



Chronic Obstructive Pulmonary Disease (COPD)

Abtahi H, MD

Imam Khomeini Medical Center

Tehran University of Medical Sciences

Disclaimer:

- This webinar is organized by Iranian Society of Internal Medicine in collaboration with Cobel Darou.
- The presentations are fully scientific and do not contain promotional contents.
- I have not received any speaker fee for this presentation.
- The CME responsibility is not with Cobel Darou.
- The content liability is with Iranian Society of Internal Medicine
- Adverse event reporting and Medical Information queries for Cobel Darou GSK marketed products will be sent to Cobel Darou via the link at the final slide.

Obstructive Lung Diseases

➤ Pulmonary disorders characterized by airflow limitation

✓ Common entities

- Chronic Obstructive Pulmonary Disease (COPD)
- Asthma
- Bronchiectasis (In some cases)
- Cystic Fibrosis

✓ Less Common entities

- Bronchiolitis Obliterans
- Bronchopulmonary dysplasia (newborn)
- Localized intrathoracic tracheal/bronchial obstruction
 - Neoplasms, Extrinsic compression, Granulomatous disease, Malacic lesions, Trauma,...

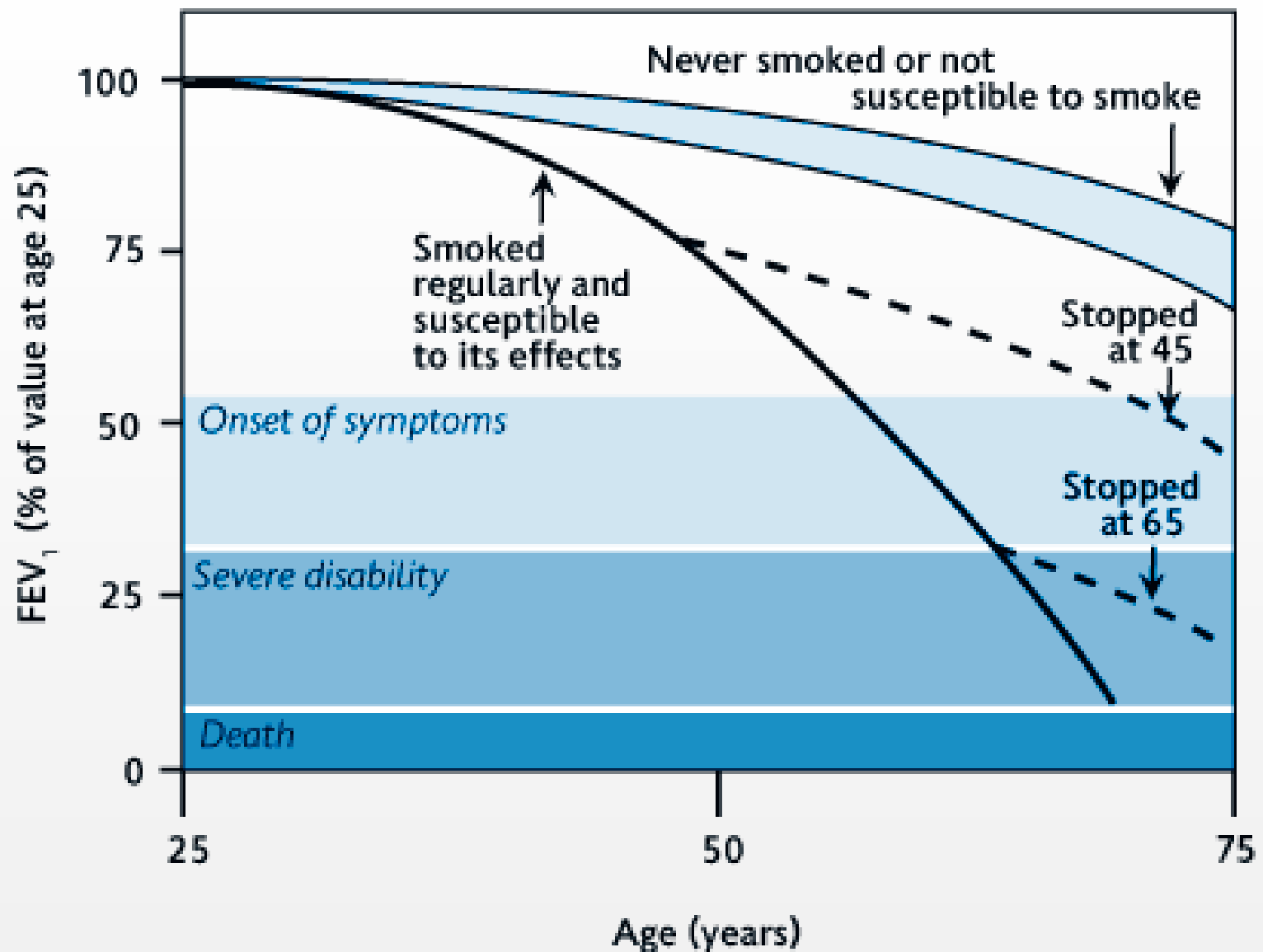
COPD Definition

- COPD is a chronic lung disease *characterized by chronic respiratory symptoms (dyspnea, cough, expectoration, and/or exacerbations) and expiratory airflow limitation that is not fully reversible*
- The airflow limitation is usually progressive and associated with abnormalities of the airways (bronchitis, bronchiolitis) and/or alveoli (emphysema)

COPD Definition

- Expiratory airflow limitation
- Abnormalities of the airways (bronchitis, bronchiolitis) and/or alveoli (emphysema)
- Smoking or other noxious materials

FEV₁ change in susceptible smokers & nonsmokers



Chronic Bronchitis (Gross Pathology)

Normal bronchi



Bronchitis



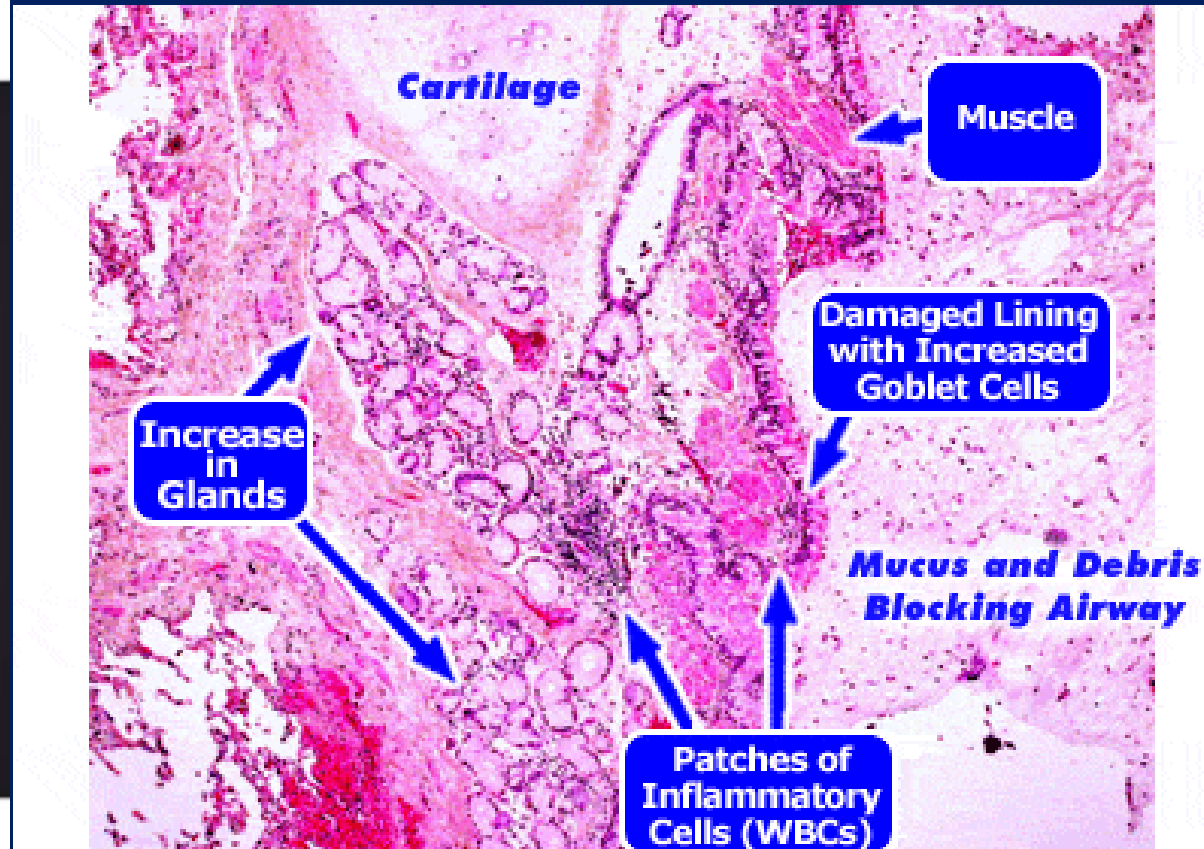
Chronic Bronchitis (Pathology)

