Bronchial Asthma

3rd year Medical Students

Dr Muhammad Yousaf

Consultant Pulmonologist

FRCP, MRCP UK

Objectives

- Definition
- Epidemiology
- Pathophysiology
- 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

Asthma Types

- **Early onset** (<12years)
- **Late onset** (>12years)

Childhood-onset asthma represents a relatively homogeneous group of patients, often with a strong **allergic history and family history** of asthma.

In contrast, **adult-onset asthmatics** are a very mixed group of patients. Those with severe disease are less likely to be atopic (34 %) than with mild-to-moderate persistent asthma (52%)

Saudi Arabia Figures

- Asthma affects >2 million Saudis

- Asthma control: 5% were controlled, 31% partially controlled, 64% uncontrolled.

UK Facts

- UK 5.4 Million
- **Three people a day** die from asthma
- 1,167 deaths from asthma in 2011
- 75% hospital admissions are avoidable
- 90% deaths from asthma are preventable
- Health Cost **£1 billion a year** (NHS)

UK Facts

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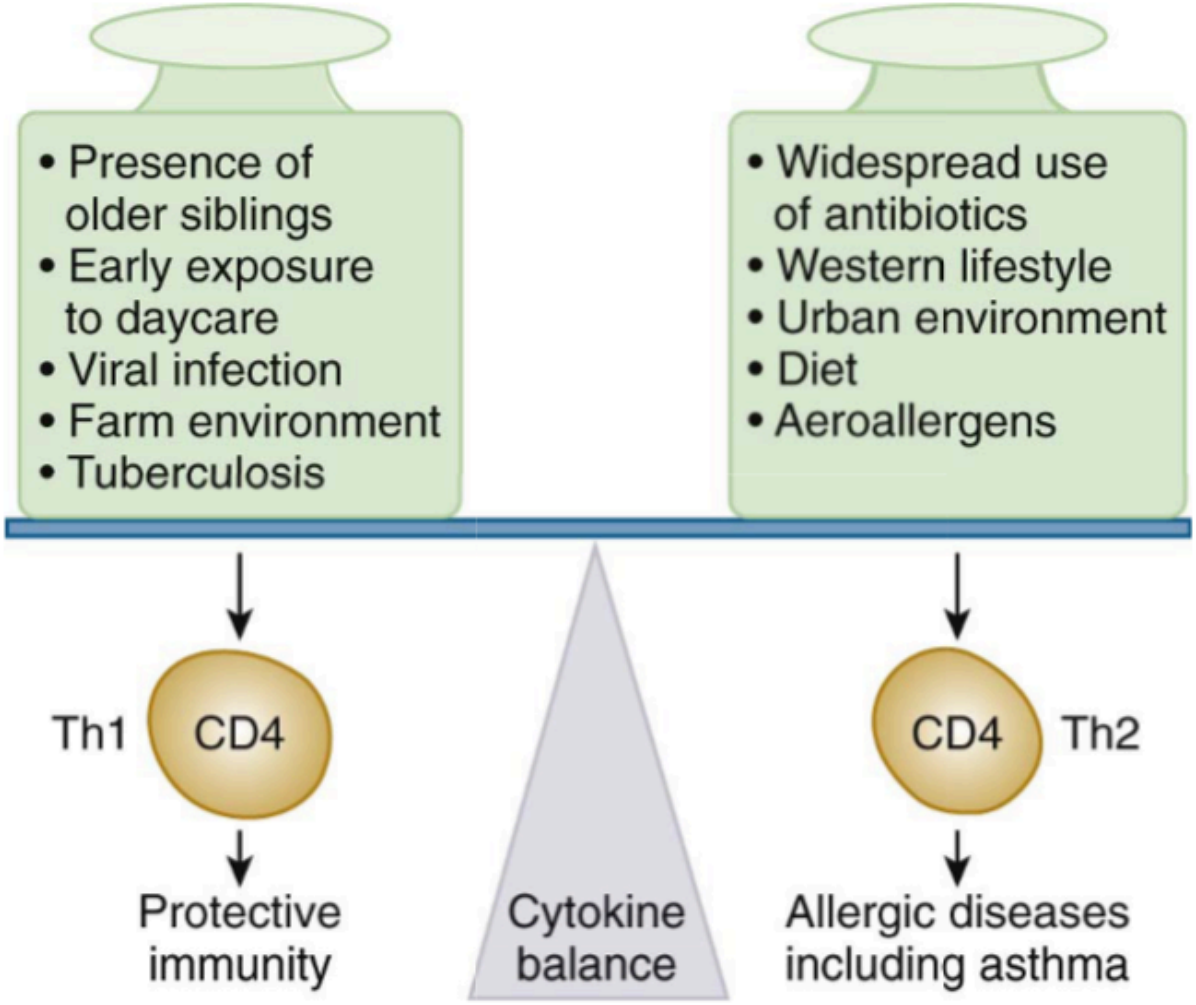
Etiology

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.

