primary Care Provider Name _____ Phone _____

Primary Care Clinic Name _____ Phone _____

☐ No Primary Care Provider ☐ Primary Care Provider Unknown

ASTHMA SEVERITY (Check one):
☐ Mild Intermittent ☐ Moderate Persistent
☐ Mild Persistent ☐ Severe Persistent

N1714S

ASTHMA ACTION PLAN

GREEN ZONE
"GO! All clear!"

Peak Flow Range:

_____ to _____
(80-100% of personal best)

- Breathing is easy
- Can play, work, and sleep without asthma symptoms

When you are in the GREEN ZONE, take the following controller medicine(s) every day.

Controller medicines	How much to take	When to take it

Spacer used: ☐ *Optichamber:* ☐with mask ☐without mask

Medicine	How much to take	*Take this medicine as needed 10-20 minutes before sports or any other strenuous activity.*

☐ Student may carry and use this medicine at school after approval by the School Nurse

YELLOW ZONE
"Caution..."

Peak Flow Range:

_____ to _____
(50-79% of personal best)

- Wake up at night

- Cough & wheeze

- Chest is tight

When you are in the YELLOW ZONE, keep taking your GREEN ZONE controller medicine(s) every day and add the following reliever medicine(s) to help keep the asthma episode from getting worse.

Reliever medicine	How much to take	When to take it

If you are in the YELLOW ZONE for more than 12-24 hours, call your doctor.
If your breathing symptoms get worse, call your doctor.

☐ Student may carry and use this medicine at school after approval by the School Nurse

RED ZONE
"STOP! Medical Alert!"

Peak Flow Range:

_____ to _____
(Below 50% of personal best)

- Medicine is not helping
- Breathing is hard and fast
- Can't walk
- Can't talk well
- Ribs show
- Nose opens wide to breathe

When you are in the RED ZONE, start taking your RED ZONE medicine(s) and *Call Your Doctor NOW!*
- **Take these medicines until you talk with your doctor.**
- **If your symptoms do not get better and you can't reach your doctor, go to the emergency room or *call 911 immediately.***

Reliever medicines	How much to take	When to take it

This asthma action plan is good for one year beginning: _____ (Date) MD/NP/PA signature _____

I give my permission for this asthma action plan to be used by the following, and for them to share information with each other about my child's asthma for one year beginning today, so that they can work together to help my child manage her/his asthma. This plan, when signed and dated, may replace the school's *consent to administer medication* form, and allows my child's medicine to be given at school.

☐ My child's school / School health office _____ ☐ My child's clinic / Hospital _____
☐ My child's day care provider _____ ☐ Visiting nurse / Home care agency _____
☐ Insurance case management / Education program _____

If verbal / telephone consent, signatures of persons taking consent / witnessing: Parent / guardian signature _____

1) _____ 2) _____ Date _____

Birthdate _____ (Addressograph / Label)

MR# _____

Name _____

Zones

- Green- GO! PEF 80-100% personal best. Symptom free.
- Yellow- CAUTION. PEF 50-79% personal best . Symptom free, but lung function reduced. Use of quick relief medications, how much and when.
- Red- STOP. PEF less than 50% personal best. Symptoms may be severe. Seek medical help immediately.

3. Control of environmental factors

- Evaluate potential role of allergens and irritants
- Mitigate exposure to allergens and pollutants
  - Review allergy testing
- Refer to allergist for further testing and possible immunotherapy if necessary

3. Control of comorbid conditions

- Identify and treat comorbid conditions that may impede asthma management
  - GERD
  - Obesity
  - OSA
  - Rhinitis or sinusitis
  - Stress and depression

4. Medications

- Maintenance medications
- Quick-relief medications

Maintenance Medications

- Long acting beta agonist (LABA)
- Inhaled Corticosteroids (ICS)
- Leukotriene modifiers
- Immunomodulators
- Prednisone

Used to maintain asthma control

LABAs

- Inhaled bronchodilators that have a duration of bronchodilation of at least 12 hours after a single dose.
- Not to be used as monotherapy for long term control of asthma.
- Use in combination with ICSs for control and prevention of symptoms
- Salmeterol and Formoterol

Corticosteroids (ICS)

- Anti-inflammatory medications that reduce airway hyperresponsiveness, inhibit inflammatory cell migration and activation, and block late phase reaction to allergen.
- Reduce mortality and hospitalization
- Asmanex, pulmicort

Leukotriene Modifiers

- Interfere with the pathway of leukotriene mediators which are released from mast cells, eosinophils and basophils.
- Alternative, not preferred therapy for mild persistent asthma
- Singulair, Accolate, Zyflo

Immunomodulators

- Used for moderate to severe persistent allergic asthma, symptoms not controlled by ICSs.
- Used as adjunctive therapy for those who have sensitivity to relevant allergens.
- Injectable anti-IgE therapy that prevents binding of IgE to the high affinity receptors on basophils and mast cells.
- Positive skin testing to perennial aeroallergen.
- Approval and dosing based on serum IgE levels (30-700IU/mL).
- Xolair

Methylxanthines

- Sustained release theophylline
- Mild to moderate bronchodilator used as alternative therapy for mild persistent asthma.
- Must monitor serum theophylline concentration.
- Chronic overmedication is common causing major toxic events.