Normal Airway



Ciliated Epithelium

Serous > Mucous

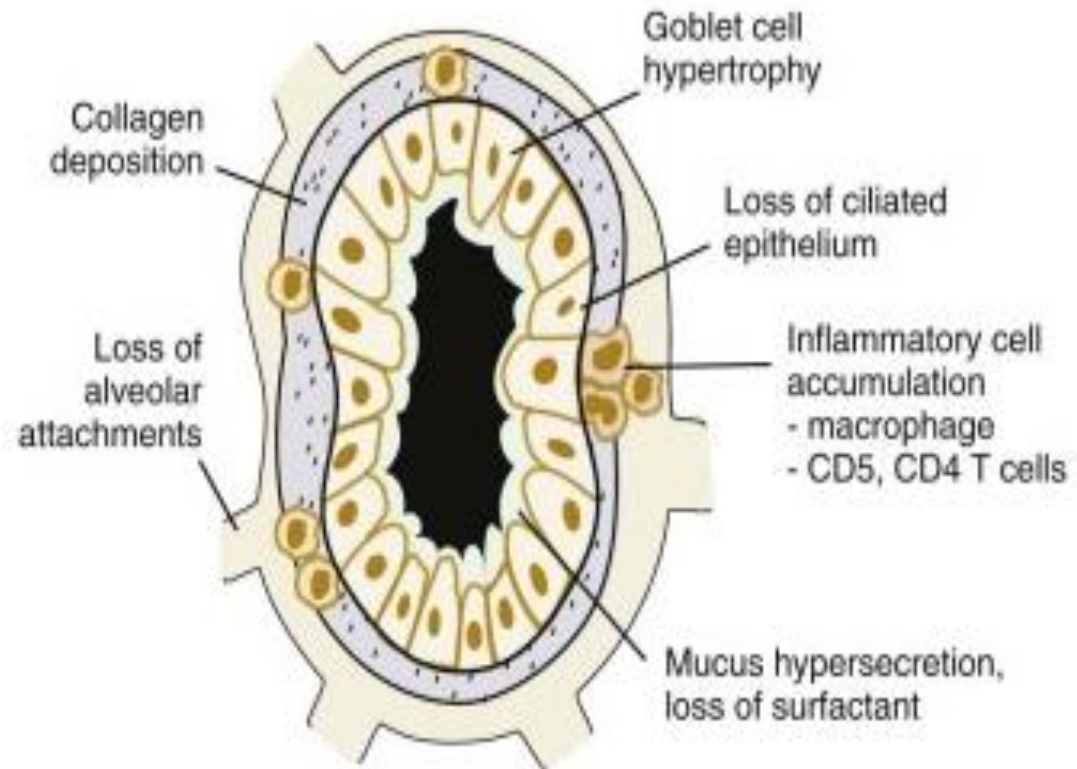


Small airway changes in COPD

Normal Small Airway
($< 2\text{mm}$)

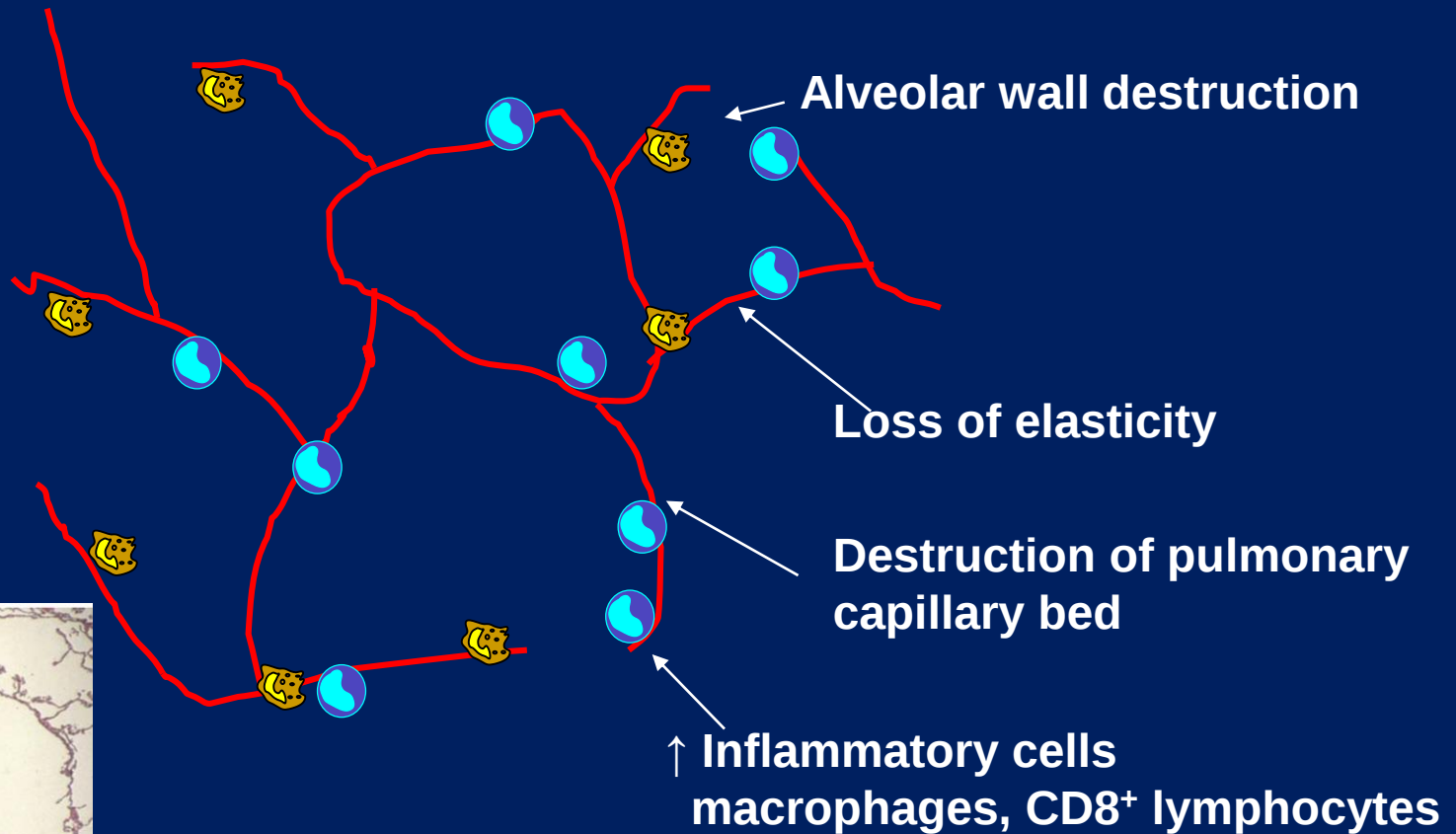
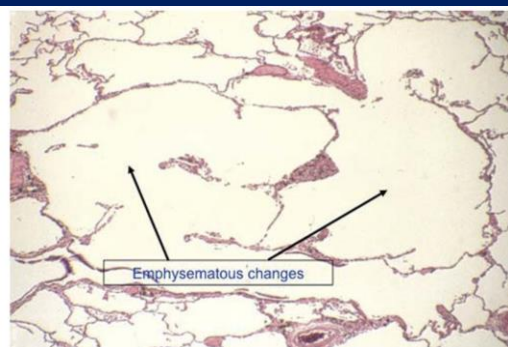
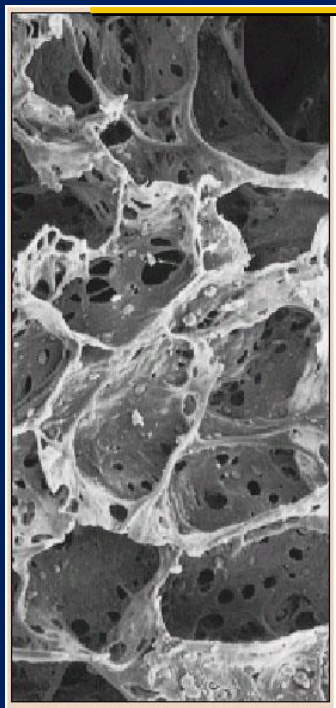


