

Bronchial Asthma

3rd year Medical Students

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Objectives

- Definition
- Epidemiology
- Pathophysiology
- Types
- Diagnosis
- Management
- Summary

Asthma

- Word “**asthma**” is derived from the ancient Greek word for “**panting.**”
- Although asthma is a clearly recognized clinical entity, agreement on a **precise definition** of asthma has proved elusive.
- Asthma has been more often **described than defined.**

Definition

*Asthma is a **chronic** inflammatory disorder of the airways in which many cells play a role: in particular, mast cells, **eosinophils**, neutrophils, **T lymphocytes**, macrophages, and epithelial cells.*

*In susceptible individuals, this inflammation causes **recurrent episodes** of **coughing, wheezing, breathlessness, and chest tightness.***

*These episodes are usually associated with widespread but **variable airflow obstruction** (airway hyper-responsiveness) that is often **reversible** either spontaneously or with treatment.*

Epidemiology

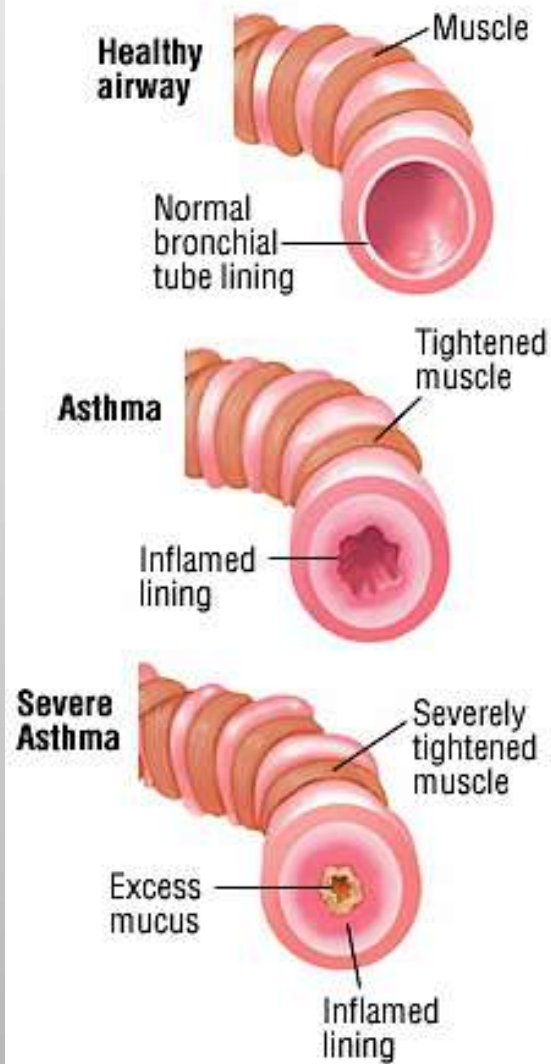
- Any age, 75% Dx age <7
- Remission around puberty
- **Prevalence** on the rise. likely Multifactorial
- Wide geographical variation (4-25%)
- Females 40% higher prevalence
- **Severe asthma** 10 % but morbidity / costs

Saudi Arabia Figures

- Asthma affects >2 million Saudis
- Asthma control: 5% were controlled, 31% partially controlled, 64% uncontrolled.

Etiology

Although asthma is **multifactorial** in origin, **inflammation** is believed to be the cornerstone of the disease and is thought to result from **inappropriate immune responses** to a variety of **antigens** in genetically susceptible individuals.



What is asthma?

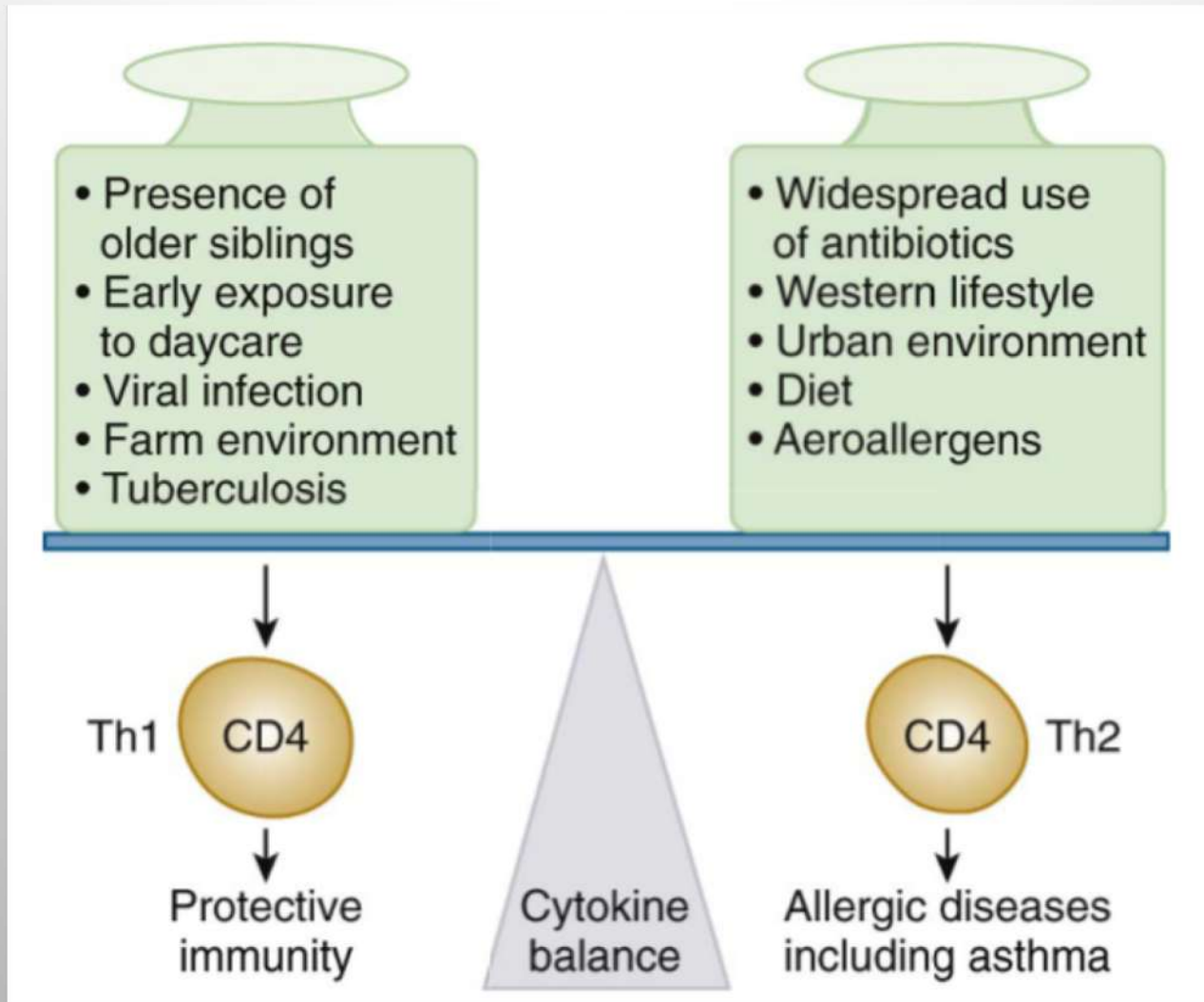
- Tightening of Airways
- Airway Remodeling
- Thick Mucous Production
- Acute and Chronic Phases
 - Wheezing
 - Coughing
 - Shortness of Breath

What causes asthma?