Causes

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

Cause - Hygiene Hypothesis

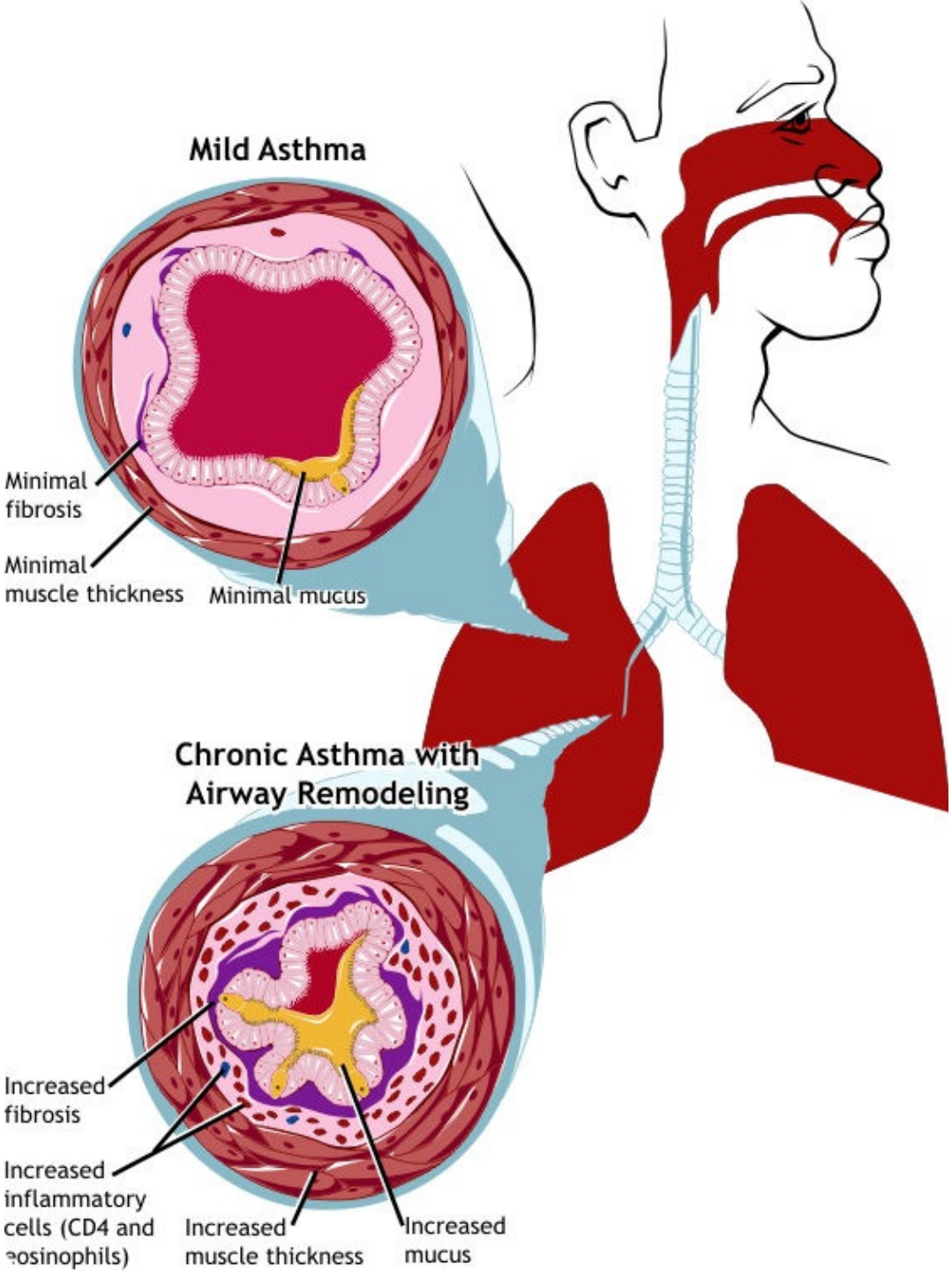


Airway Remodeling

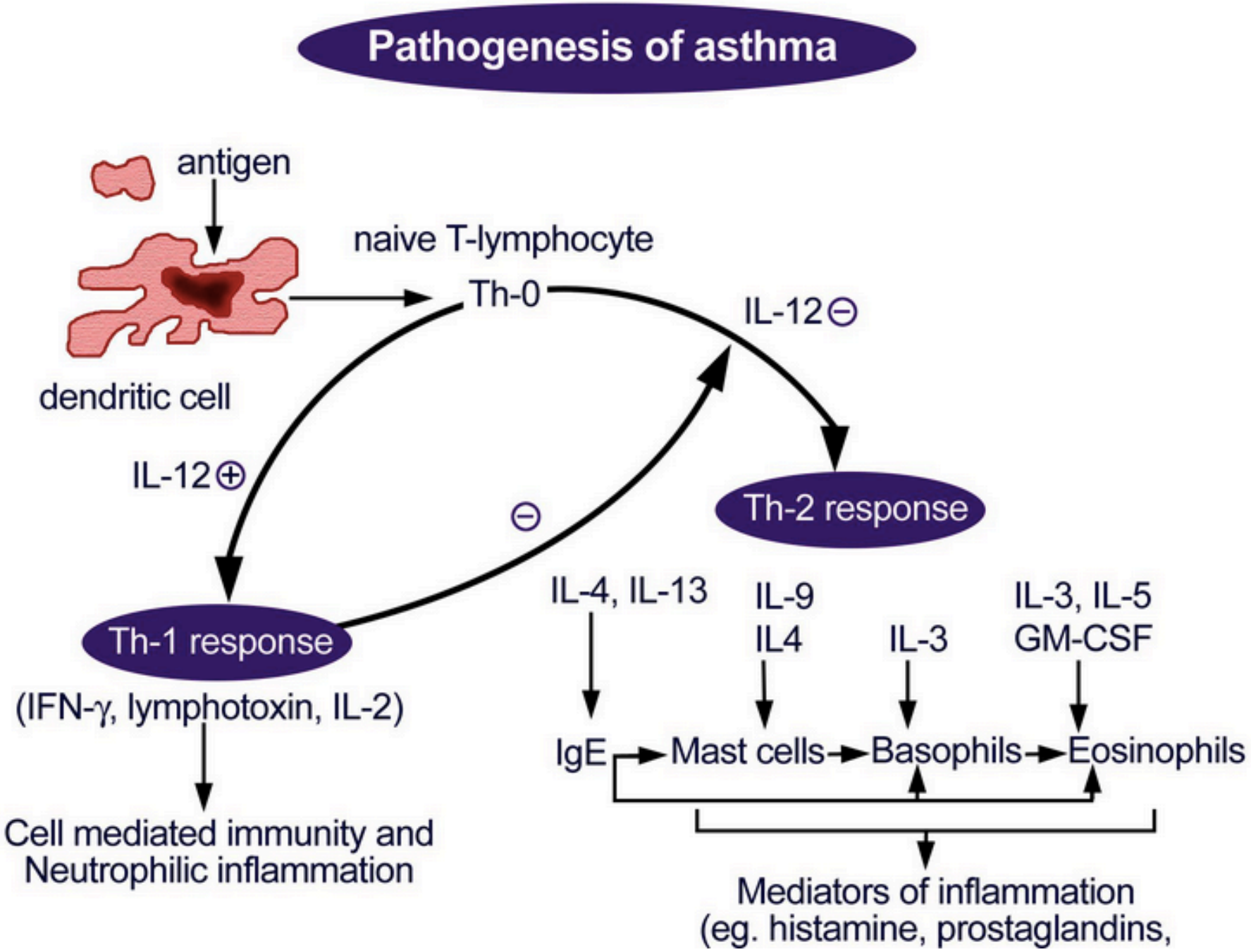
- Thickening of the **lamina reticularis** underneath the subepithelial basement membrane, is considered a hallmark of airway "remodeling"

The major pathologic changes

- Deposition of subepithelial collagen
- Smooth muscle hyperplasia (**Airway narrowing**)
- Proliferation / hyperplasia goblet cells / submucosal glands (**Mucus hypersecretion**)