Small Airway in COPD



Source: Murray 2010

Emphysematous changes in COPD



Small airway collapse in emphysema

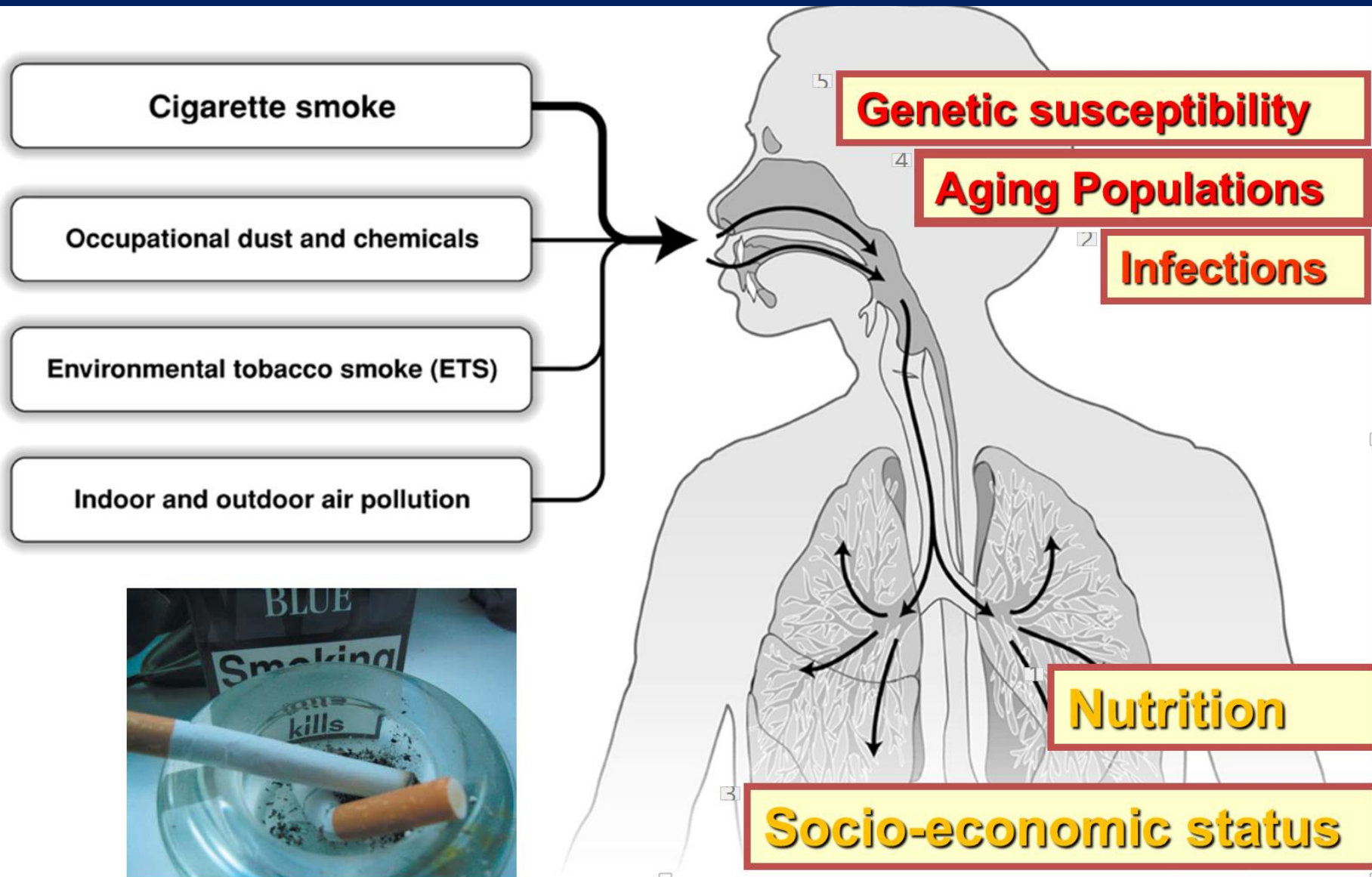


Normal small airway with alveolar attachments.



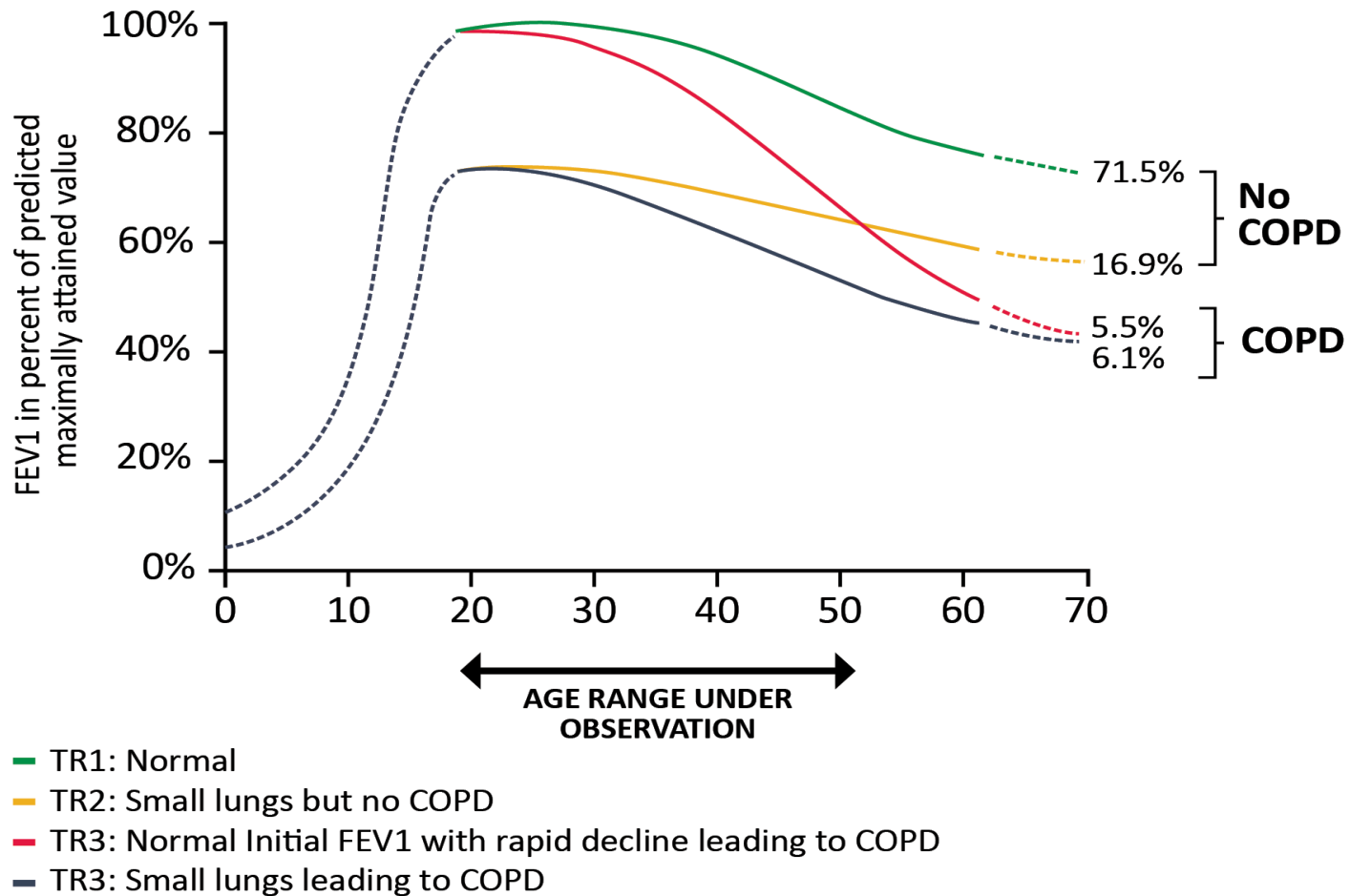
Emphysematous airway with loss of alveolar walls, enlargement of alveolar spaces, and decreased alveolar wall attachment

Risk Factors for COPD



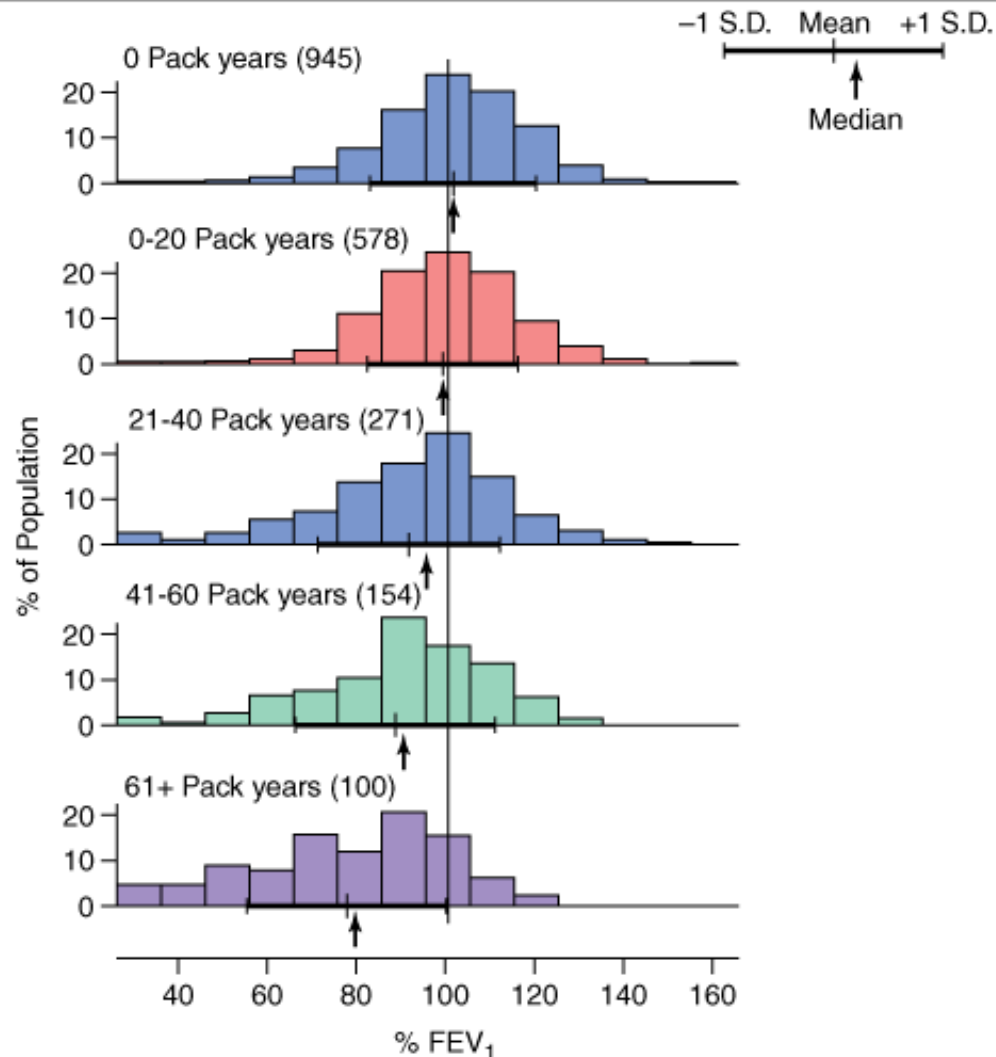
FEV1 Trajectories (TR) Over the Life Course

