

Asthma

Asthma

- Intermittent

cough

shortness of breath

chest tightness

wheezing

Variable over time or reversible
with treatment

Asthma

- The cardinal features of asthma

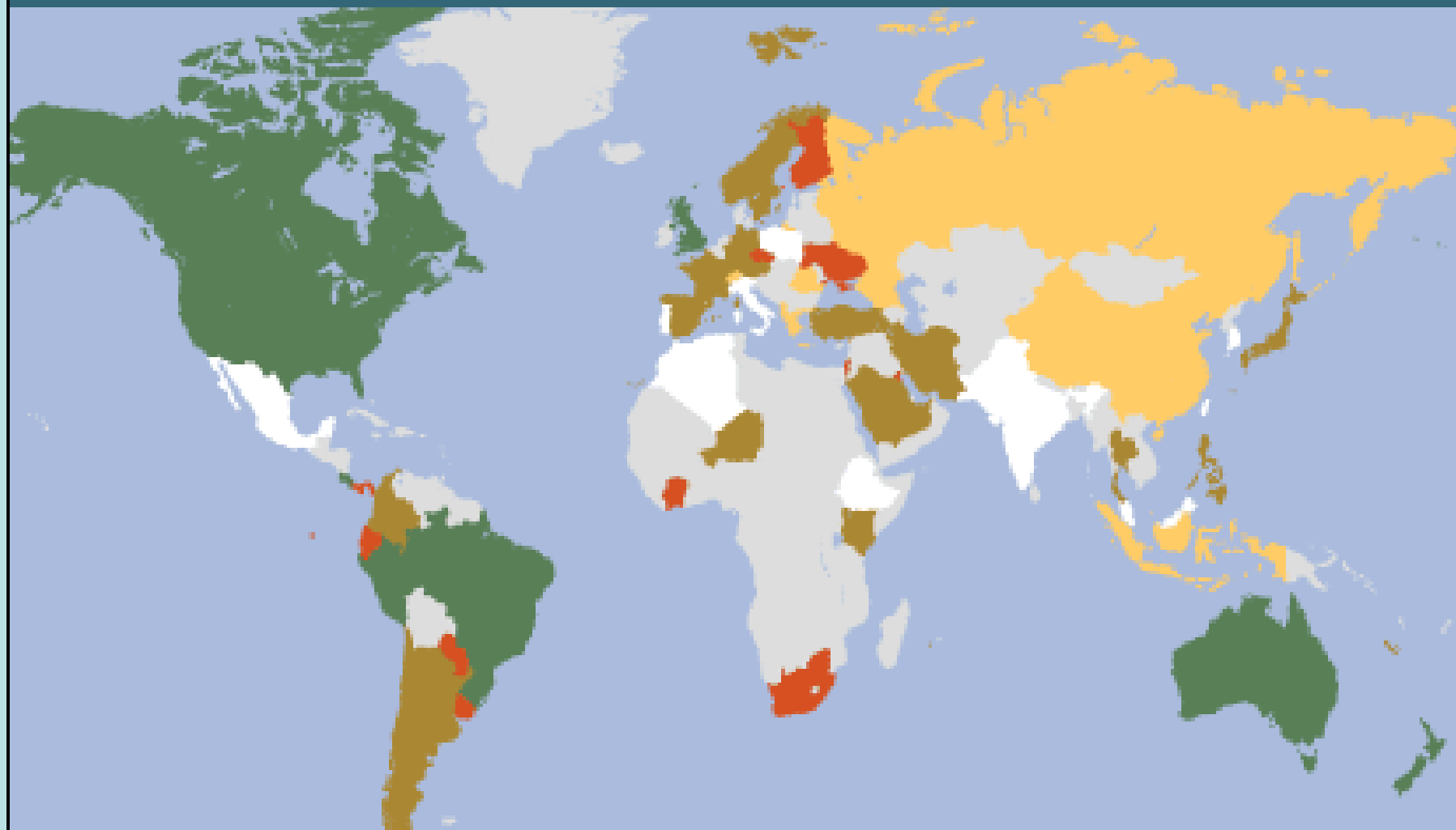
Chronic airway inflammation

Airway hyperreactivity

Epidemiology of asthma

- Asthma affects 5 - 10% of the population
- Around 300 million patients worldwide
- The incidence is increasing especially in developed countries

GLOBAL ASTHMA RATES



Percentage of the population affected.