Mild Asthma
Minimal fibrosis
Minimal muscle thickness
Minimal mucus
Chronic Asthma with Airway Remodeling
Increased fibrosis
Increased inflammatory cells (CD4 and eosinophils)
Increased muscle thickness
Increased mucus

Pathogenesis of asthma



Diagnosis

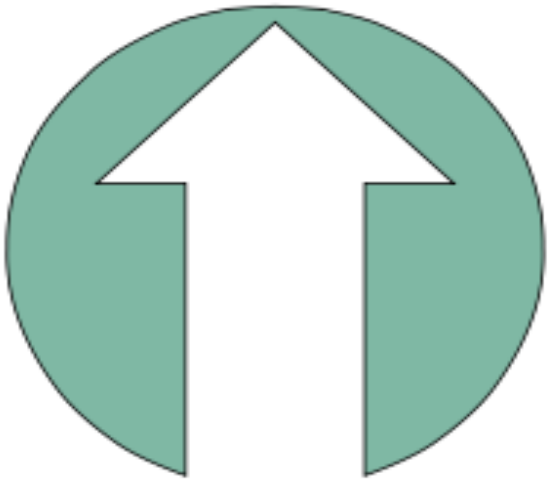
- History
- Examination
- Test

History

History High Probability

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 FEV_1 or PEF (historical or serial readings)
- Otherwise unexplained peripheral blood eosinophilia