Figure 1.1

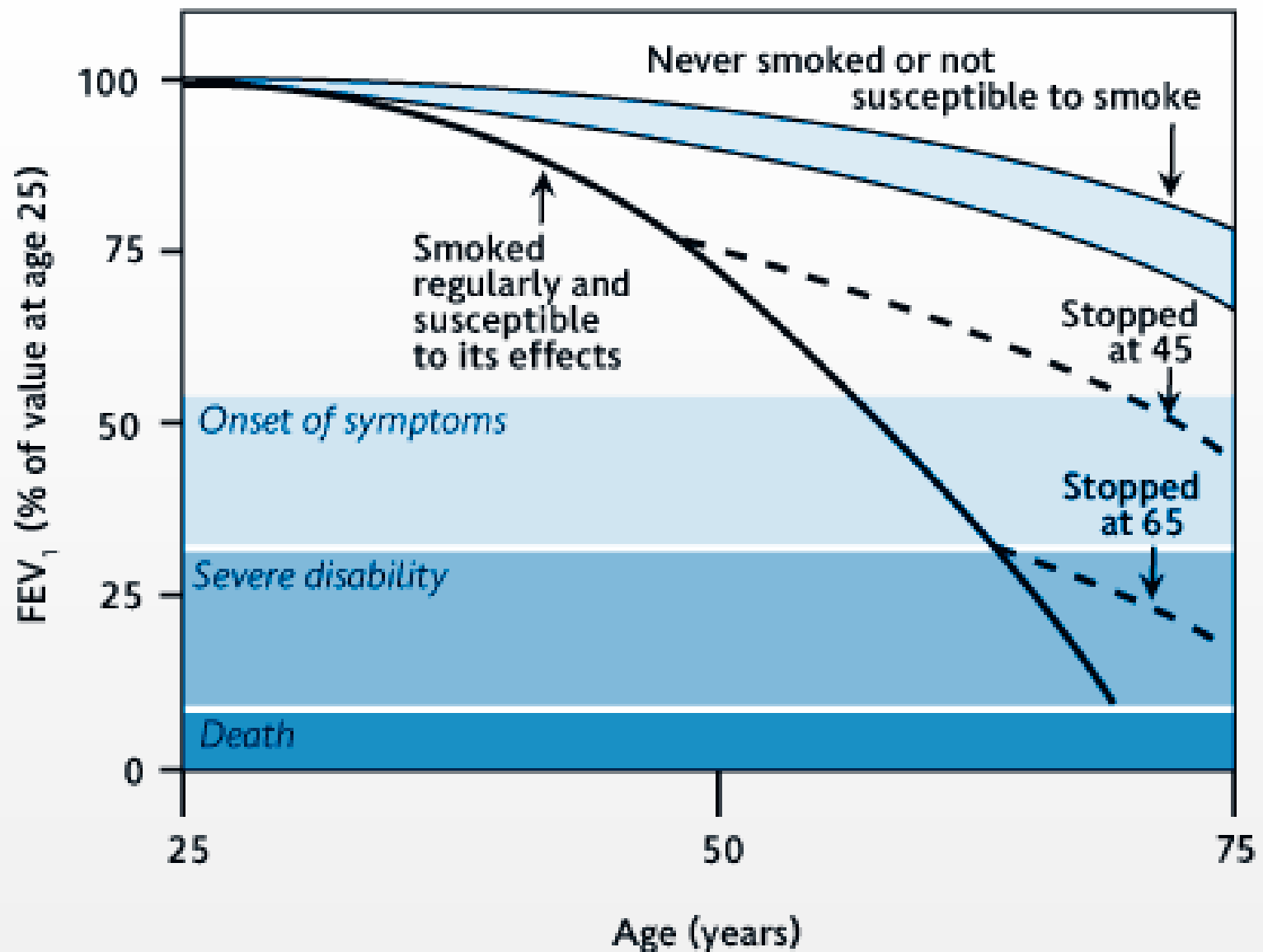


Note: This is a simplified diagram of FEV1 progression over time. In reality, there is heterogeneity in the rate of decline in FEV1 owing to the complex interactions of genes with environmental exposures and risk factors over an individual's lifetime [adapted from Lange et al. NEJM 2015;373:111-22].

Distribution of FEV₁ values (% predicted) Vs. Pack- year smoking



FEV₁ change in susceptible smokers & nonsmokers

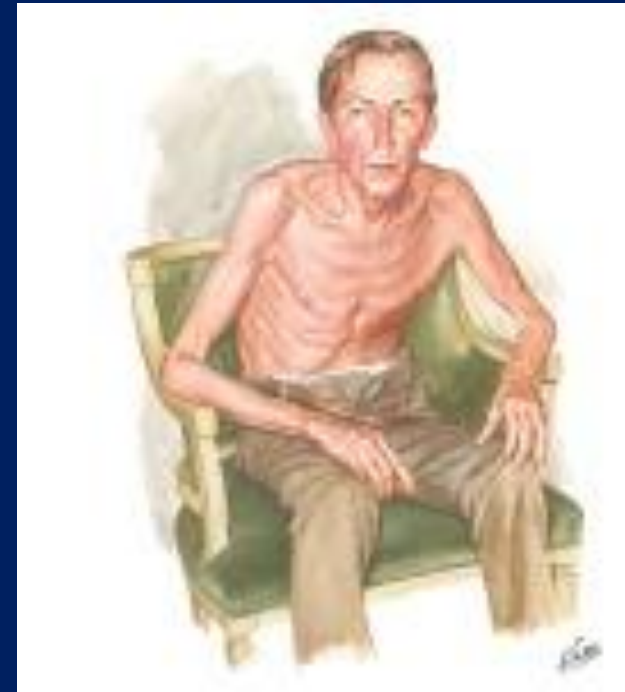


Patient 1

- 64 year old man with a 80+ pack-year smoking history, presents with dyspnea while climbing stairs and an occasional, non-productive cough
- What would you look for/expect on exam?

Patient 1 : Pink Puffer

- Diminished breath sounds on auscultation
- Forced expiratory time ≥ 6 seconds
- Increased thoracic circumference and decreased change with respiration
- Increased resonance to percussion



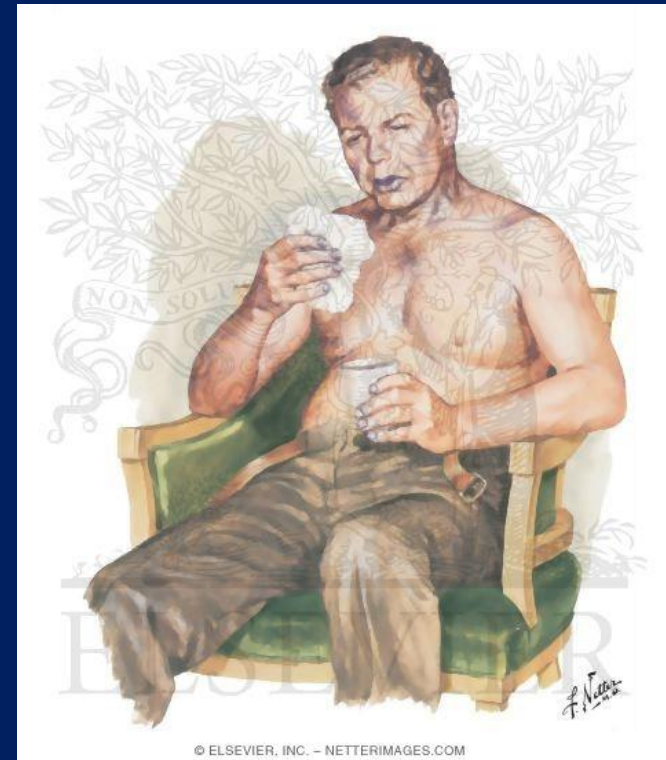
Tripod positioning

Patient 2

- 55 year man with 40 p-yr history presents with chronic cough for 3 months, productive of clear to light yellow phlegm
- What would you look for/expect on exam?

