

# ASTHMA IN CHILDREN

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# WHAT IS ASTHMA?

- ⦿ Chronic Inflammatory Airway Disease
- ⦿ Characterized by
  - Hyper-responsiveness of airways
  - Reversible airflow obstruction
  - Potential for irreversible airway narrowing

# WHAT CAUSES ASTHMA?

## ○ Host factors

### ■ Genetic

- Predisposing to atopy
- Predisposing to hyper-responsiveness
- Inflammatory mediators
- Ratio between Th1 and Th2 immune responses

### ■ Sex

- Male sex ( before age 14)

# WHAT CAUSES ASTHMA?

## ○ Environment

- Allergens
- Infections
  - RSV, Parainfluenza
  - Hygiene hypothesis?
- Tobacco exposure
- Diet
  - Breast feeding is protective

# PATHO-PHYSIOLOGY

## ○ Airway narrowing

- Smooth muscle contraction
- Airway edema
- Airway thickening
- Mucus hyper secretion

## ○ Airway hyper-responsiveness

- Excessive contractility
- Loss of maximum plateau of contractility

# PATHOLOGY

## ○ Inflammatory cells in airways

- Mast cells-release bronchoconstrictor mediators
- Eosinophils-release basic protein that damages airways
- T lymphocytes-release specific cytokines
- Dendritic cells- present allergens to lymph nodes

# HOW TO DIAGNOSE?

## ○ Clinical diagnosis

- Episodic breathlessness
- Wheezing, cough and chest tightness
- Problem diagnosing in < 5 years
  - All who wheeze do not have asthma

# CATEGORIES OF WHEEZING

1. Transient early wheezing
  - Assoc. with prematurity and parental smoking
  - Outgrown in 3 years
2. Persistent early onset wheezing
  - Assoc. with viral illness
  - No atopy
  - Might persist till 12 years
3. Late onset wheezing
  - Persist through adulthood
  - atopic



# HOW TO DIAGNOSE?

- ◉ Frequent episodes of wheeze (> once a month)
- ◉ Activity induced cough or wheeze
- ◉ Nocturnal cough in periods of viral illness
- ◉ Absence of seasonal variation in wheeze
- ◉ Symptoms persisting after the age of 3

# C/F THAT INCREASE PROBABILITY OF ASTHMA

- ⊙ More than one of the following symptoms: wheeze, cough, difficulty breathing, chest tightness, particularly if these symptoms:
  - are frequent and recurrent
  - are worse at night and in the early morning
  - occur in response to, or are worse after, exercise or other triggers, such as exposure
    - to pets, cold or damp air, or with emotions or laughter
    - occur apart from colds
- ⊙ Personal history of atopic disorder
- ⊙ Family history of atopic disorder and/or asthma
- ⊙ Widespread wheeze heard on auscultation
- ⊙ History of improvement in symptoms or lung function in response to adequate therapy

# C/F DECREASE THE POSSIBILITY OF ASTHMA

- Symptoms with colds only, with no interval symptoms
- Isolated cough in the absence of wheeze or difficulty breathing
- History of moist cough
- Prominent dizziness, light-headedness, peripheral tingling
- Repeatedly normal physical examination of chest when symptomatic
- Normal peak expiratory flow (PEF) or spirometry when symptomatic
- No response to a trial of asthma therapy
- Clinical features pointing to alternative diagnosis

# CLINICAL INDEX

- ⦿ Presence of wheeze before age 3 plus
- ⦿ Major risk factor (1/2)
  - Parental history of asthma
  - Eczema
- ⦿ Minor risk factor (2/3)
  - Eosinophilia
  - Wheezing without cold
  - Allergic rhinitis

# DIFFERENTIAL DIAGNOSIS

- ◉ Chronic rhino-sinusitis
- ◉ Gastroesophageal reflux
- ◉ Recurrent viral lower respiratory tract infections
- ◉ Cystic fibrosis
- ◉ Bronchopulmonary dysplasia
- ◉ Tuberculosis
- ◉ Congenital malformation causing narrowing of the intrathoracic airways
- ◉ Foreign body aspiration
- ◉ Primary ciliary dyskinesia syndrome
- ◉ Immune deficiency
- ◉ Congenital heart disease

# CLASSIFICATION

- ◉ Intermittent
  - Less than once a week
- ◉ Mild persistent
  - More than once a week
  - Less than once a day
- ◉ Moderate persistent
  - Daily symptoms
- ◉ Severe persistent
  - Daily symptoms frequent exacerbations