Prednisone

- Chronic therapy should be used only as a last resort.
- Multiple potential side effects
  - Hip and vertebral fractures
  - Cataracts
  - Poor glycemic control
  - Reduce bone mineral density
  - Increase risk of fracture

Quick Relief Medications

- Used to treat symptoms and exacerbations

I. Short acting beta agonists (SABA)
   - "rescue inhaler"
   - Relaxes smooth muscle
   - Relief of acute symptoms "as needed"

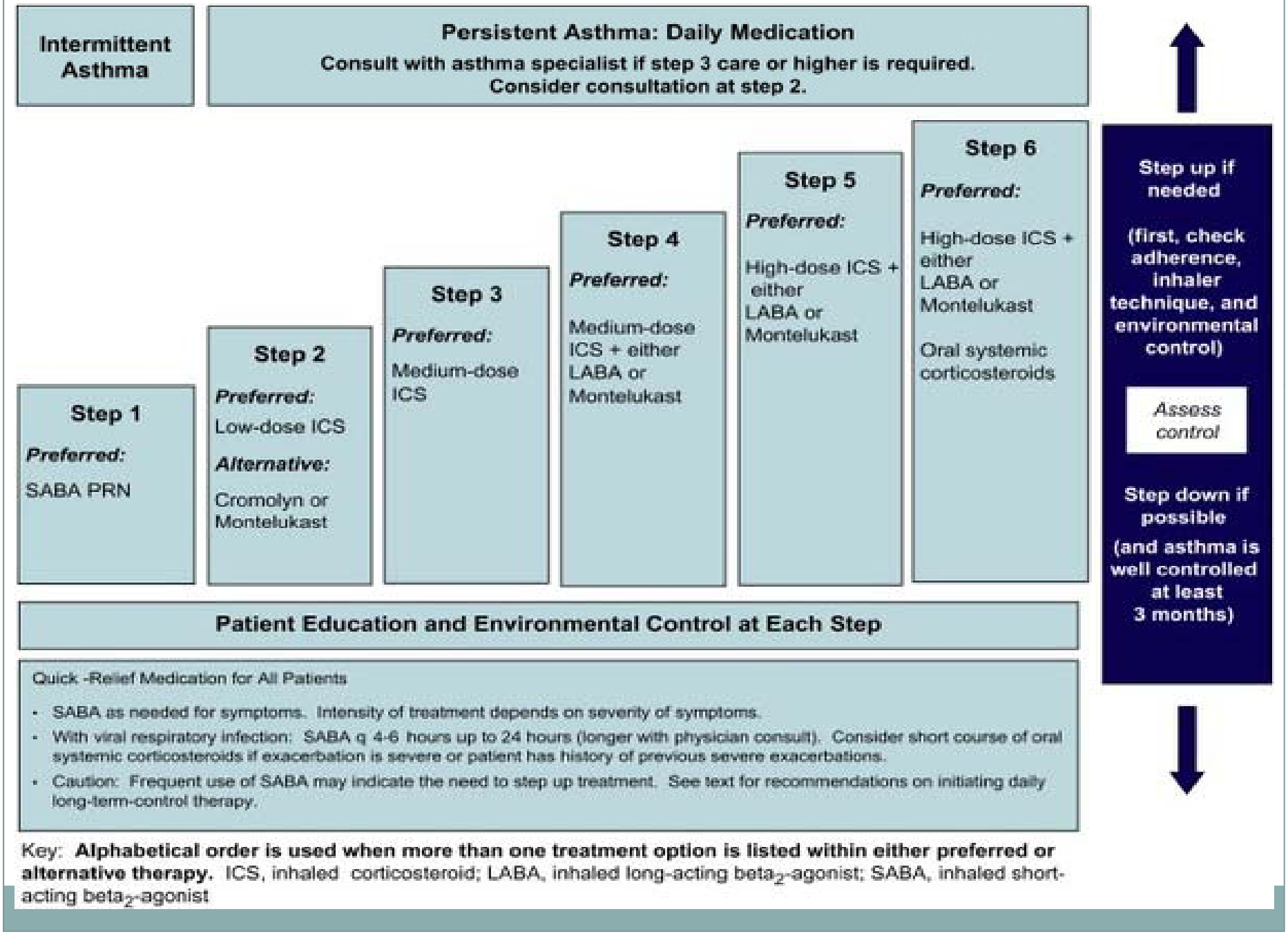
II. Systemic Corticosteroids
   - Should be limited to short-term bursts to treat exacerbation

Stepwise Approach for Asthma Management

- Used to gain and maintain control of asthma
- Incorporates all four components of therapy
- Type, amount and scheduling of medication is determined by the level of asthma severity or control.
- Once control is achieved, monitoring and follow up are essential.