History Low Probability

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

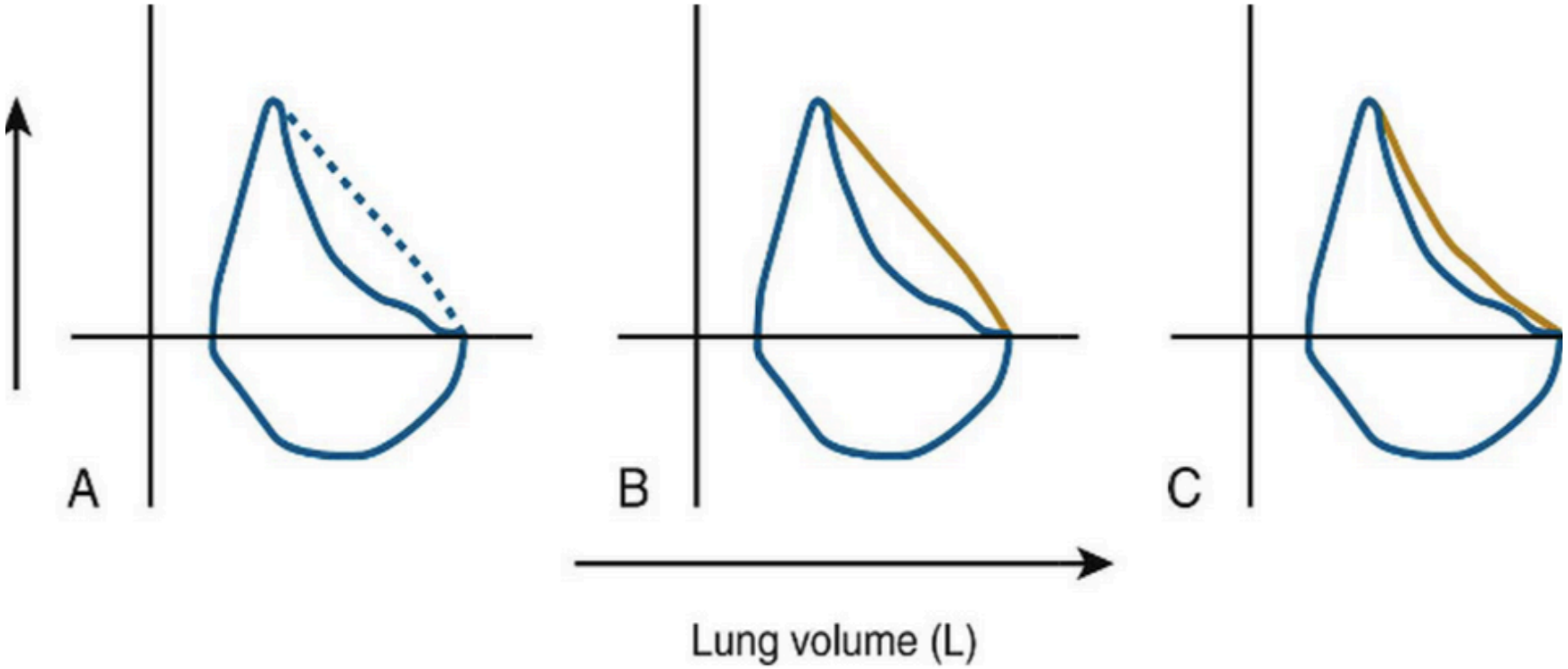
Usually if alternate Dx considered

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

Spirometry - Airflow obstruction

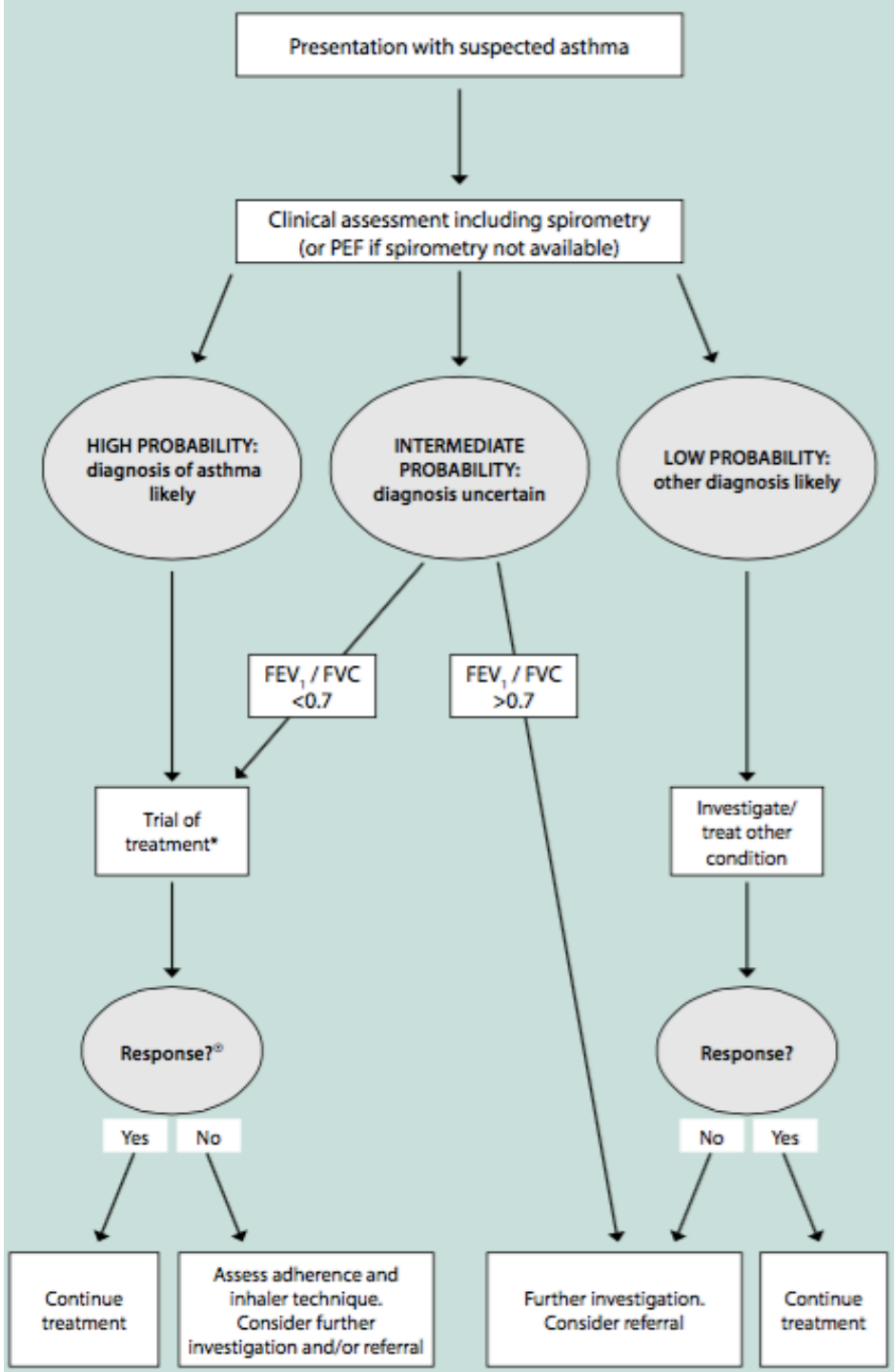
- Airflow obstruction is at least partially reversible
- **Reversibility** an increase in FEV1 of >200 mL and ≥12% from baseline after inhalation of short-acting beta2-agonist (SABA)

Lung Function



Peak Flow Meter

Diagnostic Approach


Presentation with suspected asthma
Clinical assessment including spirometry (or PEF if spirometry not available)
HIGH PROBABILITY: diagnosis of asthma likely
INTERMEDIATE PROBABILITY: diagnosis uncertain
LOW PROBABILITY: other diagnosis likely
FEV1 / FVC <0.7
FEV1 / FVC >0.7
Trial of treatment*
Investigate/ treat other condition
Response?®
Response?
Yes
No
No
Yes
Continue treatment
Assess adherence and inhaler technique. Consider further investigation and/or referral
Further investigation. Consider referral
Continue treatment

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Components of Asthma Management

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

Monitoring

- Symptoms
- Peak Flow (Home)
- Spirometry (Clinic)
- Novel 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 PEFR

Environmental Factors

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

Pharmacologic Treatment

- **Stepwise approach**

- **Reliever** Short Acting Beta agonist

Preventer

- **Steroids**
- LABA
- Theophylline
- Leukotriene's receptors Antagonist
- **Anti-IgE therapy**

Goals of Treatment

- Reduction of Impairment
- Reduction of Risk

Risk

Various adverse outcomes associated with asthma and its treatment (e.g. Exacerbations, lung function decline, medication side effects)