Initial  
classification

# FUNCTIONAL CLASSIFICATION

Characteristic	Controlled (all of the following)	Partly controlled (any measure present in any week)
Day time symptoms	None (twice or less/wk)	More than twice/wk
Limitation of activities	None	Any
Nocturnal symptoms/awakening	None	Any
Need for reliever/rescue treatment	None (twice or less/wk)	More than twice/wk
Lung function (PEF or FEV <sub>1</sub> )	Normal	<80% of predicted or PB
Exacerbations	None	One or more per Yr

# ASTHMA CONTROL

- **Uncontrolled asthma**

- 3 or more of partly controlled in any week
- One or more exacerbation in any week



# MANAGEMENT AND PREVENTION

## ○ Goals

- Achieve and maintain control of symptoms
- Maintain normal activity levels/exercises
- Maintain pulmonary functions as normal as possible
- Prevent asthma exacerbations
- Avoid adverse effects from medications
- Prevent asthma mortality

# COMPONENTS OF THERAPY

1. Develop Patient/Doctor Partnership
2. Identify and Reduce Exposure to Risk Factors
3. Assess, Treat, and Monitor Asthma
4. Manage Asthma Exacerbations
5. Special Considerations.

# PT - DOCTOR PARTNERSHIP

- ⦿ Education
- ⦿ Joint setting of goals
- ⦿ Guided self management
- ⦿ Written self management/monitoring plan
- ⦿ Periodic reviews
- ⦿ Personal asthma action plans

# IDENTIFY AND DECREASE EXPOSURE TO RISK FACTORS

- ⦿ Prenatal tobacco exposure
- ⦿ Passive smoking
- ⦿ Breast feeding

# ASTHMA TREATMENT- ROUTE/DEVICE

Age group	Preferred device	Alternate device
<4years	Pressurized metered dose inhaler with dedicated spacer with <b>face mask</b>	Nebulizer with face mask
4-6 years	Pressurized metered dose inhaler with dedicated spacer with <b>mouth piece</b>	Nebulizer with mouth piece
>6 years	Dry powder inhaler, or breath-actuated pressurized metered dose inhaler, or pressurized metered dose inhaler with spacer and mouthpiece	Nebulizer with mouthpiece

# PHARMACOTHERAPY

## ○ Reliever medications

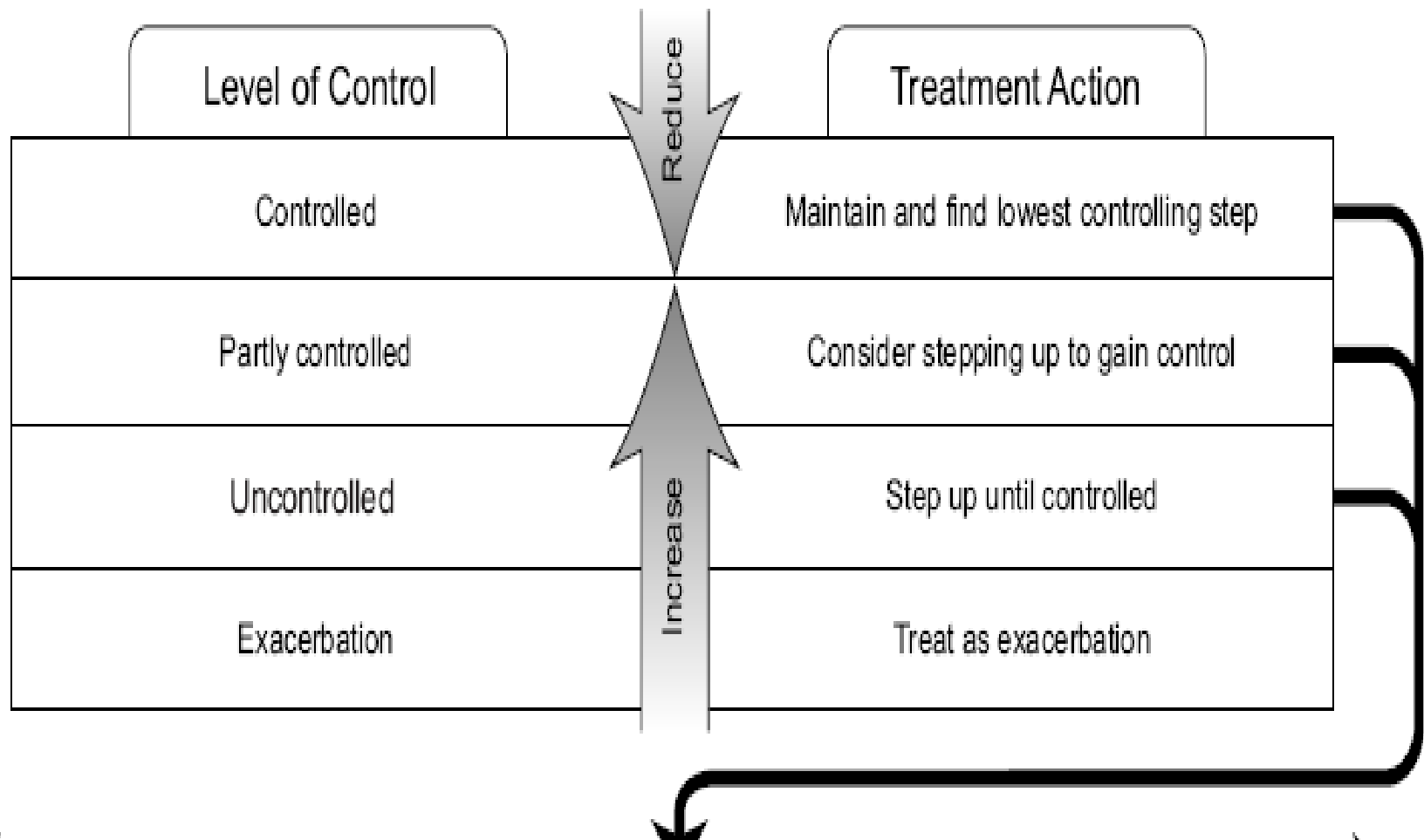
- Rapid acting inhaled  $\beta_2$  agonists
- Short acting oral  $\beta_2$  agonists