Insert classification of severity slide here

- Up to date: diagnosis and management of asthma



Key: **Alphabetical order is used when more than one treatment option is listed within either preferred or alternative therapy.** ICS, inhaled corticosteroid; LABA, inhaled long-acting beta$_2$-agonist; SABA, inhaled short-acting beta$_2$-agonist

Challenges in asthma care

- Episodic/chronic nature of disease
  - under appreciation of disease severity
  - under treatment of disease during dormant (controlled) phase
  - lack of clinically available objective markers of activity

Challenges in asthma care

- Multiple drug classes
  - SABA, LABA
  - Oral, inhaled corticosteroids (ICS)
  - leukotriene modifiers
  - theophyllline preparations
  - cromolyn/nedocromil

Challenges in asthma care

- Multiple drugs within classes with few head-to-head studies
- Multiple routes of administration
- Multiple forms of delivery systems
- Paraphernalia

Challenges in asthma care

- Patient specific issues
  - Environmental issues
  - Ability to understand/manage disease
  - Adherence issues

Case Study: M.H.

- 42 year old physical education teacher with increased asthma flares and fatigue
- Diagnosed fifteen years earlier; +allergies
- Desensitization shots stopped 8 years ago “weren’t working”
- 2 cats at home
- Husband smokes “outside”

Case Study: M.H.

- Personal best peak flow? (lost flowmeter couple of years ago)
- Increased flares since starting new school year (new office location - basement gym)
- Missed several days because of asthma and is sleeping poorly.

Case Study: M.H.

- Medications
  - albuterol 6-8 puffs/day
  - Qvar qid (eventually stopped using due to difficulty with complaince of medication)
  - Prednisone 10-20 mg “as needed”

Case Study: M.H.

- Exam: NAD, RR 18, Pulse 105, BP 134/78
- Bilateral exp wheezing, RRR, tachy
- Office spirometry
  - FEV1 52% improved to 79% post bronchodilator
  - Peak flow 225
- Allergy Testing

  - Moderate allergies to cat and dog dander.
- IgE 25

Case Study: M.H.

- Patient education: general info, patient specific (cats, smoking husband, workplace issues)
- Disease Management Referral
- Peak flow instruction and Asthma action plan
- Started Asmanex 2 puffs BID
- Added Foradil 2 puffs BID

Case Study: M.H.

- Follow up visit in 3 weeks
  - Peak flow 450
  - Sleeping much better, less fatigue
  - Using SABA once or twice per week
  - Complying with meds
  - Addressing workplace issues

Case Study: P.G.

- 69 year old Female with severe asthma.
- PMH: HTN, hyperlipids, osteoporosis
- Social History: lives alone, never smoked, no etoh
- Allergies: avelox, sulfa
- VS: 103, 140/98, 24, 93%
- Exam:
  - Chest- regular, tachy
  - Pulm- even/unlabored, decreased with faint b/l wheezing, dry cough, hoarse voice

Case Study: P.G.

- Current Medications:
  - Foradil 12mcg 1 puff BID
  - Asmanex 220mcg 2 puffs BID
  - Singulair 10mg daily
  - Ventolin HFA 2 puffs q4hours PRN
  - Flonase 50mcg PRN

Case Study: P.G.

- Spirometry:
  - Pre-drug FEV1 1.43
  - Post-drug FEV1 1.42
- Peak Flows:
  - Personal best- 400
  - Daily range of 200-300

Case Study: P.G.

- Frequent flares requiring prednisone, complains of persistent SOB and wheezing.
- Compliant with medications
- Using ventolin 3-4 times/day without relief
- Feels that symptoms are only controlled while taking prednisone.
- Prednisone re-initiated at 20mg and slowly up-titrated to control symptoms.
- Symptom control at 40mg daily.

Case Study: P.G.

- Allergy testing not previously completed.
- Assessment of Atopy:
  - Serum IgE 235
  - RAST negative
- Decision made to start Xolair.

Case Study: P.G.

- Currently had 3 Xolair injections.
- Feeling 75% better
- Requires rescue inhaler approximately twice weekly
- Wheezing and hoarseness drastically improved.
- Actively weaning prednisone with success.

QUESTIONS???