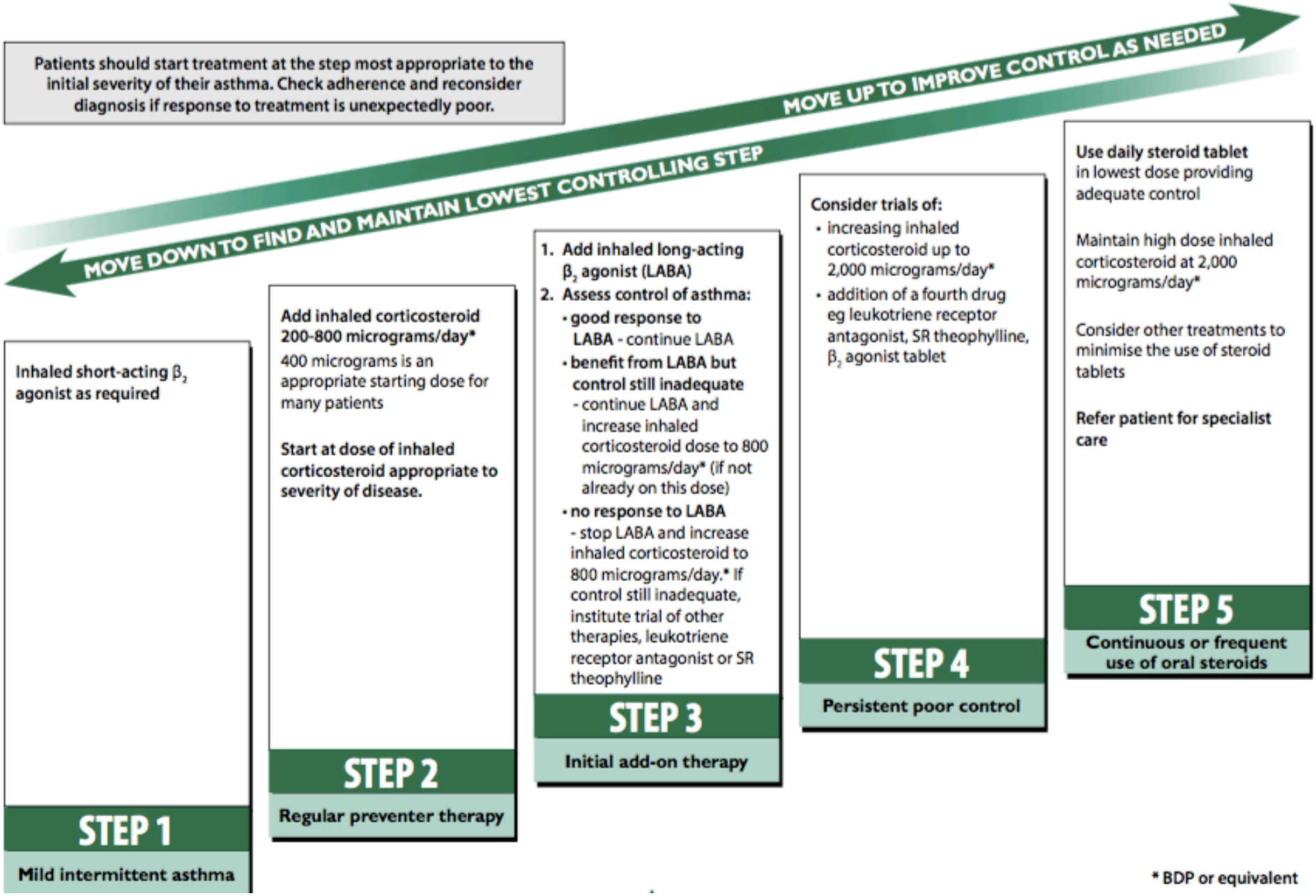
Components of Severity		Classification of Asthma Severity ≥12 years of age			
			Persistent		
		Intermittent	Mild	Moderate	Severe
Impairment **Normal FEV_1/FVC:** **8–19 yr 85%** **20 –39 yr 80%** **40 –59 yr 75%** **60 –80 yr 70%**	Symptoms	≤2 days/week	>2 days/week but not daily	Daily	Throughout the day
	Nighttime awakenings	≤2x/month	3–4x/month	>1x/week but not nightly	Often 7x/week
	Short-acting $beta_2$-agonist use for symptom control (not prevention of EIB)	≤2 days/week	>2 days/week but not daily, and not more than 1x on any day	Daily	Several times per day
	Interference with normal activity	None	Minor limitation	Some limitation	Extremely limited
	Lung function	• Normal FEV_1 between exacerbations • FEV_1 >80% predicted • FEV_1/FVC normal	• FEV_1 >80% predicted • FEV_1/FVC normal	• FEV_1 >60% but <80% predicted • FEV_1/FVC reduced 5%	• FEV_1 <60% predicted • FEV_1/FVC reduced >5%
Risk	Exacerbations requiring oral systemic corticosteroids	0–1/year (see note)	≥2/year (see note) →		
		← Consider severity and interval since last exacerbation. Frequency and severity may fluctuate over time for patients in any severity category. Relative annual risk of exacerbations may be related to FEV_1.			
Recommended Step for Initiating Treatment **(See figure 4–5 for treatment steps.)**		**Step 1**	**Step 2**	**Step 3** and consider short course of oral systemic corticosteroids	**Step 4 or 5**
		In 2–6 weeks, evaluate level of asthma control that is achieved and adjust therapy accordingly.			