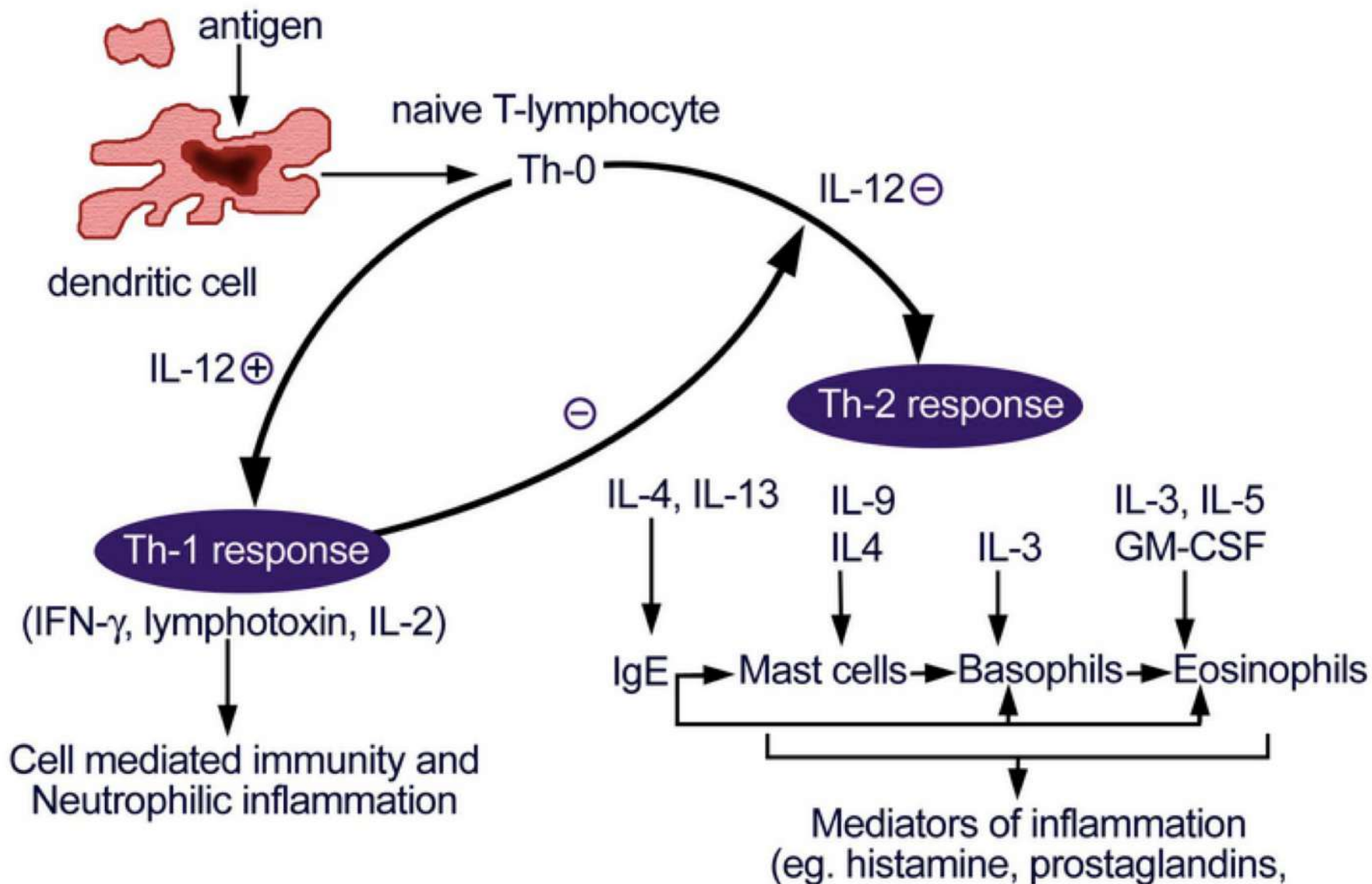
Causes

- Hygiene Hypothesis
- Atopy
- Genetics
- Smoking – controversial
- Obesity – New under lx

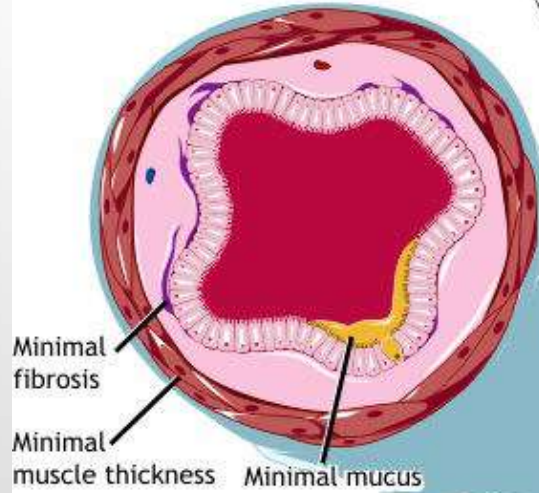
Cause - Hygiene Hypothesis



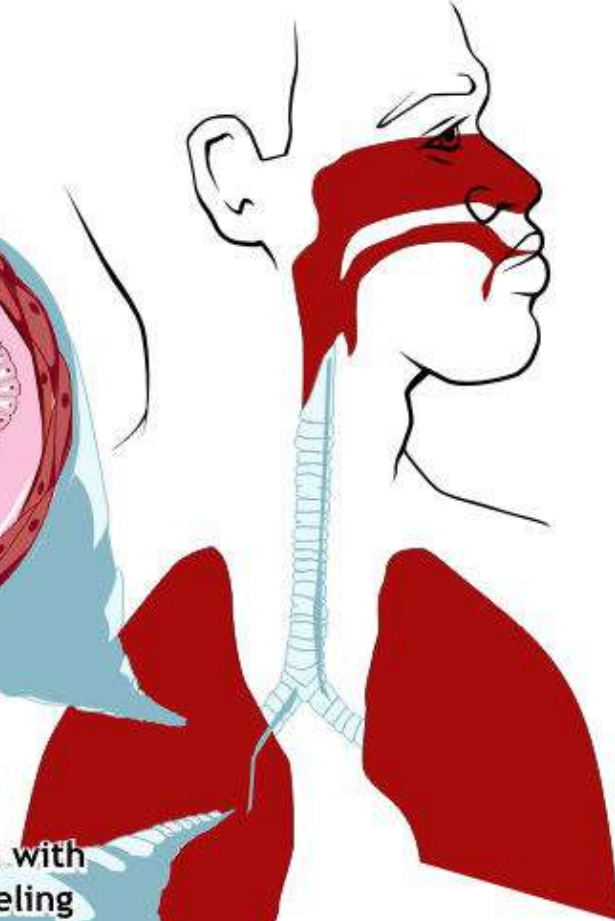
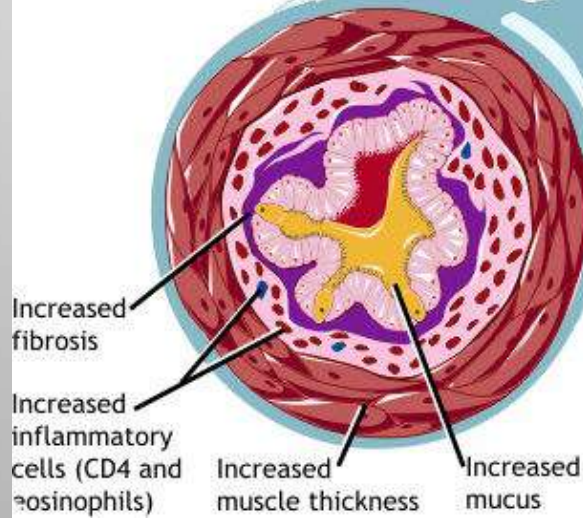
Pathogenesis of asthma