Patient 2: Blue blutter

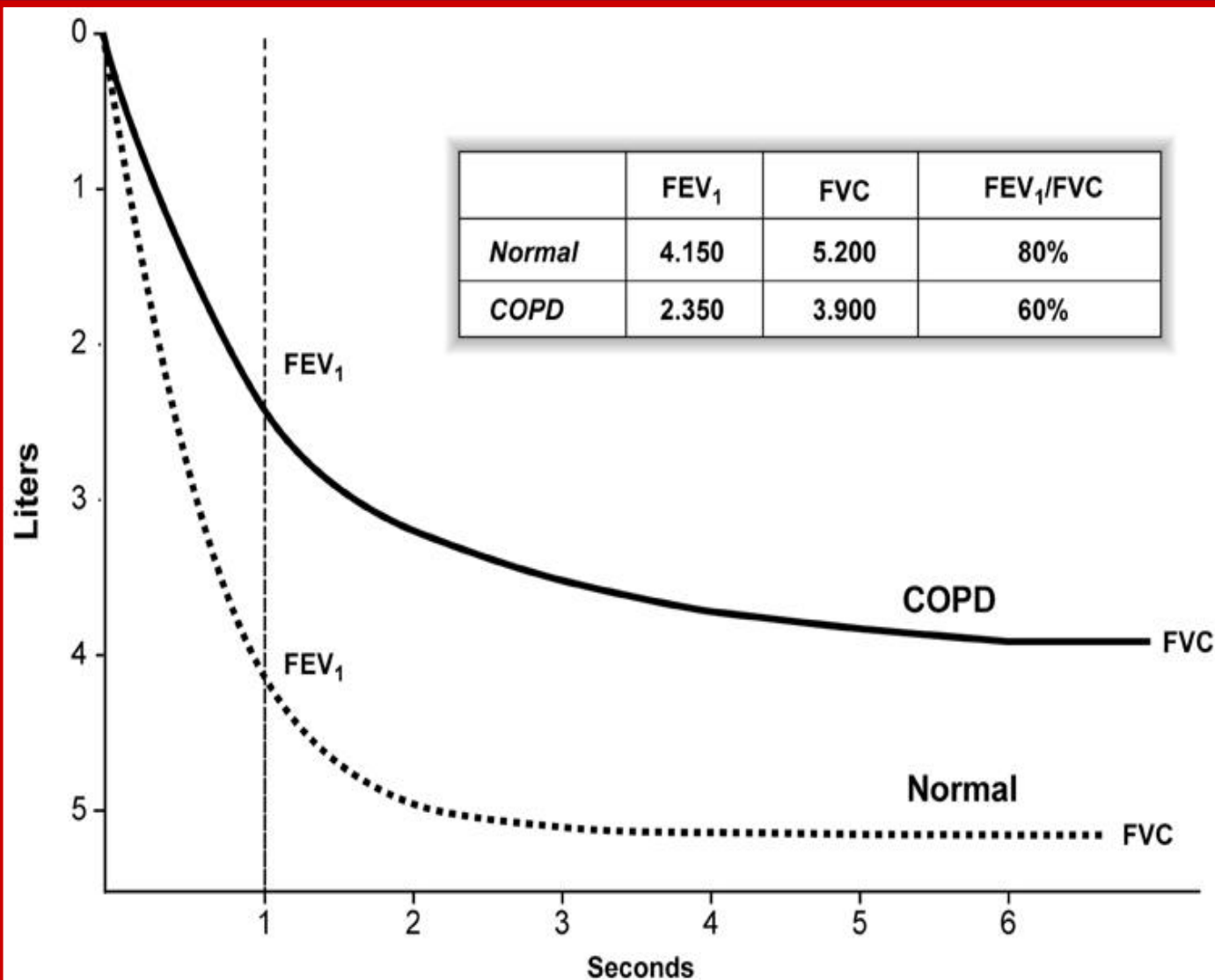
- Rhonchus breath sounds
- 1+ ankle edema



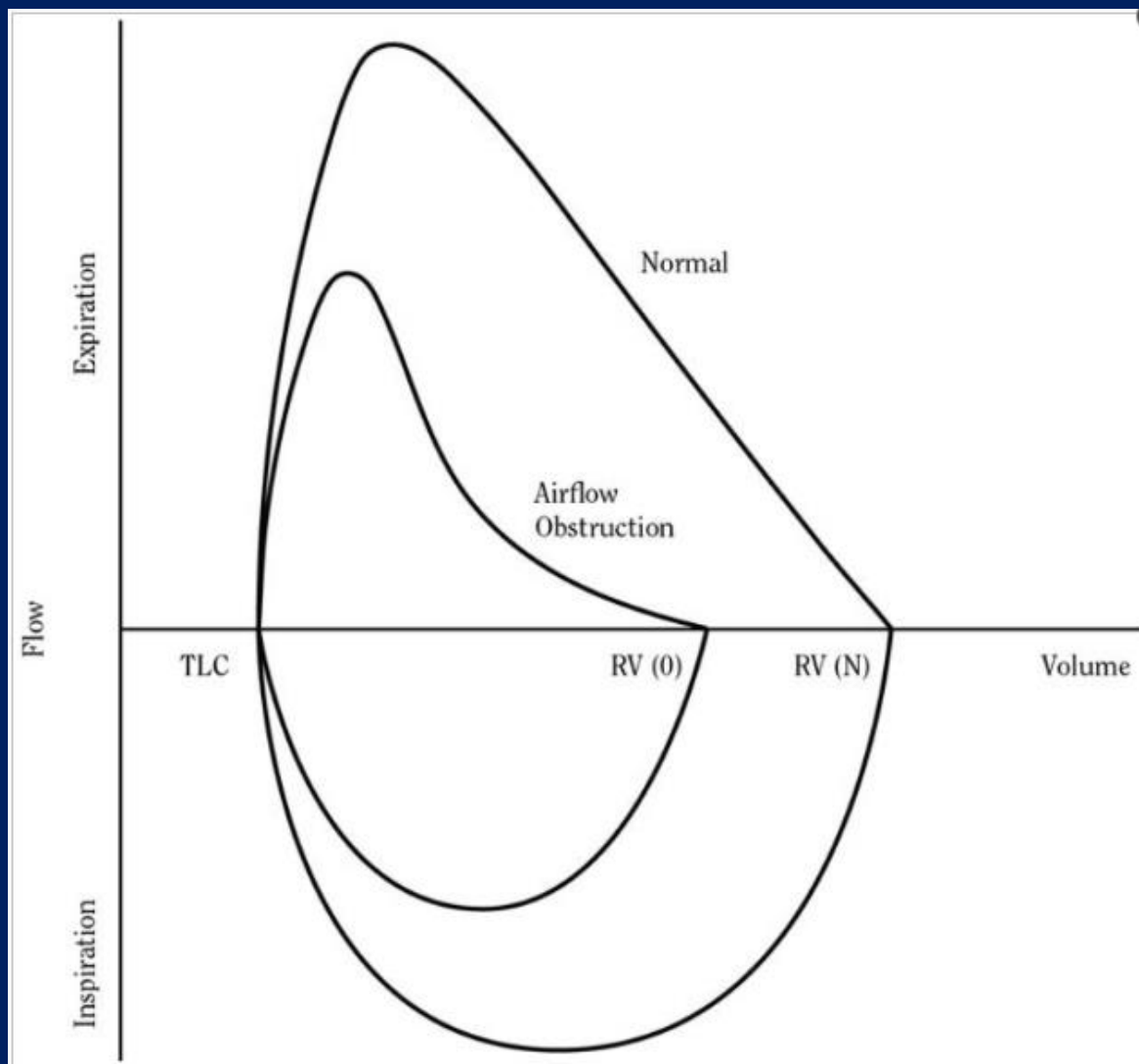
Not all patients are blue or pink

Spirometry

Normal and COPD Patient



Flow volume loop



GOLD Grades and Severity of Airflow Obstruction in COPD (based on post-bronchodilator FEV₁)

Table 2.6

In COPD patients (FEV₁/FVC < 0.7):

GOLD 1:	Mild	FEV ₁ ≥ 80% predicted
GOLD 2:	Moderate	50% ≤ FEV ₁ < 80% predicted
GOLD 3:	Severe	30% ≤ FEV ₁ < 50% predicted
GOLD 4:	Very Severe	FEV ₁ < 30% predicted