10.1 +

5.1 - 7.5

0 - 2.5

7.6 - 10.0

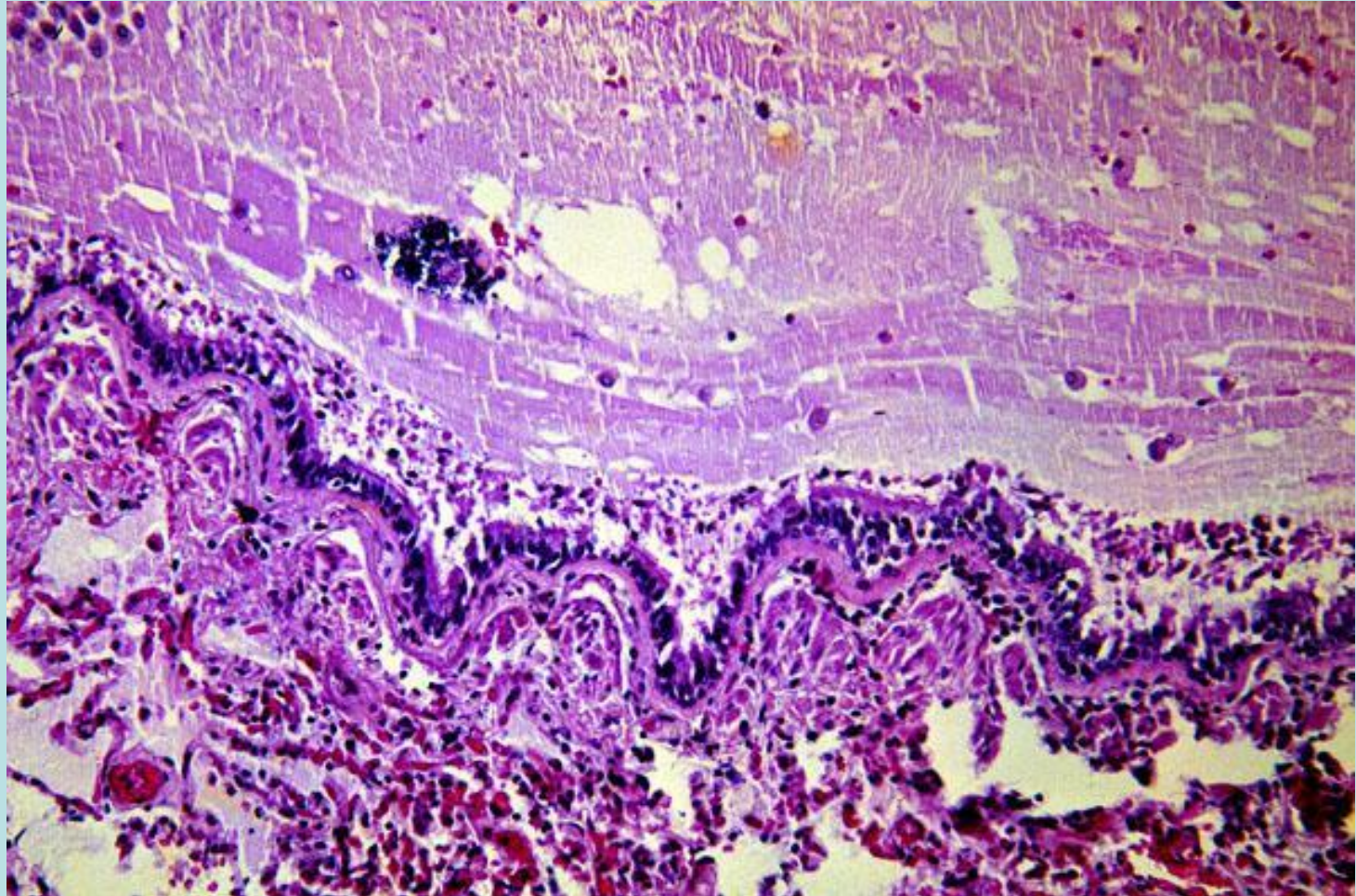
2.5 - 5.0

No standardised data available

Histopathology of asthma

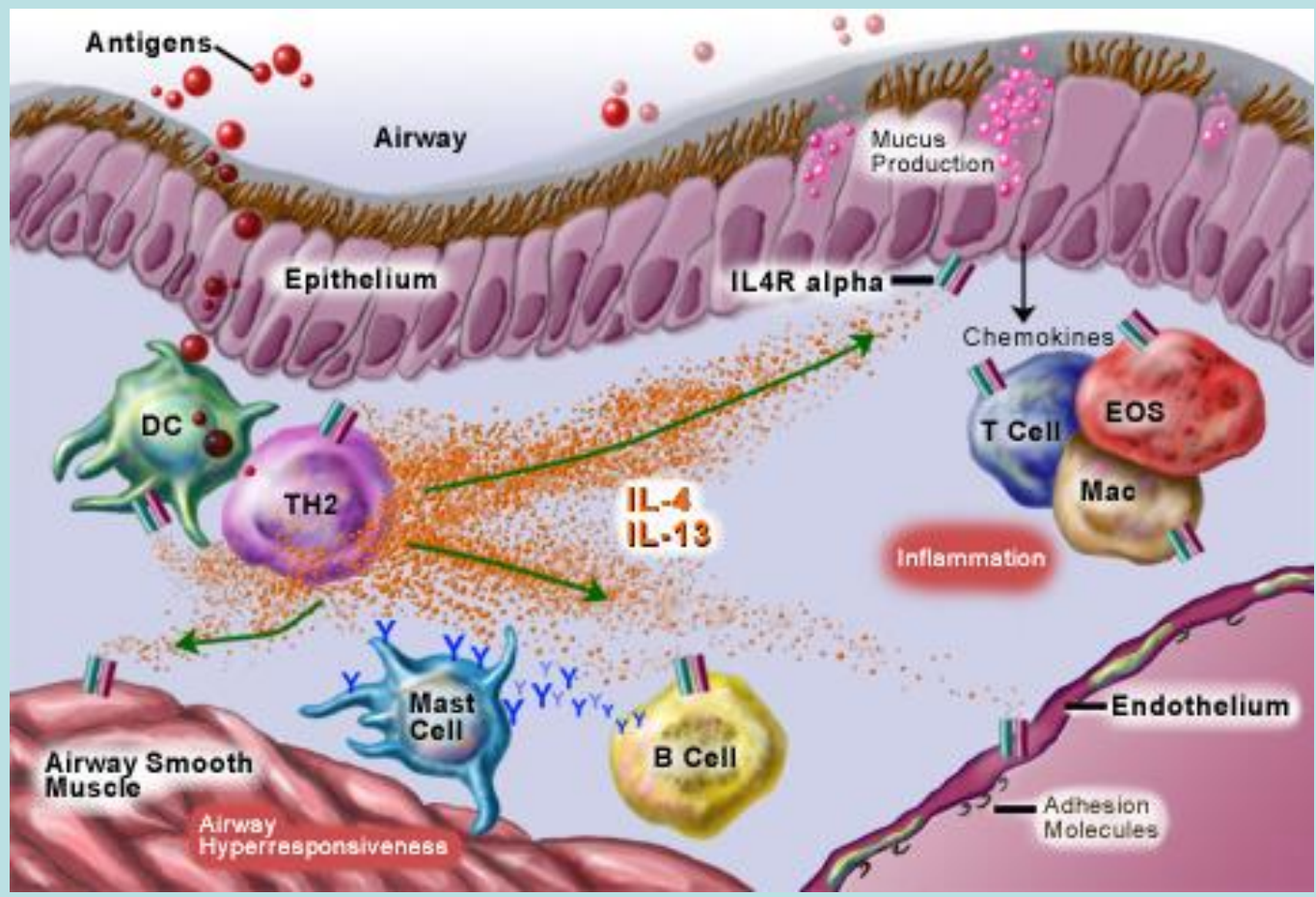
“Airway inflammation”

- Inflammatory cell infiltration
- Mucosal oedema
- Mucus gland hyperplasia
- Smooth muscle hypertrophy
- Epithelial damage
- Mucus plugging



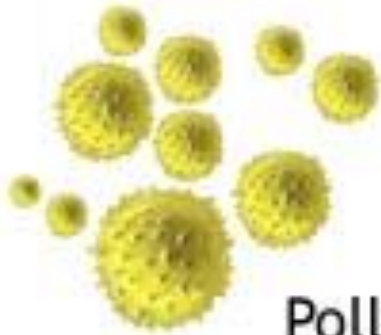
Inflammatory cells involved in the asthmatic airway inflammation

- Mast cells
- Eosinophils
- Neutrophils
- T lymphocytes (Th₂ phenotype)



Pathogenesis (Airway inflammation)

- In atopic patients, inhaled allergens interact with mucosal mast cells, via IgE dependant mechanism.
- Common examples of these allergens include house dust mites, pet's dander (such as cats and dogs), pests (such as cockroaches and fungi) and pollens.



Pollen



Dust mites



Mold



Pet dander

Pathogenesis (Airway inflammation)

- In patients with persistent asthma, complex interaction between inflammatory cells is characteristic.
- Eosinophils are increased in the asthmatic airways during active disease.
- Neutrophils also increase during exacerbations and they tend to predominate in patients with severe persistent asthma.
- T lymphocytes are also involved in asthma pathogenesis, where Th2 subtype predominates.