Mild Asthma

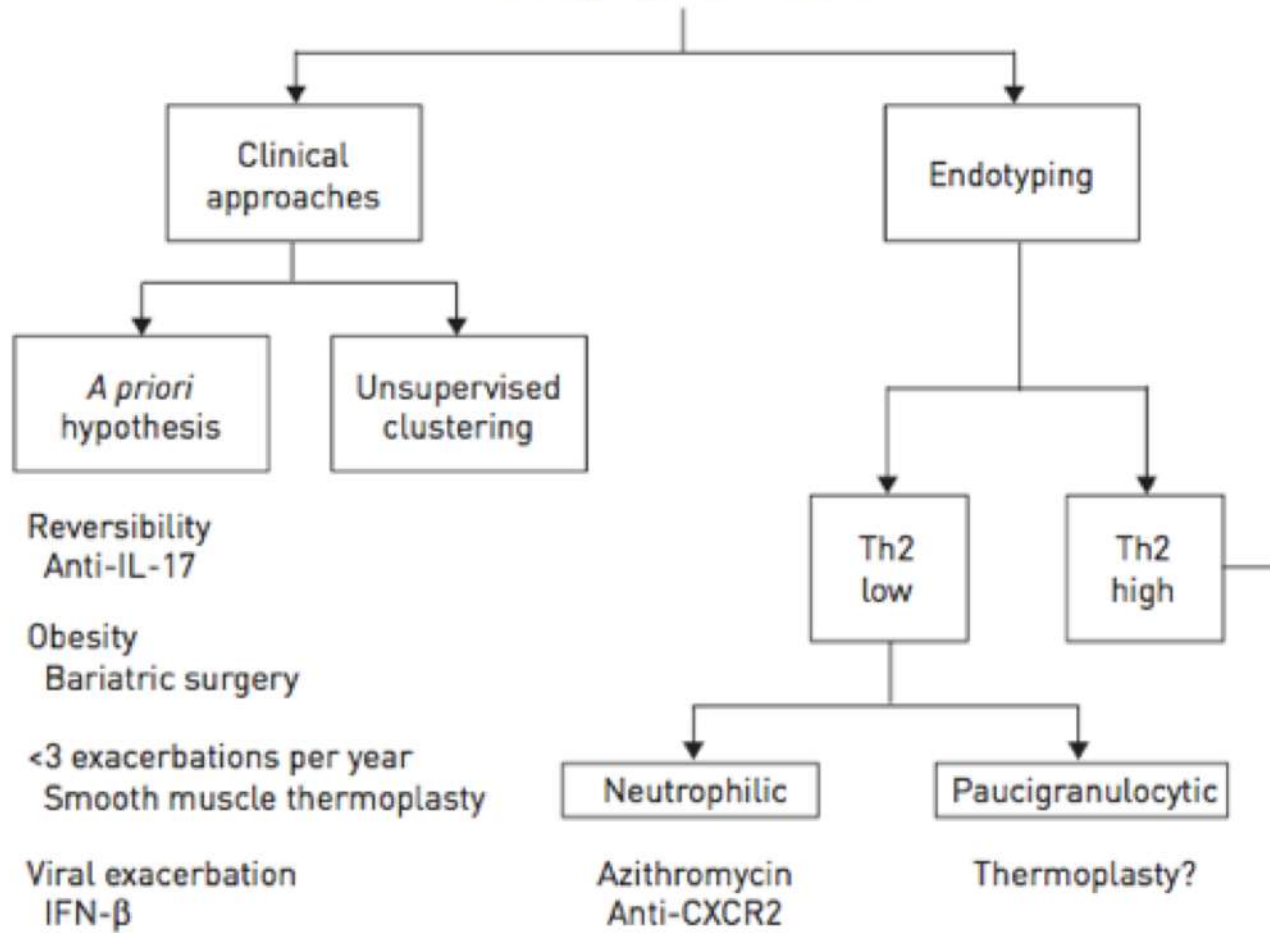


Chronic Asthma with Airway Remodeling

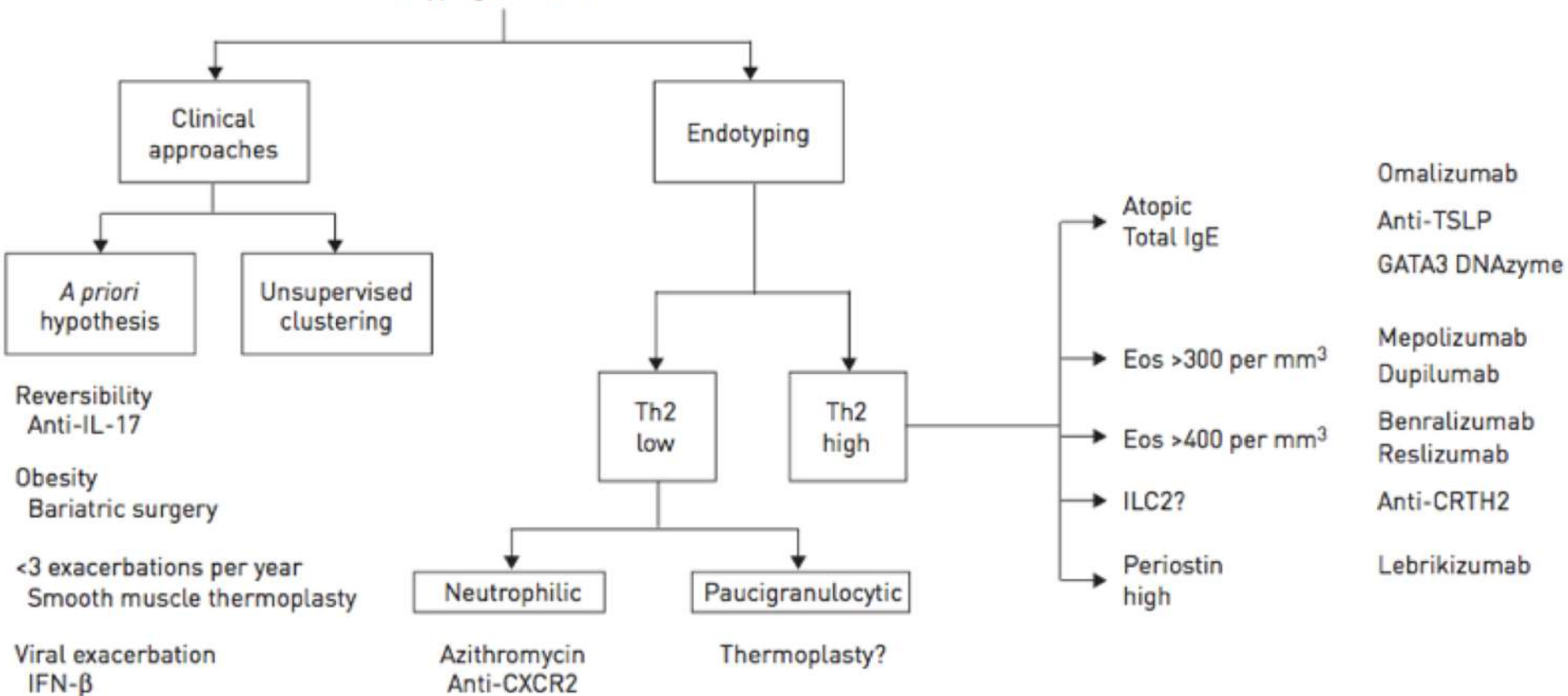


Asthma Types

Phenotyping severe asthma



Phenotyping severe asthma



Asthma

Symptoms (wheezing, chest tightness, shortness of breath), Reversible airway obstruction

Type 2 High

IL-4, IL-5, IL-13, GM-CSF

Type 2 Low

Atopy/Allergy

Early Age of Onset

Later Age of Onset

Eosinophilia

Neutrophilia

Pauci-Granulocytic

CS Responsive
(generally mild/moderate)

Type 1 High

Smoking related

Asthmatic
Granulomatosis

Type 1/Th17 High?

Severe Asthma

Obesity Related

Asthma Types

- **Early onset (<12years)**
 - **Childhood-onset asthma** a relatively **homogeneous** group
 - **Allergic Asthma** (Atopic) Usually a strong allergic Hx
 - **FH** of asthma.
- **Late onset (>12years)**
 - **Adult-onset asthmatics** are a very mixed group **Heterogeneous**
 - Late onset – **Atopic (34%)** have less severe disease. Those with severe disease are less likely to be **atopic**
 - **Non Atopic (52%)** have mild-to-moderate **persistent** asthma
 - Late onset eosinophilic asthma
 - AERD Aspirin Exacerbated Respiratory Disease

Diagnosis

- History
- Examination
- Test

History

INITIAL STRUCTURED CLINICAL ASSESSMENT

The predictive value of individual symptoms or signs is poor, and a structured clinical assessment including all information available from the history, examination and historical records should be undertaken. Factors to consider in an initial structured clinical assessment include:

Episodic symptoms

More than one of the symptoms of wheeze, breathlessness, chest tightness and cough occurring in episodes with periods of no (or minimal) symptoms between episodes. Note that this excludes cough as an isolated symptom in children. For example:

- a documented history of acute attacks of wheeze, with symptomatic and objective improvement with treatment
- recurrent intermittent episodes of symptoms triggered by allergen exposure as well as viral infections and exacerbated by exercise and cold air, and emotion or laughter in children
- in adults, symptoms triggered by taking non-steroidal anti-inflammatory medication or beta blockers.

An historical record of significantly lower FEV₁ or PEF during symptomatic episodes compared to asymptomatic periods provides objective confirmation of obstructive nature of the episodic symptoms.