Components of Control		Classification of Asthma Control (≥12 years of age)		
		Well Controlled	Not Well Controlled	Very Poorly Controlled
Impairment	Symptoms	≤2 days/week	>2 days/week	Throughout the day
	Nighttime awakenings	≤2x/month	1–3x/week	≥4x/week
	Interference with normal activity	None	Some limitation	Extremely limited
	Short-acting $beta_2$-agonist use for symptom control (not prevention of EIB)	≤2 days/week	>2 days/week	Several times per day
	FEV_1 or peak flow	>80% predicted/ personal best	60–80% predicted/ personal best	<60% predicted/ personal best
	Validated questionnaires ATAQ ACQ ACT	 0 ≤0.75* ≥20	 1–2 ≥1.5 16–19	 3–4 N/A ≤15
Risk	Exacerbations requiring oral systemic corticosteroids	0–1/year	≥2/year (see note)	
		Consider severity and interval since last exacerbation		
	Progressive loss of lung function	Evaluation requires long-term followup care		
	Treatment-related adverse effects	Medication side effects can vary in intensity from none to very troublesome and worrisome. The level of intensity does not correlate to specific levels of control but should be considered in the overall assessment of risk.		
Recommended Action for Treatment (see figure 4–5 for treatment steps)		• Maintain current step. • Regular followups every 1–6 months to maintain control. • Consider step down if well controlled for at least 3 months.	• Step up 1 step and • Reevaluate in 2–6 weeks. • For side effects, consider alternative treatment options.	• Consider short course of oral systemic corticosteroids, • Step up 1–2 steps, and • Reevaluate in 2 weeks. • For side effects, consider alternative treatment options.

*ACQ values of 0.76–1.4 are indeterminate regarding well-controlled asthma.
Key: EIB, exercise-induced bronchospasm; ICU, intensive care unit

A. Level of asthma symptom control

In the past 4 weeks, has the patient had:		**Well controlled**	**Partly controlled**	**Uncontrolled**
Daytime symptoms more than twice/week?	Yes☐ No☐			
Any night waking due to asthma?	Yes☐ No☐	None	1–2	3–4
Reliever needed* more than twice/week?	Yes☐ No☐	of these	of these	of these
Any activity limitation due to asthma?	Yes☐ No☐			


Patients should start treatment at the step most appropriate to the initial severity of their asthma. Check adherence and reconsider diagnosis if response to treatment is unexpectedly poor.
MOVE UP TO IMPROVE CONTROL AS NEEDED
MOVE DOWN TO FIND AND MAINTAIN LOWEST CONTROLLING STEP
Inhaled short-acting β2 agonist as required
STEP 1
Mild intermittent asthma
Add inhaled corticosteroid 200-800 micrograms/day*
400 micrograms is an appropriate starting dose for many patients
Start at dose of inhaled corticosteroid appropriate to severity of disease.
STEP 2
Regular preventer therapy
1. Add inhaled long-acting β2 agonist (LABA)
2. Assess control of asthma:
• good response to LABA - continue LABA
• benefit from LABA but control still inadequate - continue LABA and increase inhaled corticosteroid dose to 800 micrograms/day* (if not already on this dose)
• no response to LABA - stop LABA and increase inhaled corticosteroid to 800 micrograms/day.* If control still inadequate, institute trial of other therapies, leukotriene receptor antagonist or SR theophylline
STEP 3
Initial add-on therapy
Consider trials of:
• increasing inhaled corticosteroid up to 2,000 micrograms/day*
• addition of a fourth drug eg leukotriene receptor antagonist, SR theophylline, β2 agonist tablet
STEP 4
Persistent poor control
Use daily steroid tablet in lowest dose providing adequate control
Maintain high dose inhaled corticosteroid at 2,000 micrograms/day*
Consider other treatments to minimise the use of steroid tablets
Refer patient for specialist care
STEP 5
Continuous or frequent use of oral steroids
* BDP or equivalent