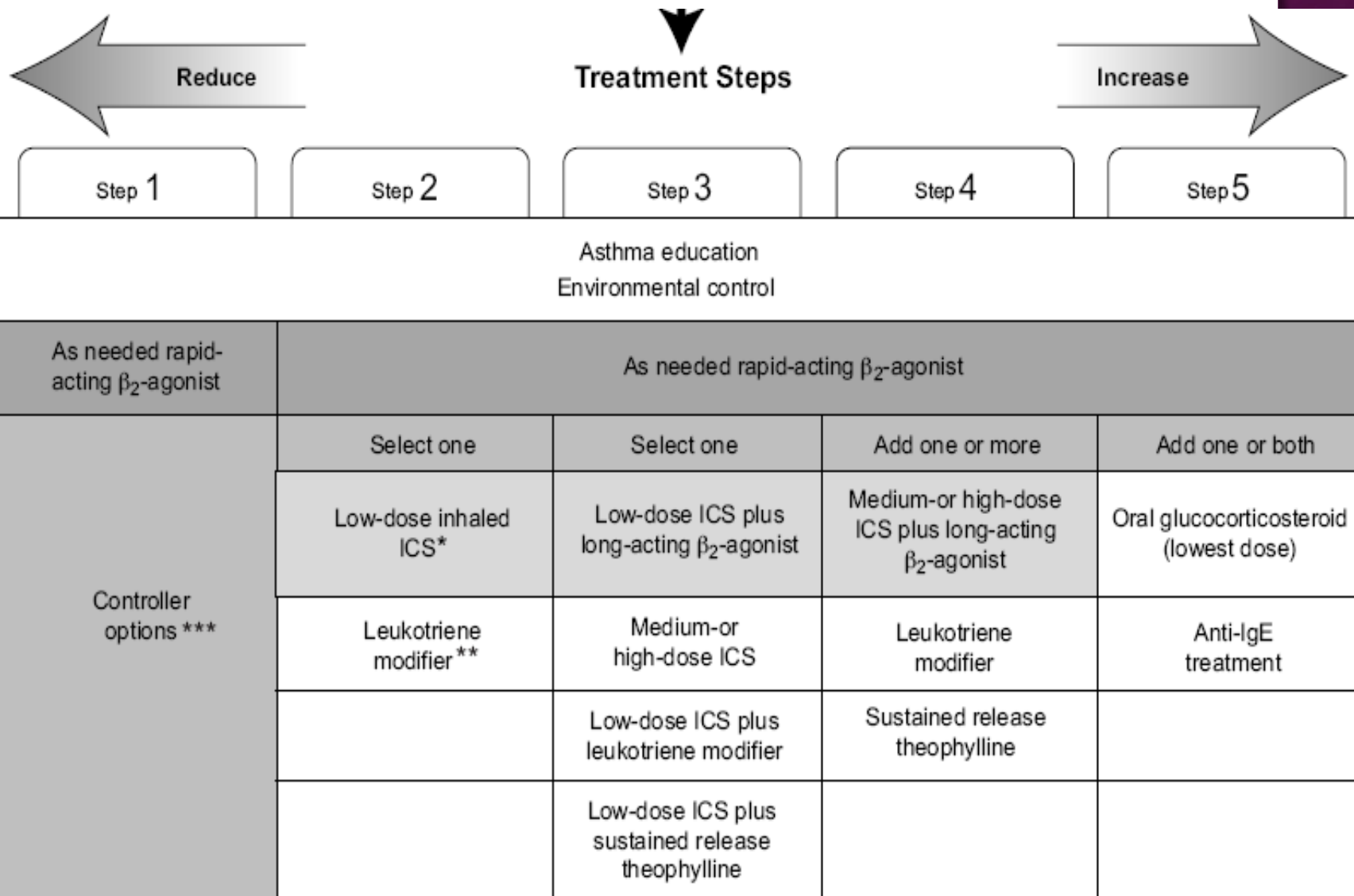
## ○ Controller medications

- Inhaled glucocorticosteroids
- Leukotriene modifiers
- Long acting inhaled  $\beta_2$  agonists
- Theophyllin
- Cromones, long acting oral  $\beta_2$  agonists, systemic steroids ?????

# Management Approach Based On Control

For Children Older Than 5 Years, Adolescents and Adults







# STEP WISE TREATMENT

- Step 1- as needed reliever medication
- Step 2-reliever medication plus single controller
- Step 3- reliever medication plus 1 or 2 controller

# ASTHMA EXACERBATION

	Mild	Moderate	Severe	Imminent Resp Failure
breathlessness	Walking	Talking Infants- difficulty feeding	At rest Infants stops feeding	
Talks in	Sentences	Phrases	Words	
Alertness	May be agitated	Agitated	Agitated	Drowsy
Wheeze	End exp	Loud	Loud	Absent
Pulsus paradoxus	Absent	May be present	Present	Absent
SaO <sub>2</sub>	>95%	91-95%	<90%	

### Initial Assessment (see Figure 4.4-1)

- History, physical examination (auscultation, use of accessory muscles, heart rate, respiratory rate, PEF or FEV<sub>1</sub>, oxygen saturation, arterial blood gas if patient in extremis)

### Initial Treatment

- Oxygen to achieve O<sub>2</sub> saturation ≥ 90% (95% in children)
- Inhaled rapid-acting β<sub>2</sub>-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<sub>2</sub> 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<sub>2</sub>-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<sub>2</sub>-agonist and inhaled anticholinergic