Wheeze confirmed by a healthcare professional on auscultation

- It is important to distinguish wheezing from other respiratory noises, such as stridor or rattly breathing.
- Repeatedly normal examination of chest when symptomatic reduces the probability of asthma.

Evidence of diurnal variability

Symptoms which are worse at night or in the early morning.

Atopic history

Personal history of an atopic disorder (ie, eczema or allergic rhinitis) or a family history of asthma and/or atopic disorders, potentially corroborated by a previous record of raised allergen-specific IgE levels, positive skin-prick tests to aeroallergens or blood eosinophilia.

Absence of symptoms, signs or clinical history to suggest alternative diagnoses (including but not limited to COPD, dysfunctional breathing, obesity).

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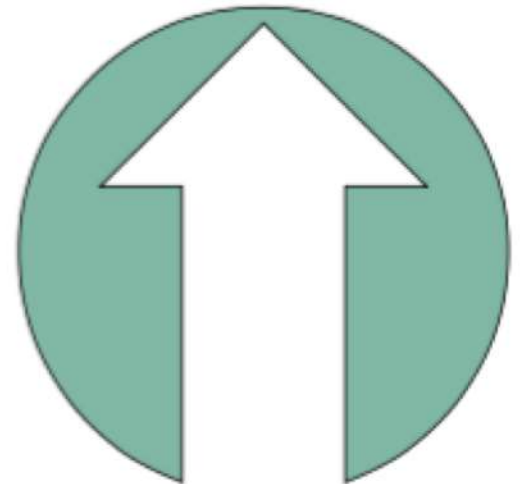
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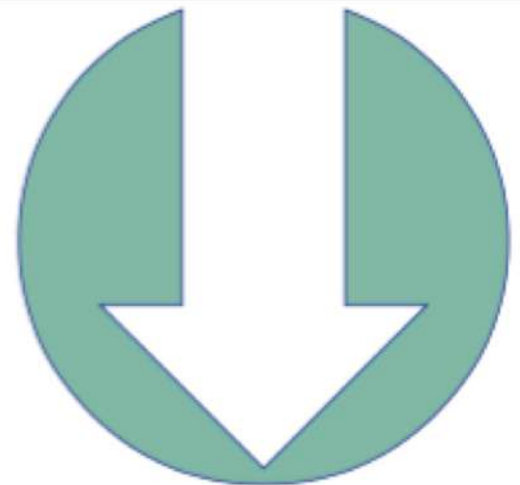
CLINICAL FEATURES THAT INCREASE THE PROBABILITY OF ASTHMA

- More than one of the following symptoms: wheeze, breathlessness, chest tightness and cough, particularly if:
 - symptoms worse at night and in the early morning
 - symptoms in response to exercise, allergen exposure and cold air
 - symptoms after taking aspirin or beta blockers
- History of atopic disorder
- Family history of asthma and/or atopic disorder
- Widespread wheeze heard on auscultation of the chest
- Otherwise unexplained low FEV₁ or PEF (historical or serial readings)
- Otherwise unexplained peripheral blood eosinophilia



CLINICAL FEATURES THAT LOWER THE PROBABILITY OF ASTHMA

- Prominent dizziness, light-headedness, peripheral tingling
- Chronic productive cough in the absence of wheeze or breathlessness
- Repeatedly normal physical examination of chest when symptomatic
- Voice disturbance
- Symptoms with colds only
- Significant smoking history (ie > 20 pack-years)
- Cardiac disease
- Normal PEF or spirometry when symptomatic*



Differential Diagnosis

Other Illness with wheezing / SOB

- COPD (Smoker)
- Heart failure
- Airway obstruction (Tumors, FB)
- Vocal cord dysfunction

May Coexist and complicate Dx of asthma

- GERD, OSA, ABPA

Examination

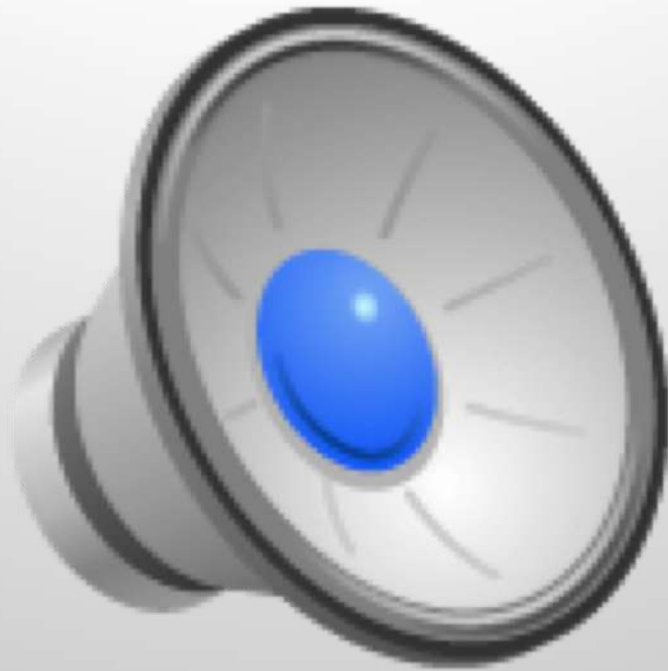
Examination

- **Upper respiratory tract** (nasal secretion, mucosal swelling, nasal polyp)
- **Chest** (**Wheezing** or prolonged phase of forced exhalation, Chest hyper-expansion, accessory muscles)
- **Skin** (atopic dermatitis, eczema)

Wheezing

- **Wheezing**—high-pitched whistling sounds when breathing out
- A lack of wheezing and a normal chest examination do not exclude asthma