Pathogenesis

- In aspirin-sensitive asthma, aspirin inhibit cyclo-oxygenase, shunting arachidonic acid metabolism through lipo-oxygenase pathway, resulting in the production of leukotrienes
- In exercise-induced asthma, hyperventilation result in water loss from the respiratory mucosa, triggering mediator release.

Pathogenesis (Airway hyperreactivity)

- Airway hyperreactivity is related to airway inflammation, which means exaggerated bronchoconstriction in response to triggers that have little or no effect in normal individuals, like histamine, methacholine and mannitol.
- Airway limitation (obstruction) results from both airway inflammation and airway hyperreactivity, and is typically reversible, spontaneously or with treatment.

Pathology of asthma (Airway remodeling)

- Long standing severe asthma
- Structural alteration of the airways including fibrosis
- Fixed narrowing of the airways
- Reduced response to bronchodilators

Aetiology of asthma

Environmental factors:

- Protect:

Childhood infections (including parasitic infections), living in large families, living on farm

- Predispose:

Respiratory syncytial virus infection, allergen exposure, indoor pollution and dietary deficiency of antioxidants

Genetic factors

Clinical features of asthma

A disease of variable presentation

Typical picture:

- Recurrent episodes of cough, chest tightness, breathlessness, and wheezing
- Attacks are reversible spontaneously or with treatment
- Triggered by allergens, exercise, infections, cold air, and dust
- Diurnal pattern of symptoms (morning dipping)

Clinical features of asthma

- Examination may show evidence of airway obstruction (prolonged expiration and wheezing).
- Nasal polyps and eczema may be present.
- Although some patients are asymptomatic in between the attacks (intermittent asthma), many others have continuous wheezing and breathlessness (persistent asthma), but variability is usually present with symptoms fluctuating in severity over time

Clinical features of asthma

- Nocturnal asthma
- Cough variant asthma
- Drug induced asthma
 - aspirin and NSAIDs
 - β blockers
- Occupational asthma

Occupational asthma

- "Occupational asthma" is the most common occupational lung disease. It is defined as asthma which is related to work environment.
- Common examples include isocyanates, flour and wood dust, latex, paint spray and animals.
- Occupational asthma should be suspected if symptoms are worse during working hours and improves on weekends and holidays.

Diagnosis of asthma

Clinical diagnosis (based on history) + demonstrating reversible airway obstruction

Pulmonary function tests:

Spirometry: improvement of FEV1 > 15% (and 200 ml) after bronchodilator therapy

PEF (20% diurnal variation)