Initial Pharmacological Treatment

Figure 4.2



Initial Inhaler recommendation based on

1) Symptoms severity 2) Exacerbation Hx in the past year

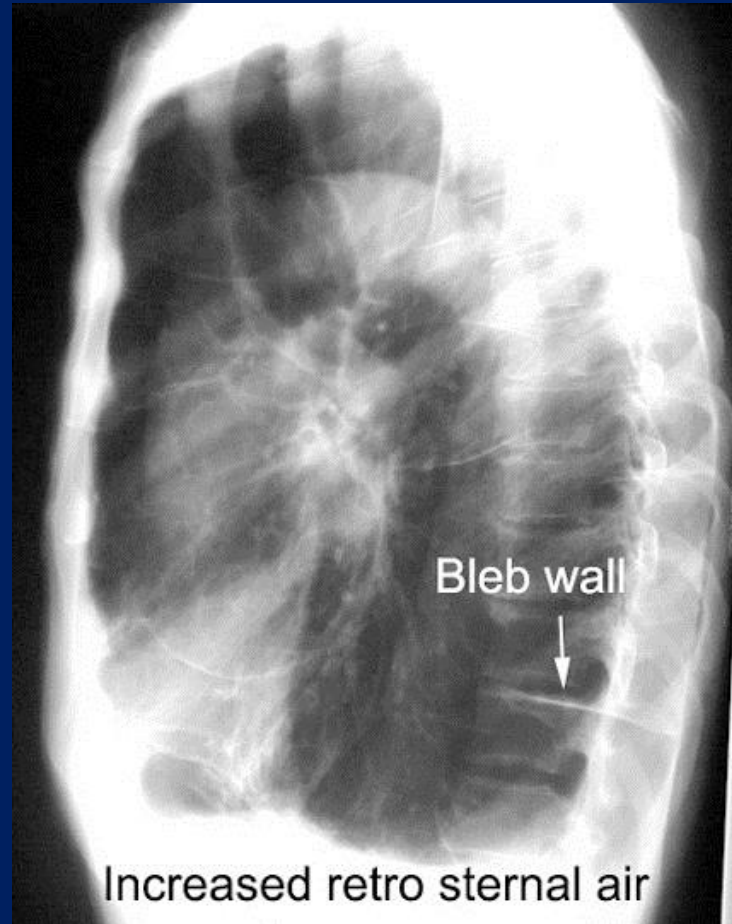
Not based on FEV1%

Role of Spirometry in COPD

Table 2.5

- **Diagnosis**
- **Assessment of severity of airflow obstruction (for prognosis)**
- **Follow-up assessment**
 - Therapeutic decisions
 - Pharmacological in selected circumstances (e.g., discrepancy between spirometry and level of symptoms)
 - Consider alternative diagnoses when symptoms are disproportionate to degree of airflow obstruction
 - Non-pharmacological (e.g., interventional procedures)
 - Identification of rapid decline

Chest X ray

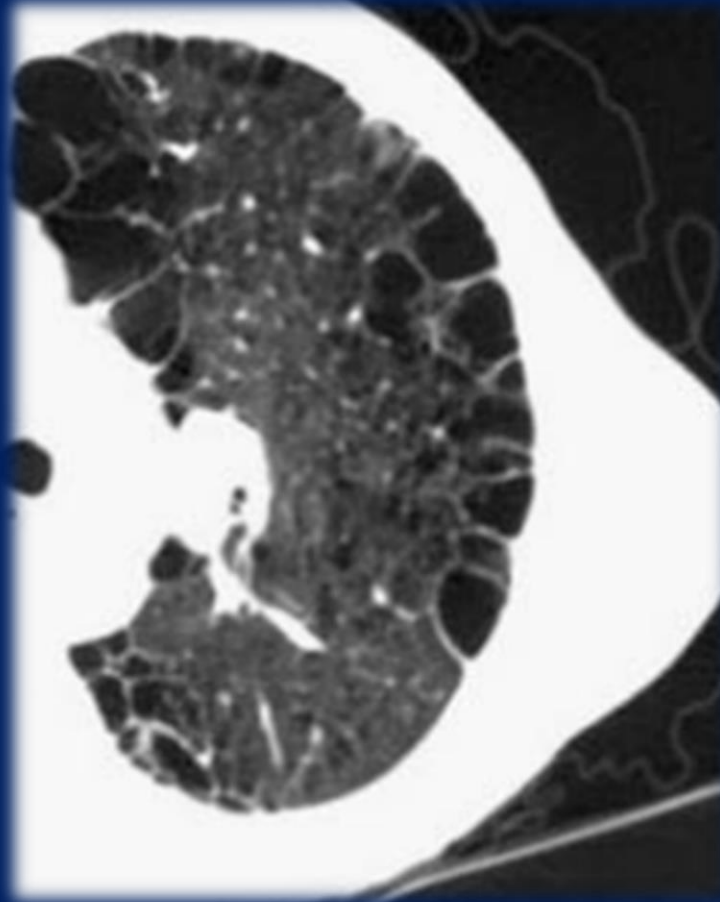


E-Fig. 16.6 Anterior-posterior (*left*) and lateral (*right*) chest radiographs show changes caused by severe chronic obstructive pulmonary disease, including hyperinflation, increased anterior-posterior diameter, flattened diaphragms, and enlarged pulmonary arteries.

HRCT (Emphysema)

Centrilobular

Paraceptal

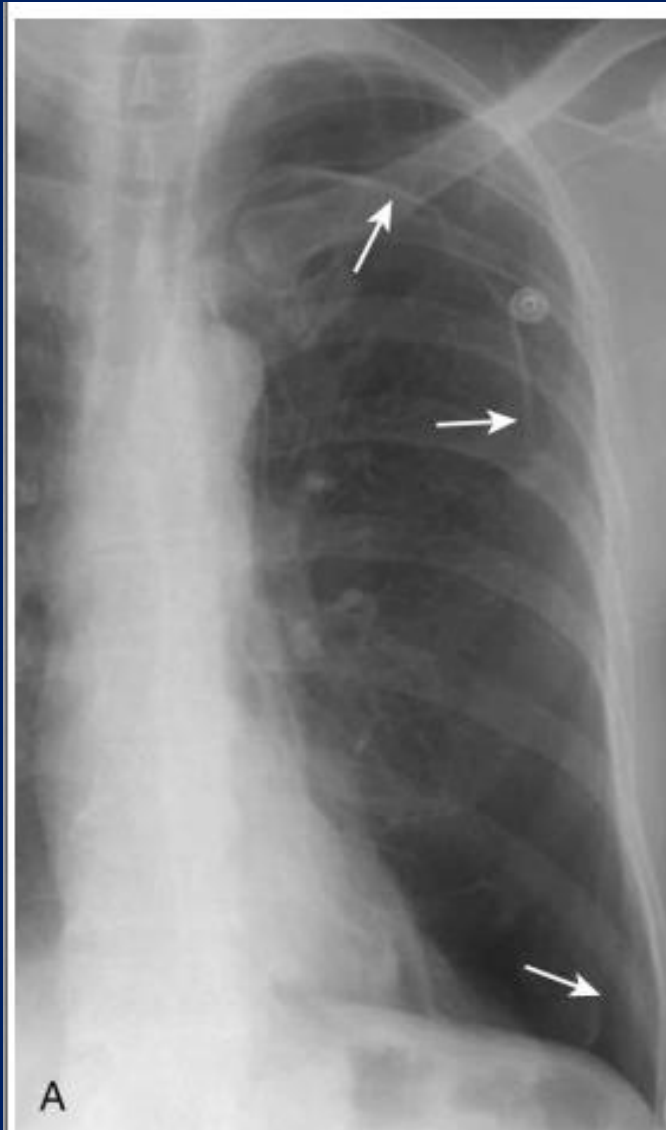


HRCT (Emphysema)