Wheeze



Investigations

Tests

- **Spirometry** – Routine

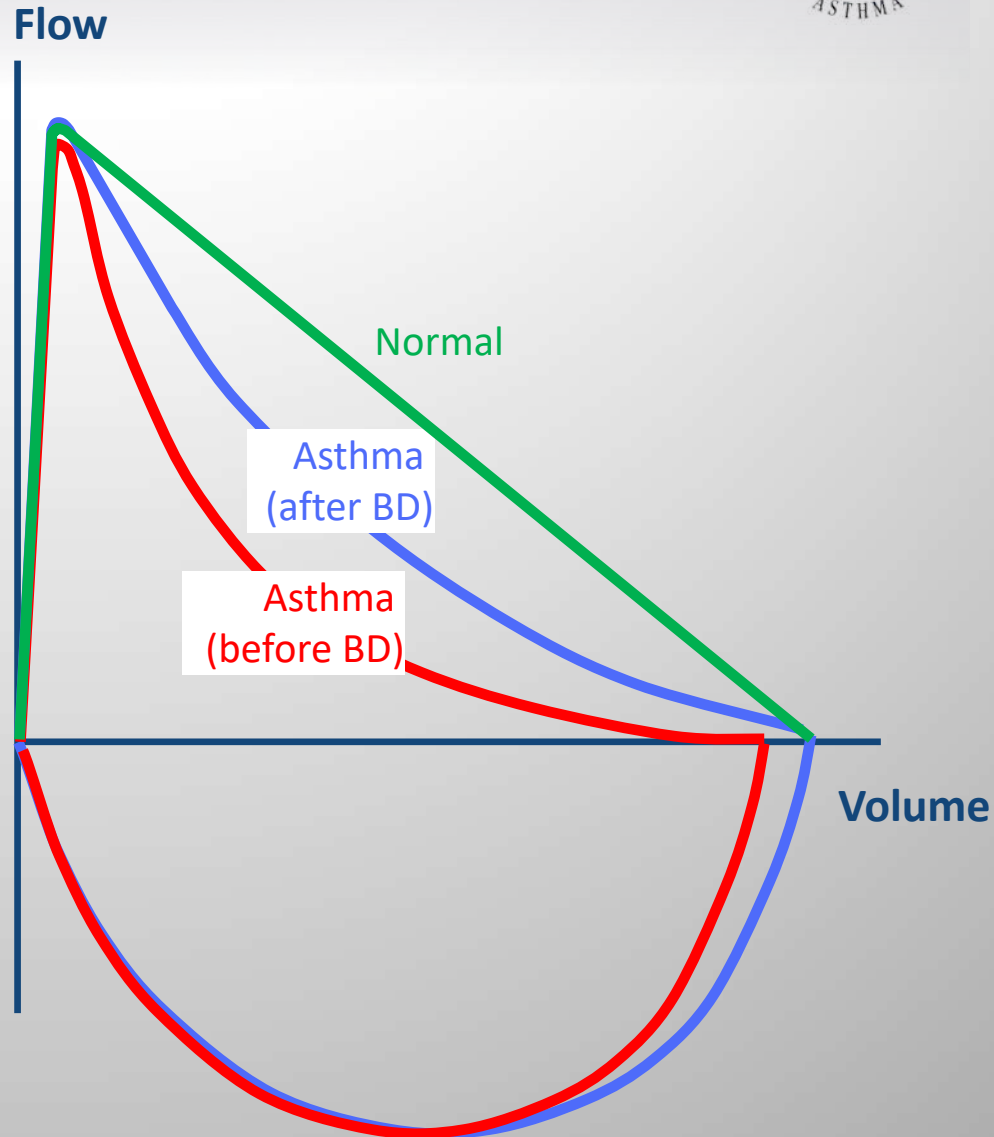
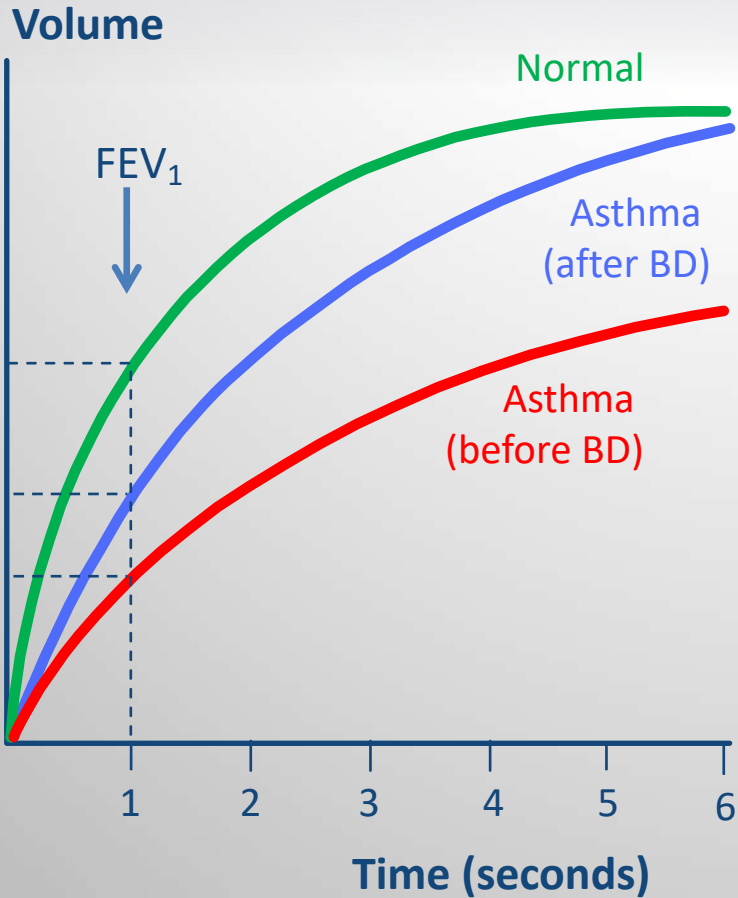
Usually if alternate Dx considered

- Full Lung Functions
- CXR / CT Chest
- FBC
- Airway Hyper-responsiveness tests (If spiro normal)

Asthma Dx – variable airflow limitation

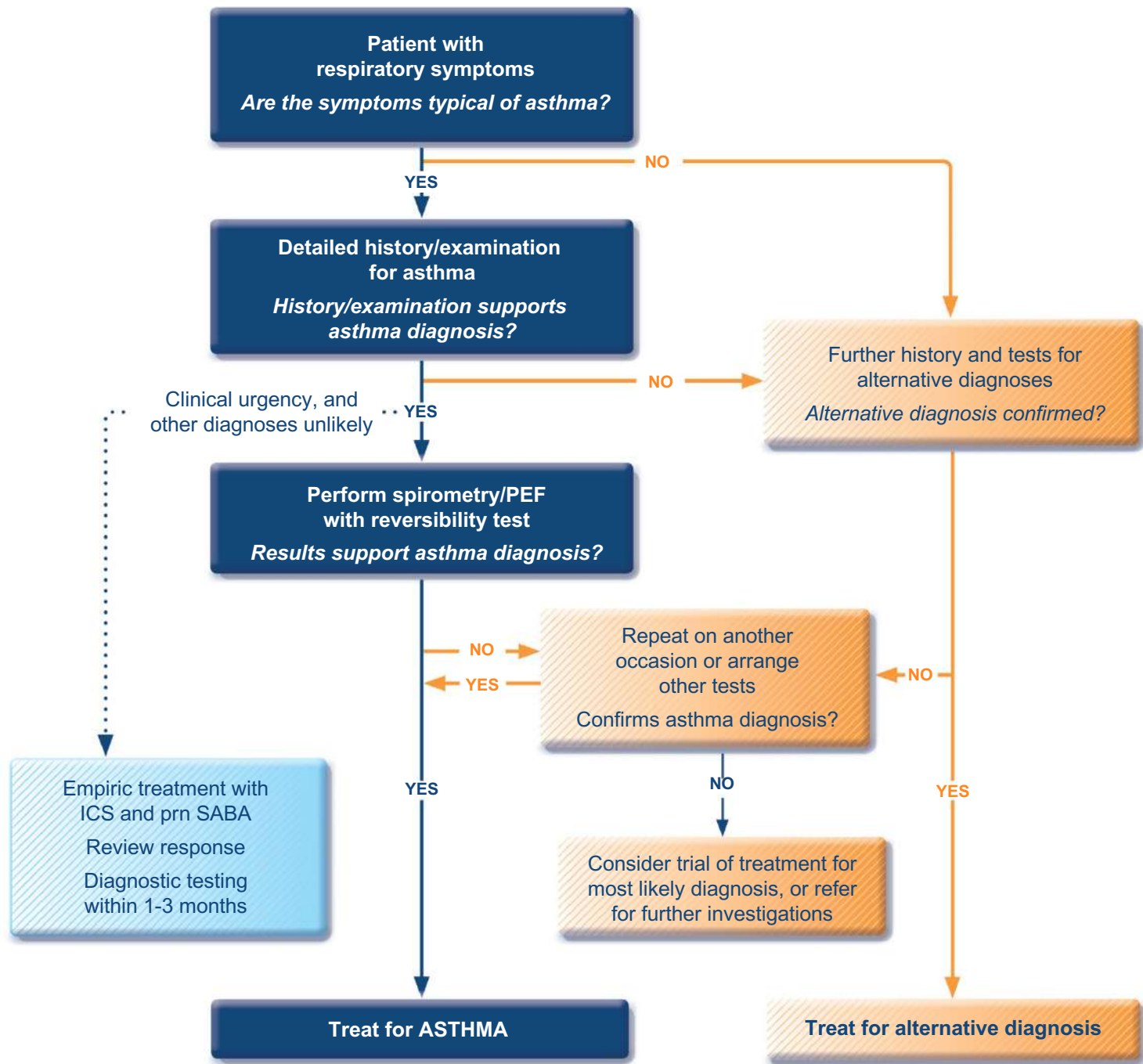
- **Confirm presence of airflow limitation**
 - Document that FEV_1/FVC is reduced <0.75 (at least once)
- **Confirm variation in lung function or Reversibility**
 - Excessive bronchodilator reversibility ($FEV_1 >12\%$ and $>200\text{mL}$)
 - Excessive diurnal variability twice-daily PEF monitoring

Typical spirometric tracings



Note: Each FEV₁ represents the highest of three reproducible measurements

Diagnostic Approach



Management

Components of Asthma Management

- Monitoring
- Education
- Control of environmental factors
- Pharmacologic Rx

Monitoring

- Symptoms
- Peak Flow (Home)
- Spirometry (Clinic)
- FENO and Sputum eosinophils
- Assess **Severity and Control** of asthma

Education

- Compliance
- Inhalers techniques
- Asthma Action plans

Specific directions for daily management and for adjusting medications in response to increasing symptoms or decreasing PEFV