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

1. Sit up straight – don't lie down. Try to keep calm
2. Take one puff of my reliever inhaler every 30 to 60 seconds up to a maximum of 10 puffs
3. A) If I feel worse at any point while I'm using my inhaler
   B) If I don't feel any better after 10 puffs
   C) If I feel better: make an urgent same-day appointment with my GP or asthma nurse to get advice

CALL 999

Ambulance taking longer than 15 minutes?
Repeat step 2

If I feel better, and have made my urgent same-day appointment:
- Check if I've been given rescue prednisolone tablets
- If I have these I should take them as prescribed by my doctor or asthma nurse

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 Management

Acute Asthma Management

- Assess Severity
- Start appropriate treatment promptly
- Investigate CXR, FBC

MANAGEMENT OF ACUTE ASTHMA IN ADULTS

ASSESSMENT OF SEVERE ASTHMA

B **Healthcare professionals must be aware that patients with severe asthma and one or more adverse psychosocial factors are at risk of death.**

INITIAL ASSESSMENT

MODERATE ASTHMA

- increasing symptoms
- PEF >50-75% best or predicted
- no features of acute severe asthma

ACUTE SEVERE ASTHMA

Any one of:

- PEF 33-50% best or predicted
- respiratory rate ≥25/min
- heart rate ≥110/min
- inability to complete sentences in one breath

LIFE-THREATENING ASTHMA

In a patient with severe asthma any one of:

- PEF <33% best or predicted
- SpO_2 <92%
- PaO_2 <8 kPa
- normal $PaCO_2$ (4.6-6.0 kPa)
- silent chest
- cyanosis
- poor respiratory effort
- arrhythmia
- exhaustion, altered conscious level
- hypotension

NEAR-FATAL ASTHMA

Raised $PaCO_2$ and/or requiring mechanical ventilation with raised inflation pressures

MANAGEMENT OF ACUTE ASTHMA IN ADULTS

CRITERIA FOR ADMISSION

B	Admit patients with any feature of a life-threatening or near-fatal asthma attack.
B	Admit patients with any feature of a severe asthma attack persisting after initial treatment.
C	Patients whose peak flow is greater than 75% best or predicted one hour after initial treatment may be discharged from ED, unless there are other reasons why admission may be appropriate.

TREATMENT OF ACUTE ASTHMA

OXYGEN

C
- **Give supplementary oxygen to all hypoxaemic patients with acute severe asthma to maintain an SpO_2 level of 94-98%. Lack of pulse oximetry should not prevent the use of oxygen.**

A
- **In hospital, ambulance and primary care, nebulisers for giving nebulised β_2 agonist bronchodilators should preferably be driven by oxygen.**

STEROID THERAPY

A **Give steroids in adequate doses in all cases of acute asthma attack.**

✓ Continue prednisolone 40-50 mg daily for at least five days or until recovery.

OTHER THERAPIES

A **Nebulised magnesium is not recommended for treatment in adults with acute asthma.**

B **Consider giving a single dose of IV magnesium sulphate to patients with:**
- **acute severe asthma** (PEF <50% best or predicted) **who have not had a good initial response to inhaled bronchodilator therapy.**

✓ Magnesium sulphate (1.2-2 g IV infusion over 20 minutes) should only be used following consultation with senior medical staff.

B **Routine prescription of antibiotics is not indicated for patients with acute asthma.**

β_2 AGONIST BRONCHODILATORS

A **Use high-dose inhaled β_2 agonists as first line agents in patients with acute asthma and administer as early as possible. Reserve intravenous β_2 agonists for those patients in whom inhaled therapy cannot be used reliably.**

✓ In patients with acute asthma with life-threatening features the nebulised route (oxygen-driven) is recommended.

A **In severe asthma that is poorly responsive to an initial bolus dose of β_2 agonist, consider continuous nebulisation with an appropriate nebuliser.**

IPRATROPIUM BROMIDE

B **Add nebulised ipratropium bromide** (0.5 mg 4-6 hourly) **to β_2 agonist treatment for patients with acute severe or life-threatening asthma or those with a poor initial response to β_2 agonist therapy.**

REFERRAL TO INTENSIVE CARE

Refer any patient:
- requiring ventilatory support
- with acute severe or life-threatening asthma, who is failing to respond to therapy, as evidenced by:
  - deteriorating PEF
  - persisting or worsening hypoxia
  - hypercapnia
  - ABG analysis showing ↓ pH or ↑ H^+
  - exhaustion, feeble respiration
  - drowsiness, confusion, altered conscious state
  - respiratory arrest

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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

References

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