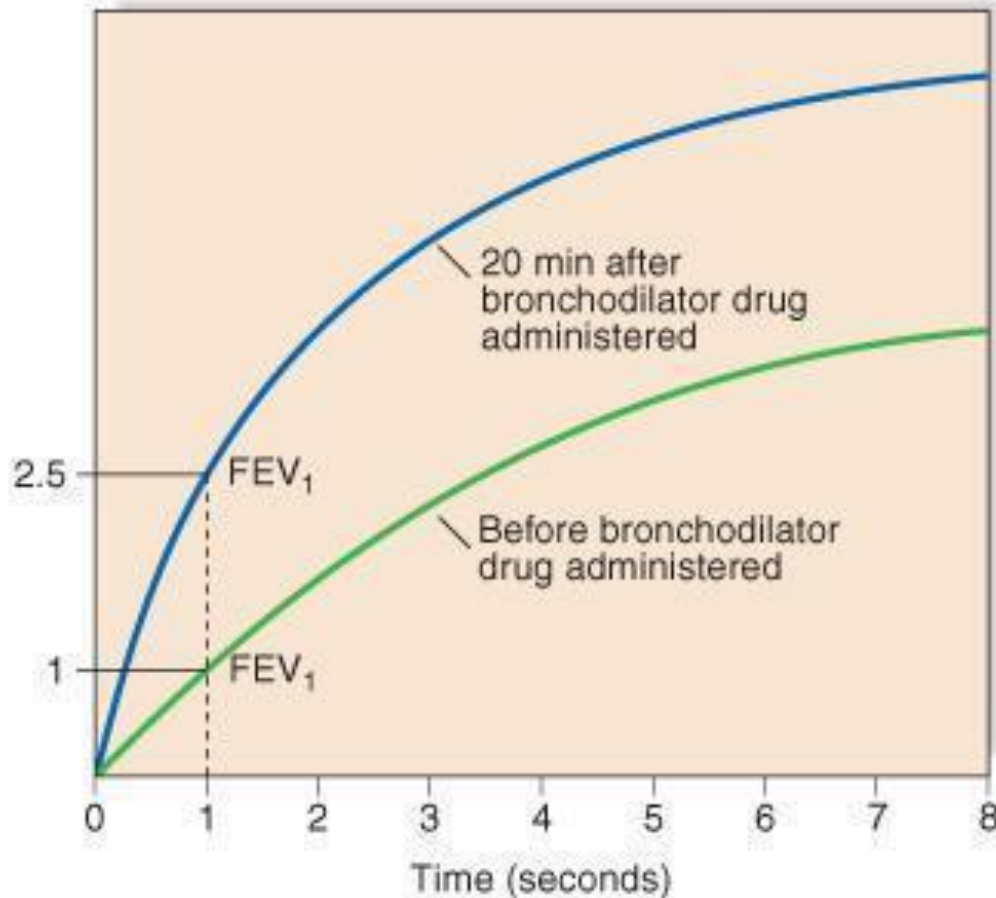
Testing airway hyperreactivity

Exercise test (>15% decrease in FEV1 after 6 min. exercise)

Spirometry



Volume expired (litres)



دكتور
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موقع طلاب الطب في جامعة دمشق

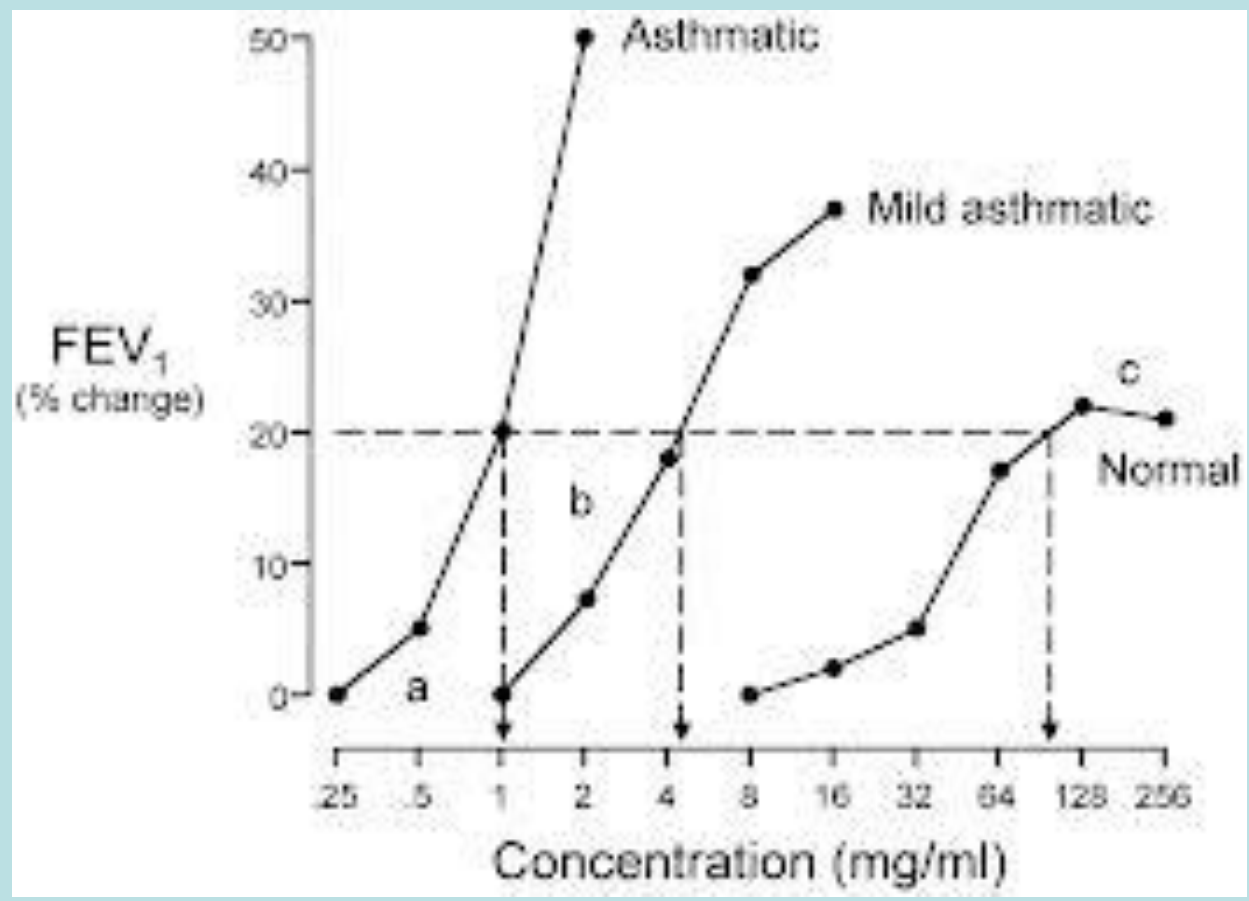
Elsevier. Boon et al.: Davidson's Principles and Practice of Medicine 20e - www.studentconsult.com