Environmental Factors

- **Triggers** (Aeroallergens, Irritants)
- **Co-morbid conditions** (Obesity, GERD, Rhinitis, ABPA, VCD, stress)
- **Medications** (Aspirin, Beta Blockers)
- **Infections** (Vaccinations)

Pharmacologic Management

Aims

The aim of asthma management is control of the disease. Complete control is defined as:

- **no daytime symptoms**
- **no night time awakening due to asthma**
- **no need for rescue medication**
- **no asthma attacks**
- **no limitations on activity including exercise**
- **normal lung function (in practical terms FEV₁ and/or PEF >80% predicted or best)**
- **minimal side effects from medication.**

GINA assessment of symptom control



A. Symptom control

Level of asthma symptom control

In the past 4 weeks, has the patient had:

- Daytime asthma symptoms more than twice a week? Yes No
- Any night waking due to asthma? Yes No
- Reliever needed for symptoms* more than twice a week? Yes No
- Any activity limitation due to asthma? Yes No

Well-controlled	Partly controlled	Uncontrolled
None of these	1-2 of these	3-4 of these

*Excludes reliever taken before exercise, because many people take this routinely

Assessment of risk factors for poor asthma outcomes



Independent* risk factors for exacerbations include:

- Ever intubated for asthma
- Uncontrolled asthma symptoms
- Having ≥ 1 exacerbation in last 12 months
- Low FEV₁ (measure lung function at start of treatment, at 3-6 months to assess personal best, and periodically thereafter)
- Incorrect inhaler technique and/or poor adherence
- Smoking
- Elevated FeNO in adults with allergic asthma
- Obesity, pregnancy, blood eosinophilia



* Independent of the level of symptom control

Approach

APPROACH TO MANAGEMENT

1. Start treatment at the level most appropriate to initial severity.
2. Achieve early control.
3. Maintain control by:
 - increasing treatment as necessary
 - decreasing treatment when control is good.

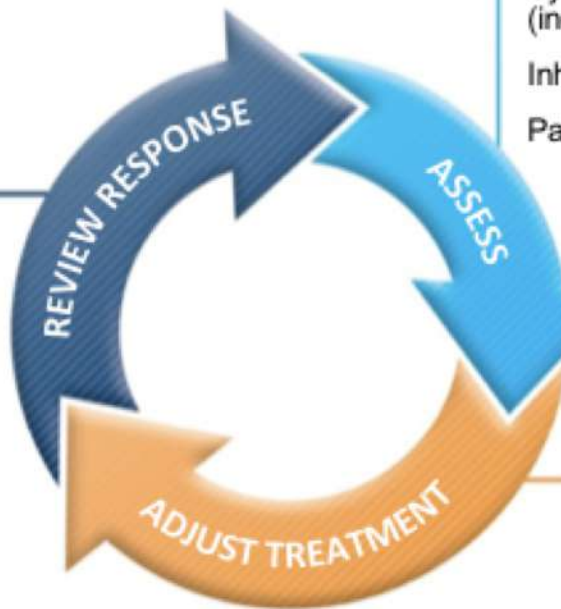


Before initiating a new drug therapy practitioners should check adherence with existing therapies, check inhaler technique and eliminate trigger factors.

Pharmacologic Treatment

- **Relievers**
 - Short Acting Beta agonist
- **Preventer**
 - **Steroids**
 - Long acting Beta Agonist and LAMA
 - Leukotriene's receptors Antagonist
 - Theophylline
- **Personalized Medicine**
 - eg Anti IgE or Anti IL5

Symptoms
Exacerbations
Side-effects
Patient satisfaction
Lung function



Diagnosis
Symptom control & risk factors
(including lung function)
Inhaler technique & adherence
Patient preference

Asthma medications
Non-pharmacological strategies
Treat modifiable risk factors

**PREFERRED
CONTROLLER
CHOICE**

*Other
controller
options*

RELIEVER

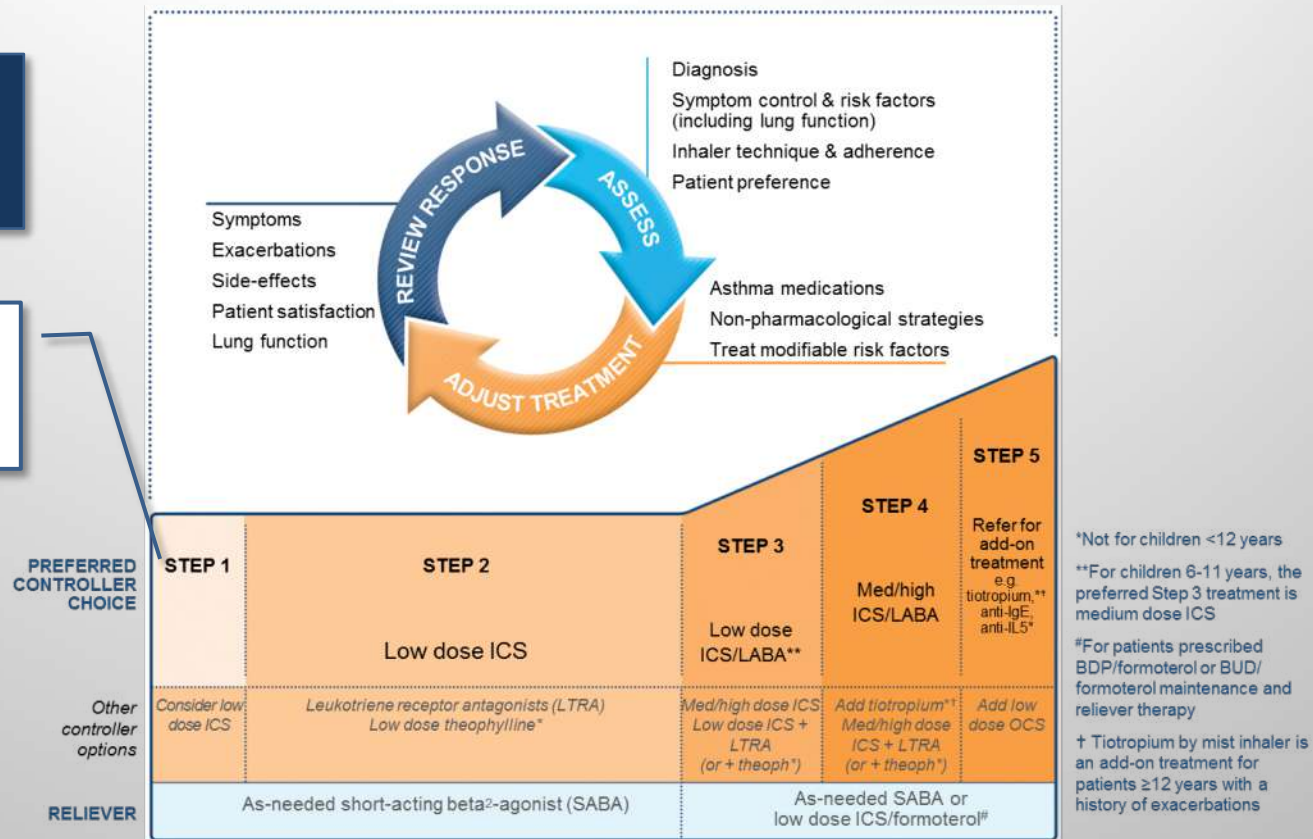
	STEP 1	STEP 2	STEP 3	STEP 4	STEP 5
PREFERRED CONTROLLER CHOICE		Low dose ICS	Low dose ICS/LABA**	Med/high ICS/LABA	Refer for add-on treatment e.g. tiotropium,** anti-IgE, anti-IL5*
<i>Other controller options</i>	Consider low dose ICS	Leukotriene receptor antagonists (LTRA) Low dose theophylline*	Med/high dose ICS Low dose ICS+LTRA (or + theoph*)	Add tiotropium** High dose ICS + LTRA (or + theoph*)	Add low dose OCS
RELIEVER	As-needed short-acting beta ₂ -agonist (SABA)		As-needed SABA or low dose ICS/formoterol#		

GINA 2018 – main treatment figure



Step 1 treatment is for patients with symptoms <twice/month and no risk factors for exacerbations

Previously, no controller was recommended for Step 1, i.e. SABA-only treatment was 'preferred'