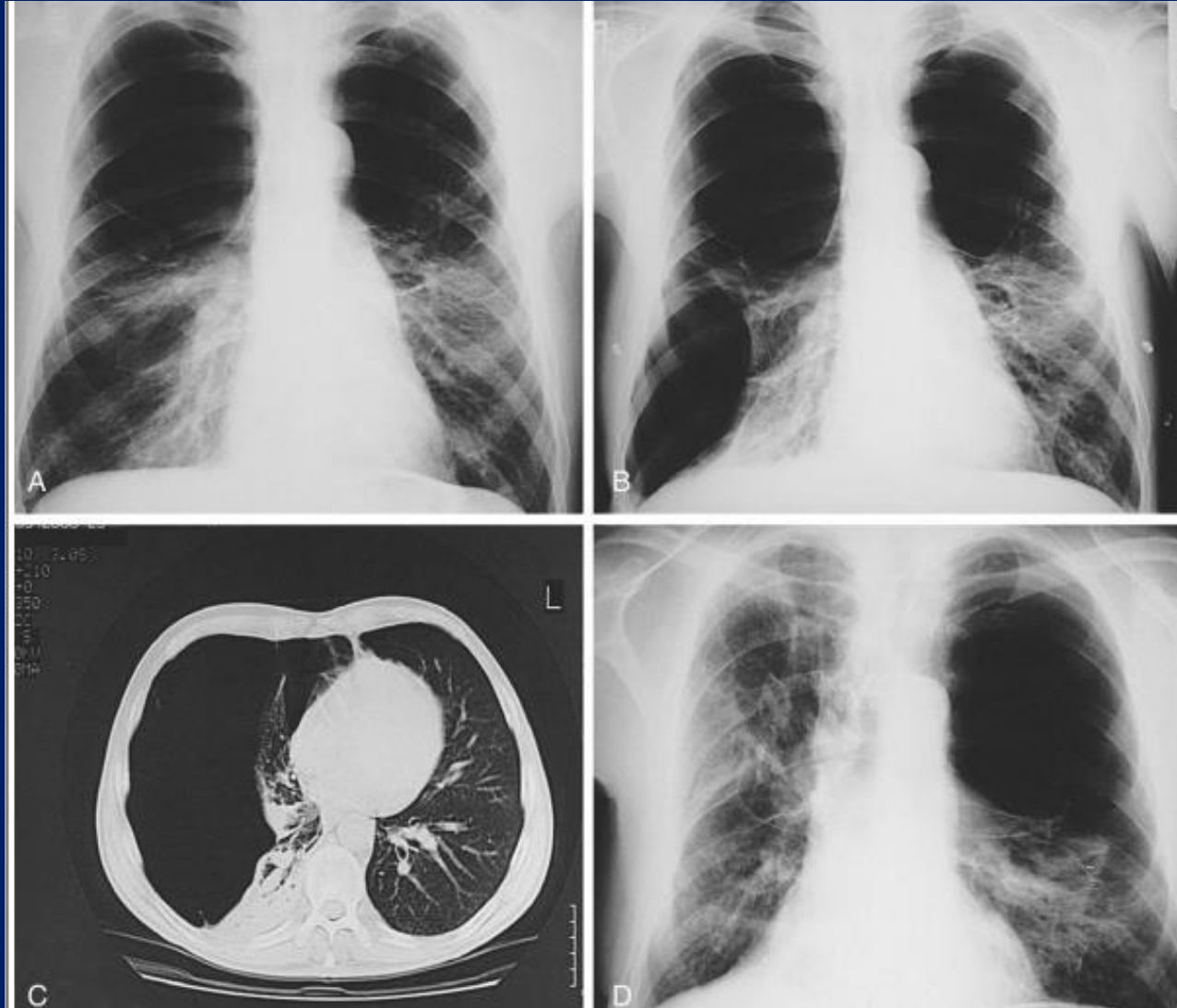


HRCT shows a paucity of vascular structures in both lower lobes, most evident in the anterior-basal segment of the right lower lobe.

Pneumothorax



Giant Bullae



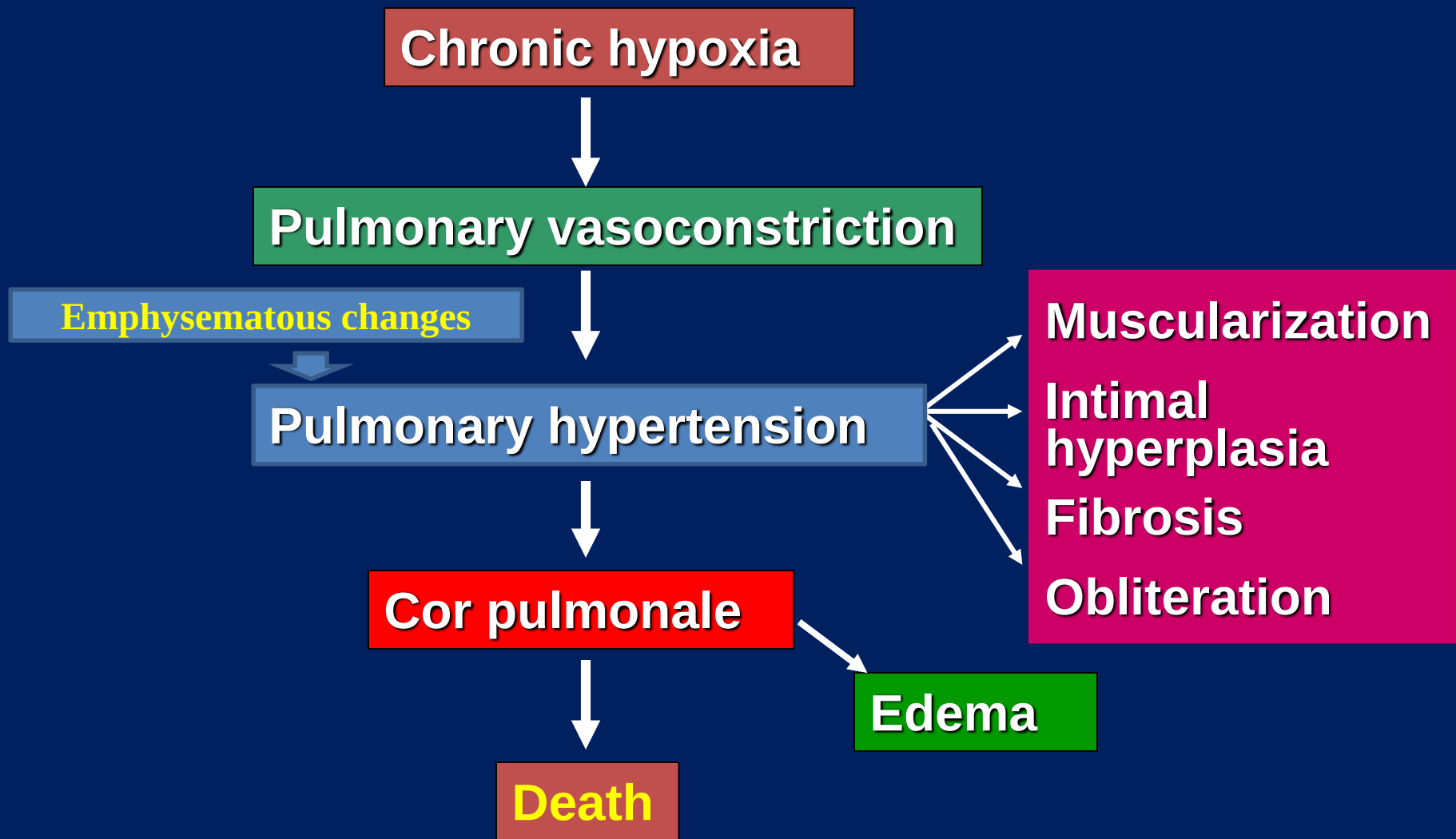
Systemic features of COPD

- Cachexia
- Skeletal muscle wasting and disuse atrophy
- Increased risk of cardiovascular disease
- increased concentrations of CRP
- Normochromic normocytic anaemia
- Secondary polycythaemia
- Osteoporosis
- Depression and anxiety

COPD systemic features

- Advanced disease may be accompanied by systemic wasting, with significant weight loss, bitemporal wasting, and diffuse loss of subcutaneous adipose tissue. This syndrome has been associated with both inadequate oral intake and elevated levels of inflammatory cytokines (TNF-).
- Such wasting is an independent poor prognostic factor in COPD

Pulmonary Hypertension in COPD



Differential Diagnosis COPD and Asthma

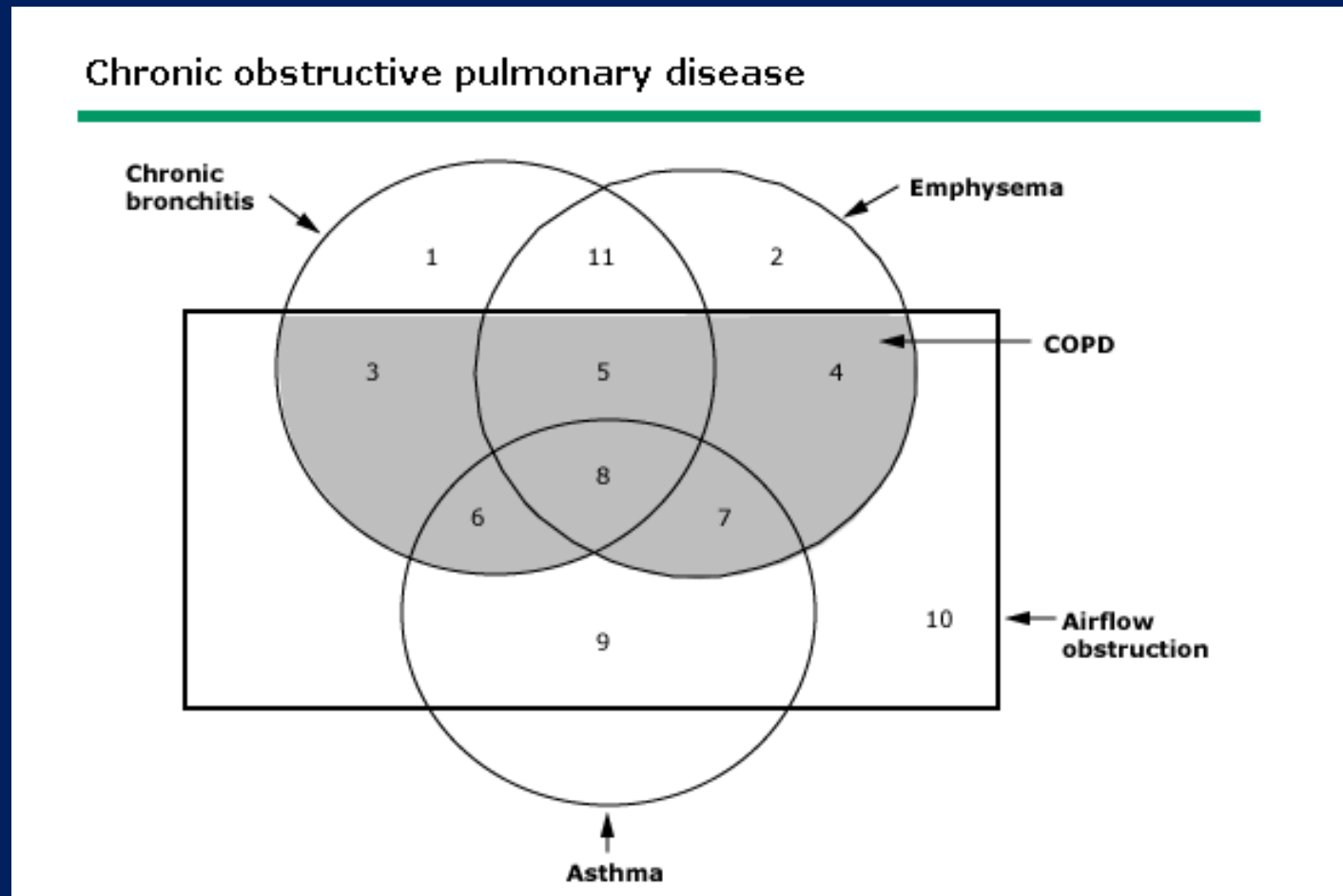
COPD

- ✓ Onset in mid-life
- Symptoms slowly progressive
- Long smoking history
- Dyspnea during exercise
- Largely irreversible airflow limitation