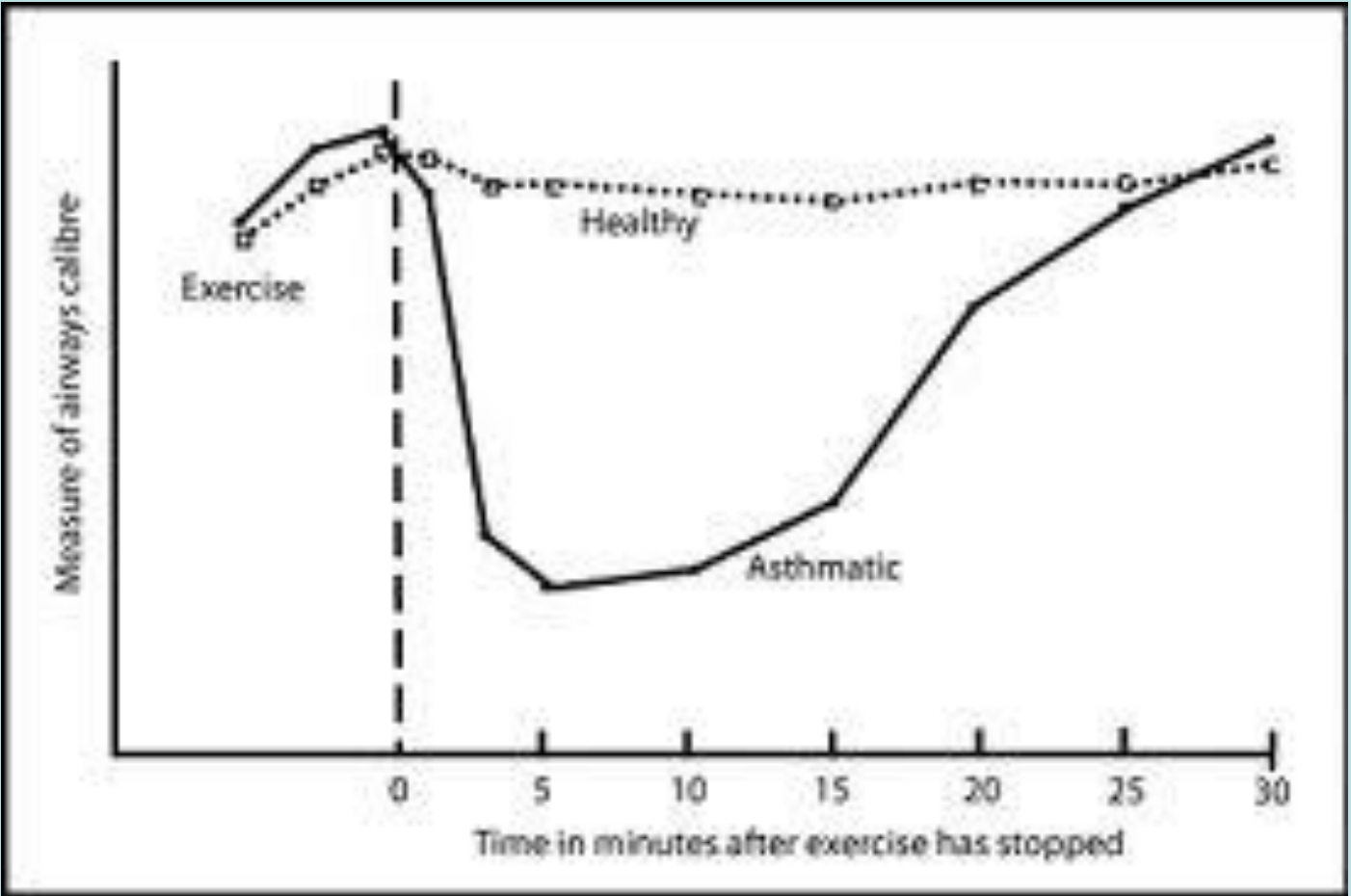
Reversibility Test: Forced expiratory manoeuvres before and 20 minutes after inhalation of a Beta-2 adrenoceptor agent. Note the increase in FEV1 from 1.0 to 2.5 litres.

اختبار العكوسية: يقوم المريض هنا بالقيام بمناورة لتسجيل الجريان الزفيرى الأعظمى قبل وبعد 20 دقيقة من أخذ مشابهة لمستقبلات بيتا-2 الأدرنرجية. لاحظ الزيادة في الجريان الزفيرى الأعظمى خلال الثانية الأولى من 1 إلى 2.5 لترات.