GINA 2018, Box 3-5 (2/8) (upper part)

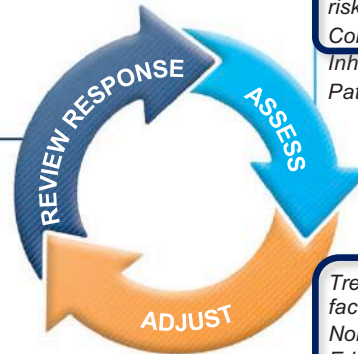
Box 3-5A

Adults & adolescents 12+ years

Personalized asthma management:

Assess, Adjust, Review response

Symptoms
Exacerbations
Side-effects
Lung function
Patient satisfaction



Confirmation of diagnosis if necessary
Symptom control & modifiable risk factors (including lung function)
Comorbidities
Inhaler technique & adherence
Patient goals

Treatment of modifiable risk factors & comorbidities
Non-pharmacological strategies
Education & skills training
Asthma medications

Asthma medication options:

Adjust treatment up and down for individual patient needs

PREFERRED CONTROLLER

to prevent exacerbations and control symptoms

Other controller options

PREFERRED RELIEVER

Other reliever option

STEP 1

As-needed low dose ICS-formoterol *
Low dose ICS taken whenever SABA is taken †

STEP 2

Daily low dose inhaled corticosteroid (ICS), or as-needed low dose ICS-formoterol *
Leukotriene receptor antagonist (LTRA), or low dose ICS taken whenever SABA is taken †

STEP 3

Low dose ICS-LABA

Medium dose ICS, or low dose ICS+LTRA #

STEP 4

Medium dose ICS-LABA

High dose ICS, add-on tiotropium, or add-on LTRA #

STEP 5

High dose ICS-LABA
Refer for phenotypic assessment ± add-on therapy, e.g. tiotropium, anti-IgE, anti-IL5/5R, anti-IL4R

Add low dose OCS, but consider side-effects

As-needed low dose ICS-formoterol *
As-needed low dose ICS-formoterol ‡
As-needed short-acting β_2 -agonist (SABA)

* Off-label; data only with budesonide-formoterol (bud-form)
† Off-label; separate or combination ICS and SABA inhalers

‡ Low-dose ICS-form is the reliever for patients prescribed bud-form or BDP-form maintenance and reliever therapy
Consider adding HDM SLIT for sensitized patients with allergic rhinitis and FEV₁ >70% predicted

- Provide guided self-management education (self-monitoring + written action plan + regular review)
- Treat modifiable risk factors and comorbidities, e.g. smoking, obesity, anxiety
- Advise about non-pharmacological therapies and strategies, e.g. physical activity, weight loss, avoidance of sensitizers where appropriate
- Consider stepping up if ... uncontrolled symptoms, exacerbations or risks, but check diagnosis, inhaler technique and adherence first
- Consider adding SLIT in adult HDM-sensitive patients with allergic rhinitis who have exacerbations despite ICS treatment, provided FEV1 is >70% predicted
- Consider stepping down if ... symptoms controlled for 3 months + low risk for exacerbations. Ceasing ICS is not advised.

Asthma Self Management

- Communicate and educate patient
- A **written asthma action plan** includes all the information you need to look after your asthma well, so you'll have fewer symptoms and significantly cut your risk of an asthma attack.



Every day asthma care:

My personal best peak flow is:

My preventer inhaler

(insert name/colour):

I need to take my preventer inhaler every day even when I feel well

I take puff(s) in the morning and puff(s) at night.

My reliever inhaler

(insert name/colour):

I take my reliever inhaler only if I need to

I take puff(s) of my reliever inhaler if any of these things happen:

- I'm wheezing
- My chest feels tight
- I'm finding it hard to breathe
- I'm coughing.

Other medicines I take for my asthma every day:

With this daily routine I should expect/aim to have no symptoms. If I haven't had any symptoms or needed my reliever inhaler for at least 12 weeks, ask my GP or asthma nurse to review my medicines in case they can reduce the dose.



People with allergies need to be extra careful as attacks can be more severe.



When I feel worse:

- My symptoms are coming back (wheeze, tightness in my chest, feeling breathless, cough)
- I am waking up at night
- My symptoms are interfering with my usual day-to-day activities (eg at work, exercising)
- I am using my reliever inhaler times a week or more
- My peak flow drops to below

This is what I can do straight away to get on top of my asthma:

1 If I haven't been using my preventer inhaler, start using it regularly again or:

Increase my preventer inhaler dose to puffs times a day until my symptoms have gone and my peak flow is back to normal

Take my reliever inhaler as needed (up to puffs every four hours)

If I don't improve within 48 hours make an urgent appointment to see my GP or asthma nurse.

2 If I have been given prednisolone tablets (steroid tablets) to keep at home:

Take mg of prednisolone tablets (which is x 5mg) immediately and again every morning for days or until I am fully better.

URGENT! Call my GP or asthma nurse today and let them know I have started taking steroids and make an appointment to be seen within 24 hours.

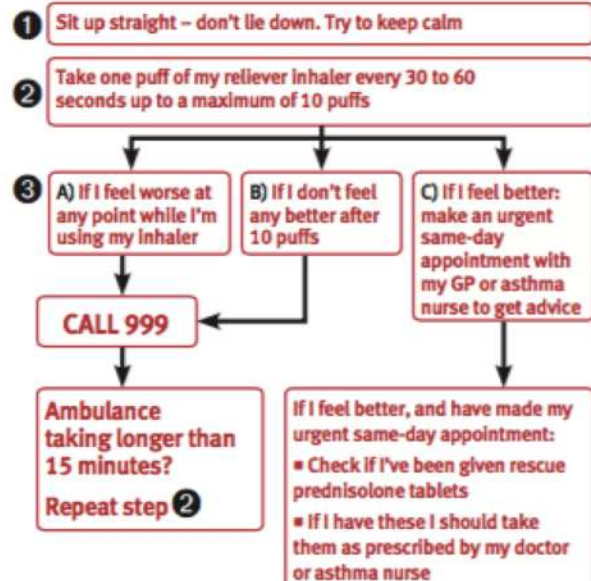


In an asthma attack:

- My reliever inhaler is not helping or I need it more than every hours
- I find it difficult to walk or talk
- I find it difficult to breathe
- I'm wheezing a lot or I have a very tight chest or I'm coughing a lot
- My peak flow is below