- Systemic glucocorticosteroids
- Intravenous magnesium

### Reassess after 1-2 Hours

## **Good Response within 1-2 Hours:**

- Response sustained 60 min after last treatment
- Physical exam normal: No distress
- PEF > 70%
- O<sub>2</sub> saturation > 90% (95% children)

## Improved: Criteria for Discharge Home

- PEF > 60% predicted/personal best
- Sustained on oral/inhaled medication

## Home Treatment:

- Continue inhaled  $\beta_2$ -agonist
- Consider, in most cases, oral glucocorticosteroids
- Consider adding a combination inhaler
- Patient education: Take medicine correctly  
Review action plan  
Close medical follow-up

## **Incomplete Response within 1-2 Hours:**

- Risk factors for near fatal asthma
- Physical exam: mild to moderate signs
- PEF < 60%
- O<sub>2</sub> saturation not improving

## **Admit to Acute Care Setting**

- Oxygen
- Inhaled  $\beta_2$ -agonist  $\pm$  anticholinergic
- Systemic glucocorticosteroid
- Intravenous magnesium
- Monitor PEF, O<sub>2</sub> saturation, pulse

### **Poor Response within 1-2 Hours:**

- Risk factors for near fatal asthma
- Physical exam: symptoms severe, drowsiness, confusion
- PEF < 30%
- PCO<sub>2</sub> > 45 mm Hg
- P O<sub>2</sub> < 60mm Hg

### **Admit to Intensive Care**

- Oxygen
- Inhaled  $\beta_2$ -agonist + anticholinergic
- Intravenous glucocorticosteroids
- Consider intravenous  $\beta_2$ -agonist
- Consider intravenous theophylline
- Possible intubation and mechanical ventilation