Peak expiratory flowmeter







Other investigation in bronchial asthma

- Blood gas analysis
- Chest X - ray
- Allergy testing

<p>Mild Intermittent (Step 1)</p>	<p>Symptoms \leq 2 times a week Asymptomatic between exacer.</p>	<p>Nocturnal symptoms \leq 2 times a month</p>	<p>FEV1 \geq 80% predicted</p>
<p>Mild Persistent (step 2)</p>	<p>Symptoms $>$ 2 times a week, but less than daily</p>	<p>Nocturnal symptoms $>$ 2 times a month but less than weekly</p>	<p>FEV1 \geq 80% predicted</p>

<p>Moderate persistent (step 3)</p>	<p>Daily symptoms Exacerb. \geq twice a week</p>	<p>Nocturnal symptoms \geq 1 time a week</p>	<p>FEV1 60 - 80% predicted</p>
<p>Severe persistent (step 4 & 5)</p>	<p>Continual symptoms, frequent exacerb.</p>	<p>Nocturnal symptoms frequent</p>	<p>FEV1 \leq 60% predicted</p>

Management of stable asthma

Patient education

- Nature of their disease
- Difference between various medication
- Technique of inhaler use
- Use of PEF as a guide to severity



Management of stable asthma

Avoidance of aggravating factors

- Occupational asthma
- Household pets (animal dander allergy)
- House dust mite
- Cockroaches
- Fungi

Management of stable asthma

Drug therapy

Step 1 “mild intermittent asthma”
(Occasional use of inhaled short acting
 β_2 agonists)

No acute severe attack over 2 years

Inhaled short acting β_2 agonist
inhaler (salbutamol) on as-required
basis only

Management of stable asthma

Drug therapy

Step 2: "persistent asthma" (Introduction of regular (preventive) therapy)

- Acute exacerbation last 2 years
- Symptoms 3 times weekly
- Nocturnal asthma 3 times monthly

Inhaled SABA as-required +

Inhaled corticosteroid (ICS) on regular
basis (250 µg twice daily) (small
dose ICS)

Management of stable asthma

Drug therapy

Step 3: (Add-on therapy)

Review: adherence, inhaler technique and co-morbidity

Increase the dose of inhaled corticosteroid to 1000 μ g daily (moderate dose ICS) and/or add-on

- Inhaled LABA (salmeterol or formoterol) OR
- Leukotriene receptor antagonist (montelukast) OR
- Theophylline

Management of stable asthma

Drug therapy

Step 4: (Poor control on moderate dose ICS and add-on therapy: addition of a fourth drug)

- Increase ICS to 2000 μg daily (high dose ICS)
- Combine the choices mentioned in step 3 and long acting oral β_2 agonist
- Monoclonal antibodies against IgE (omalizumab)

Management of stable asthma

Drug therapy

Step 5: (Continuous or frequent use of oral corticosteroids)

Continuous daily doses of oral steroids
(single morning dose)

Frequent courses of oral steroids

Notes:

- Keep the minimal dose
- Prescribe bisphosphonate

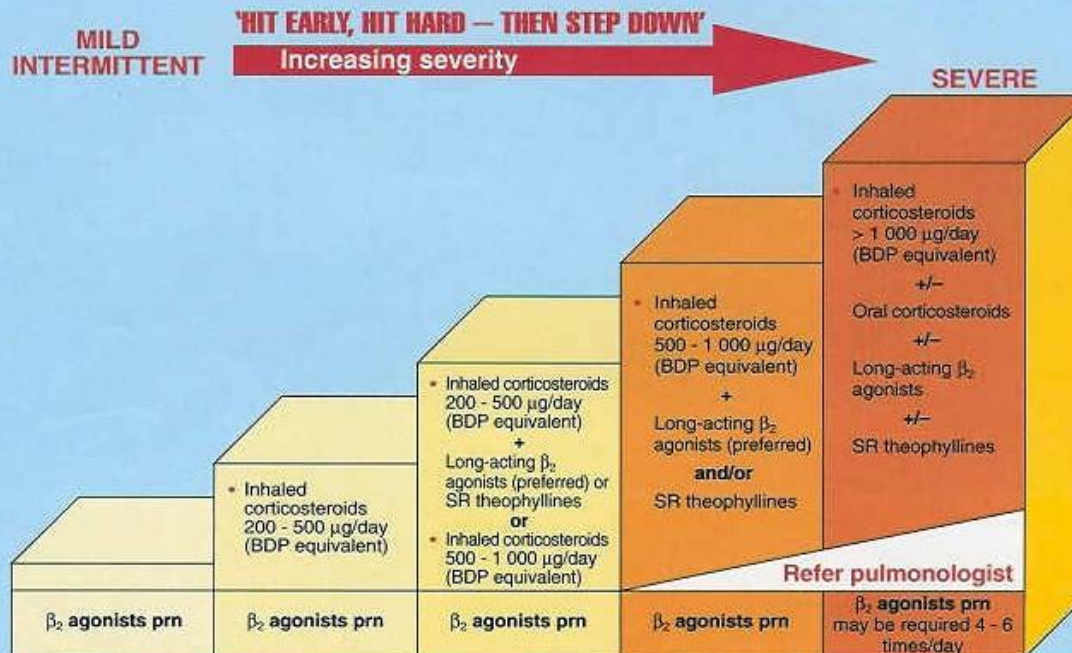
Role of bronchial thermoplasty

Newer approaches

CLASSIFY SEVERITY AT PRESENTATION

	Intermittent	Persistent		
		Mild	Moderate	Severe
Category	I	II	III	IV
Daytime symptoms	≤ 2/week	2 - 4/week	> 4/week	Continuous
Night-time symptoms	≤ 1/month	2 - 4/month	> 4/month	Frequent
PEF (predicted)	≥ 80%	≥ 80%	60 - 80%	< 60%

START TREATMENT AT MOST APPROPRIATE STEP



Refer pulmonologist

Step down:

- When treatment aims are achieved:
 - Not sooner than 3 months
 - Reduce or stop oral steroids first

Step up:

- If uncontrolled at any severity level
- Consider pulse of oral steroids: prednisone 30 - 40 mg/day for 7 - 14 days at any time to gain rapid control

Leukotriene receptor antagonists: Pending further data on long-term efficacy, leukotriene receptor antagonists should be used in combination with inhaled corticosteroids.

Management of stable asthma

Drug therapy

Step down therapy:

Once control is achieved, a step down approach is followed every 3 months keeping the smallest dose sufficient to maintain effective control.

Asthma in pregnancy

- Asthma follows an unpredicted course in pregnancy (one third improve, one third worsen and one third remain unchanged).
- All drugs including oral prednisolone are safe.
- Prostaglandins are bronchoconstrictors and should not be used to induce labour.
- Breast feeding should continue.
- Uncontrolled asthma represents the greatest danger to the mother and foetus.

Mild to moderate exacerbation

- Progressively worsening PEF records
- Onset of nocturnal asthma
- Persistent of morning dipping to mid-day
- Diminished response to bronchodilators

Severe exacerbation of asthma

Acute severe asthma

- Severe dyspnoea
- Unability to complete a sentence in one breath
- Tachycardia (> 110 / min)
- Tachypnoea (> 25 / min)
- PEF is 33%–50% of predicted (less than 200 L/min).
- PaO₂ (and SpO₂) is usually normal, but PaCO₂ is low

Acute exacerbation of asthma

Life threatening asthma

- Inability to speak
- Cyanosis
- Exhaustion
- Confusion
- Bradycardia
- Silent chest
- PEF is less than 33% predicted (less than 100 L/min).
- SpO₂: <92% (PaO₂ <60 mmHg). PaCO₂: normal or raised.



Treatment of severe exacerbations of asthma

- High concentration oxygen is administered to maintain oxygen saturation (SpO₂) above 93%.
- High dose nebulized bronchodilators: β 2 agonist (salbutamol 2.5 - 5 mg) repeated within 30 minutes, which can be combined with nebulized ipratropium bromide (anticholinergic)
- Systemic corticosteroids as IV hydrocortisone 200 mg or oral prednisolone 40 -60 mg.
- Consider IV Magnesium sulphate (1.2 - 2.0 gm/20 min.), or aminophylline (5 mg/Kg over 20 minutes loading, then 1mg/Kg/hr infusion)
- Ventilatory support

Treatment of severe exacerbations of asthma (Ventilatory support)

- Ventilatory support (endotracheal intubation and mechanical ventilation) is needed if life threatening asthma persists despite adequate therapy.
- Indications: coma, respiratory arrest, extreme exhaustion and deterioration of blood gas results.

Treatment of severe exacerbations of asthma (pre-discharge arrangements)

- The patient is discharged when he is stable with PEF more than 75% predicted.
- Short course of oral corticosteroids should be prescribed with optimization of his medication and managing any possible trigger factors.

Treatment of severe exacerbations of asthma (prognosis)

- The outcome of acute severe asthma is generally good, death is rare.
- Failure to recognize the severity of an attack contributes to undertreatment or treatment delay.