THIS IS AN EMERGENCY TAKE ACTION NOW

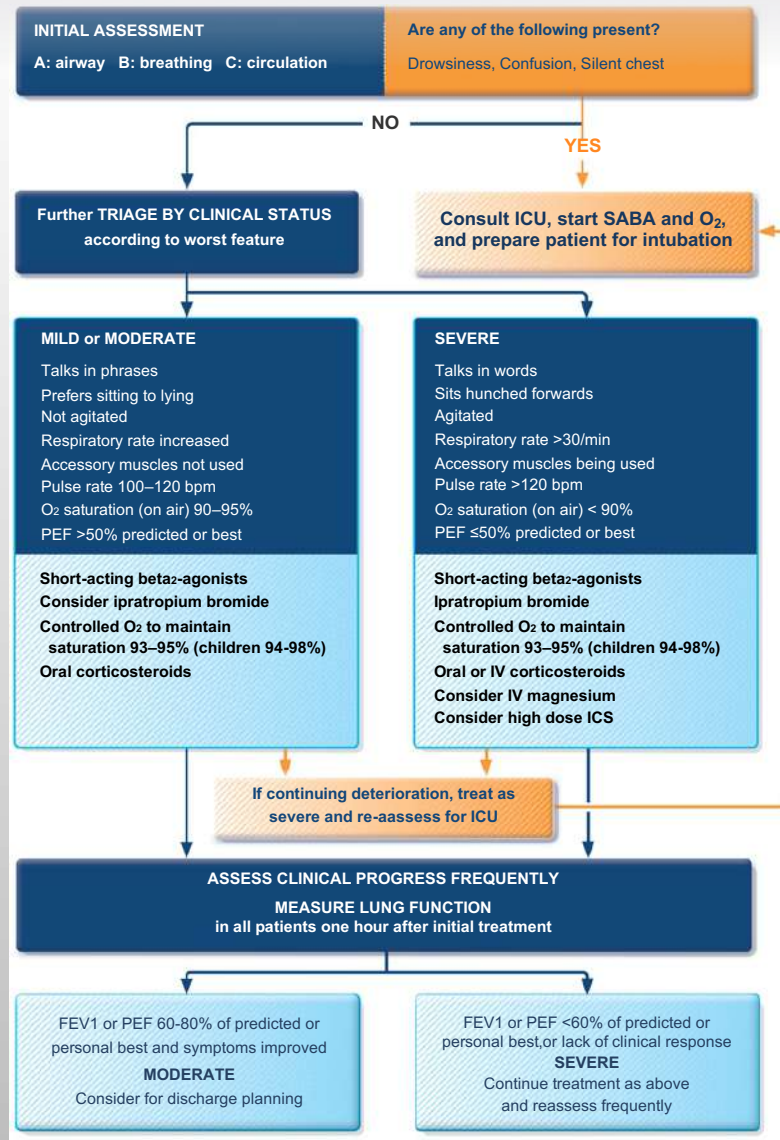


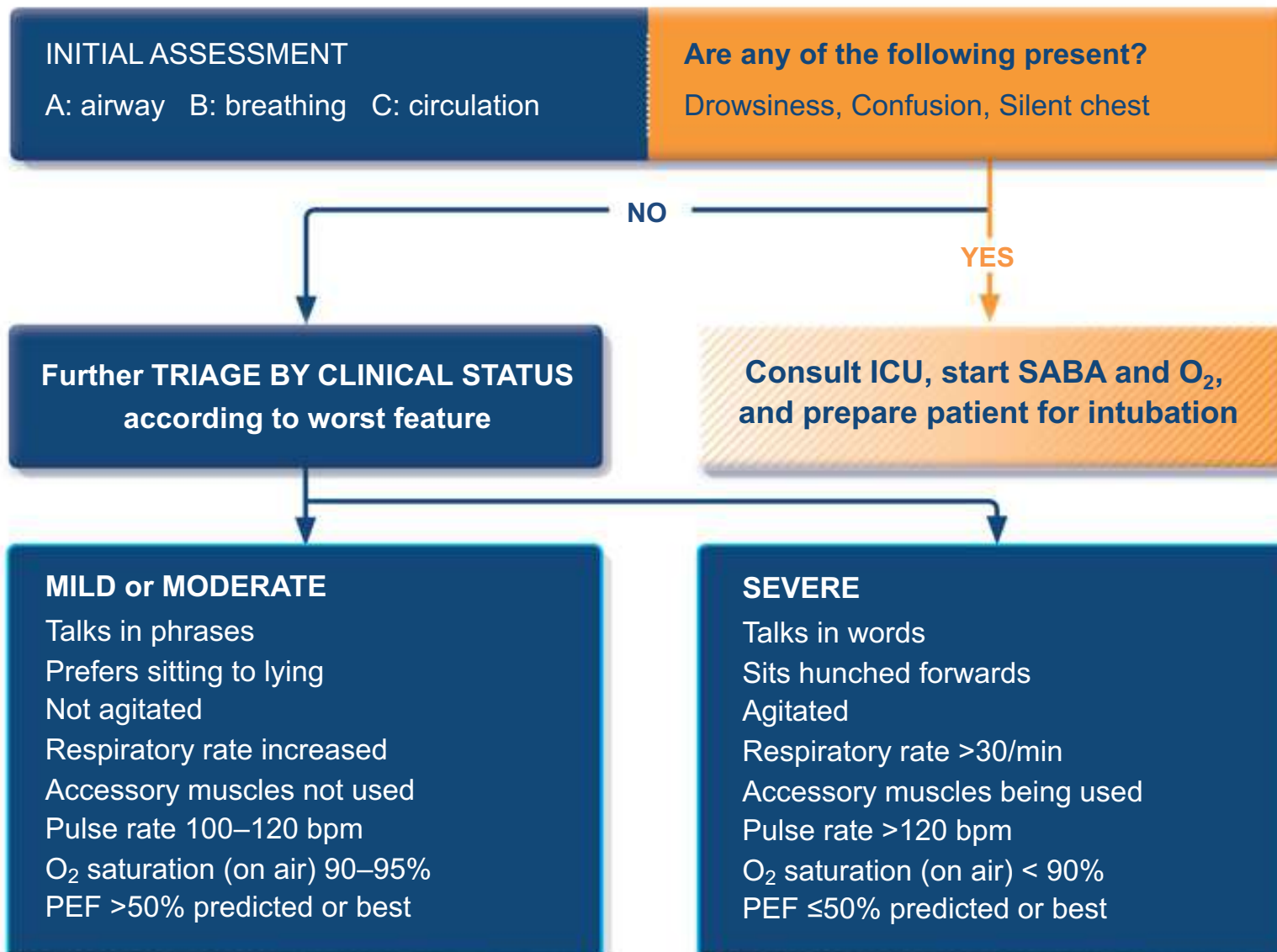
IMPORTANT! This asthma attack information is not designed for people who use the Symbicort® SMART regime OR Fostair® MART regime. If you use one of these speak to your GP or asthma nurse to get the correct asthma attack information.

Acute Asthma Attack- Severity

Box 7.1: Levels of severity of acute asthma in adults	
Level	Characteristics
Moderate asthma attacks	<ul style="list-style-type: none"> · Increasing symptoms · PEFR >50–75% best or predicted · No features of acute severe asthma
Acute severe asthma	<ul style="list-style-type: none"> · Any one of: <ul style="list-style-type: none"> ○ PEF 30–50% best or predicted ○ Respiratory rate \geq25/min ○ Heart rate \geq120/min · Inability to complete sentences in one breath
Life-threatening asthma	<ul style="list-style-type: none"> · Any one of the followings in a patient with severe asthma: <ul style="list-style-type: none"> ○ SpO₂<92% (PaO₂<60 mmHg) on high-flow FIO₂ ○ PEF <30% best or predicted ○ Bradycardia ○ Dysrhythmia ○ Cyanosis ○ Hypotension ○ Normal or high PaCO₂ ○ Exhaustion ○ Confusion ○ Silent chest ○ Coma · Weak respiratory effort
Near-fatal asthma	<ul style="list-style-type: none"> · Raised PaCO₂ and/or requiring mechanical ventilation
Brittle asthma	<ul style="list-style-type: none"> · Type 1: Wide PEF variability (>40% diurnal variation for >50% of the time over a period >3–6 months) despite intense therapy · Type 2: Sudden severe attacks on a background of apparently well-controlled asthma

Managing exacerbations in acute care settings





MILD or MODERATE

Talks in phrases
Prefers sitting to lying
Not agitated
Respiratory rate increased
Accessory muscles not used
Pulse rate 100–120 bpm
O₂ saturation (on air) 90–95%
PEF >50% predicted or best

Short-acting beta₂-agonists
Consider ipratropium bromide
Controlled O₂ to maintain saturation 93–95% (children 94-98%)
Oral corticosteroids

SEVERE

Talks in words
Sits hunched forwards
Agitated
Respiratory rate >30/min
Accessory muscles being used
Pulse rate >120 bpm
O₂ saturation (on air) < 90%
PEF ≤50% predicted or best

Short-acting beta₂-agonists
Ipratropium bromide
Controlled O₂ to maintain saturation 93–95% (children 94-98%)
Oral or IV corticosteroids
Consider IV magnesium
Consider high dose ICS

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 Consider ipratropium bromide
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 Oral corticosteroids

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 Oral or IV corticosteroids
 Consider IV magnesium
 Consider high dose ICS

If continuing deterioration, treat as
 severe and re-assess for ICU

ASSESS CLINICAL PROGRESS FREQUENTLY
MEASURE LUNG FUNCTION
 in all patients one hour after initial treatment

FEV₁ or PEF 60–80% of predicted or
 personal best and symptoms improved
MODERATE
 Consider for discharge planning

FEV₁ or PEF <60% of predicted or
 personal best, or lack of clinical response
SEVERE
 Continue treatment as above
 and reassess frequently

Key Messages

Asthma is a chronic inflammatory condition associated with significant morbidity and mortality which is preventable and manageable with appropriate treatment and effective patient communication

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*Asthma is a **chronic** inflammatory condition associated with **significant morbidity and mortality** which is **preventable and manageable** with appropriate treatment and effective patient communication*