ASTHMA

- ✓ Onset early in life (often childhood)
- ✓ Symptoms vary from day to day
- ✓ Symptoms at night/early morning
- ✓ Allergy, rhinitis, and/or eczema also present
- ✓ Family history of asthma
- ✓ Largely reversible airflow limitation

Interrelationships among COPD and asthma



Interrelationships among COPD and asthma

- Airflow obstruction in some patients with asthma symptoms does not remit completely. Some patients with COPD features have significant response to steroid inhaler and other treatments such as anti-IL5 antibodies. The etiology and pathogenesis of the CAO in such patients is under investigation.

Mr. A

- A 54-year-old man currently employed as a mechanic
- First visit at pulmonary outpatient clinic
- Complaining of shortness of breath with exertion and a productive cough
- His coughing had recently increased and was producing thick, yellow sputum
- his cough had been present for several years but was “usually not a problem.”

Mr. A

- He had recently noticed more shortness of breath than usual and was now dyspneic at rest
- Smoking 2.5 packs /day for 30 y.
- Many attempt to stop
 - ✓ successful for no longer than 3 or 4 months
- Family Hx
 - ✓ His father died of emphysema at 64
 - ✓ Diabetes in 51-year-old brother

QUESTION 1

What are the key symptoms to explore?

What medical problems are suggested by the medical history?

Answer

- Cough and Shortness of breath need further evaluation
- The interviewer should determine
 - ✓ Severity of dyspnea
 - Asking about the degree to which it limits daily routine (Function class I-IV).
 - ✓ Changes in dyspnea over past years and factors that trigger dyspnea
 - ✓ Changes in dyspnea and sputum volume and color over the past few days

Dx and Differential Diagnosis

- Hx suggests : COPD exacerbated by a respiratory infection such as acute bronchitis, flu, bronchospasm, or pneumonia
- Chronic bronchitis?

QUESTION 2

- What is Mr. A's smoking history in pack-years?

ANSWERS

➤ 75 pack-years

✓ (2.5 packs per day* 30 years)

QUESTION 3

- What is the significance of the family and occupational history?

ANSWERS

- His father died of emphysema (Ask about smoking Hx?)
 - ✓ It appears that the tendency for COPD is genetically transferable from parent to child
 - ✓ Although the disease is not considered a hereditary disease in most patients
 - Consider α 1-antitrypsin deficiency
- The occupational exposure to irritant gases as a machanic may increase his risk for lung disease

QUESTION 4

- What should the physical examination accomplish at this point in assessment of this patient?

ANSWERS

➤ The physical examination should help determine the extent of Mr. A's pulmonary dysfunction and the cause of his symptoms.

✓ Cyanosis, wheeze, rhonchi, pedal edema

The clinician

➤ Assess

✓ vital signs, sensorium, breath sounds, respiratory pattern, heart sounds, and ankle edema

Case 2 presentation

Objectives

Acute exacerbation of COPD

Comorbidities and Systemic features (esp
Pulmonary hypertension and Cor-pulmonale)

Past Medical History

- A 51-year-old obese construction worker
- Smoked regularly since age 17 a pack/day
- without previous complaints or treatment for chronic respiratory symptoms

Present illness

- Sore throat, cough, fever, and increasing breathing difficulties a few days ago
- Over 24 hours, he became so short of breath that he went to the emergency department

Physical examination

- Febrile and had labored breathing with expiratory wheezing
- Vital signs
 - Blood pressure: 162/97 mm Hg; Heart rate: 102 bpm; Temperature: 39.5°C

Initial Evaluation and Management

Admitted at Infectious ward

- Chest x-ray
 - ✓ No infiltrates suggestive of pneumonia
- Nasal swab positive for influenza



Management

- Antiviral therapy (condition stabilized after 48 hours)
- Discharged from the hospital
 - ✓ Advice for treatment of his hypertension

One years later

Visited by a General physician

Chief Complaint

- Having trouble keeping up with his co-workers as he becomes short of breath at work
- New York Heart Association class II dyspnea
 - ✓ ordinary physical activity such as long-distance walking, climbing two flights of stairs, somewhat limited by dyspnea
- Bothered by a persistent cough

Further Assessment (Physical Examination)

- Neck: mildly distended neck vein
- Chest: scattered rhonchi throughout; coarse crackles
- Heart: tachycardia and regular rhythm; increased intensity of pulmonic component of second heart sound; Grade 2/6 systolic murmur at LSB; no gallop rhythm
- Extremities: pitting edema of ankles; mucus membranes and nail beds minimally cyanotic

Questions

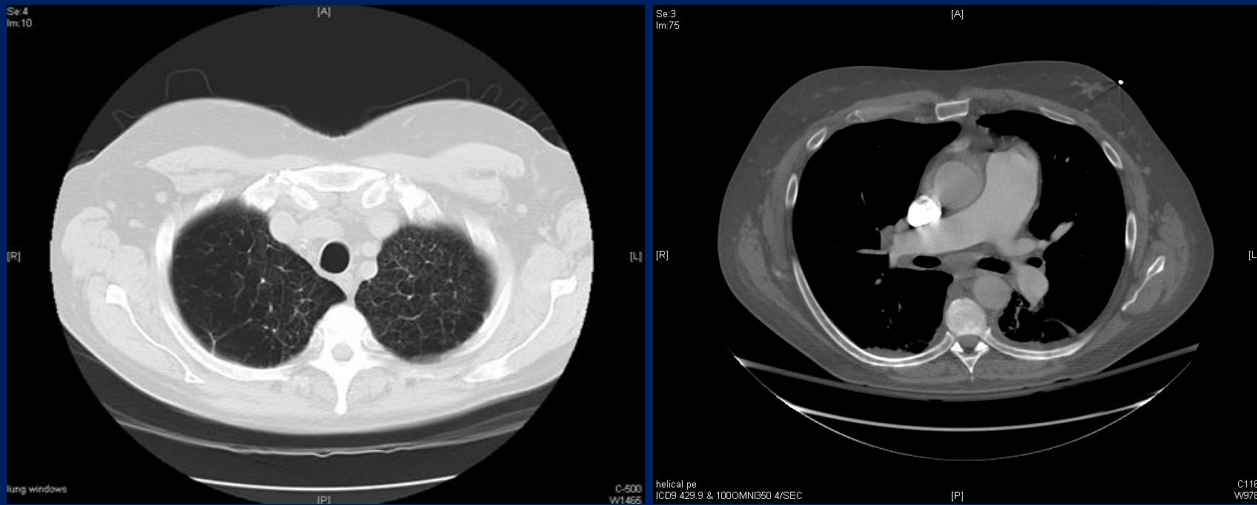
- What additional evaluations would you have carried out?
- Was the appropriate treatment for this patient?

Chest Radiograph

- Increase in heart diameter
- Prominent pulmonary arteries
- Decreased retrosternal airspace
- Clear lung fields



CT Scan of the Chest (With Contrast)



- Upper lobe emphysema, enlarged central pulmonary arteries, no evidence of thromboembolic disease

Questions

- Based on the available information, what is your provisional diagnosis for this patient?
- What additional evaluations would you have carried out?

Physical Exam, ECG, Labroatry findings

- BMI: 30.2 kg/m²
- Blood pressure: 157/96 mm Hg
- Pulse: 102 bpm
- Respiration rate: 19 breaths/minute
- ECG: Right axis deviation;
R ventricular hypertrophy
- Lipids:
 - Total cholesterol: 226 mg/dL
 - LDL-C: 137 mg/dL
 - Triglycerides: 169 mg/dL
- FBS: 156 mg/dl, Hgb A1C: 8.4%

General Doctor

Conclusions and Actions

- Suspects cardiovascular disease, possibly mild heart failure, and probably type 2 diabetes
 - ✓ Another evaluation of blood glucose 4 weeks Later
 - ✓ Refers him to a cardiologist

Further Assessment and Management by General Doctor

- *FBS after 4 weeks :143 mg/dL(type 2 diabetes)*
- **Actions**
 - ✓ Consultation regarding diet and lifestyle
 - ✓ 1000 mg/day metformin
 - ✓ Hydrochlorothiazide 50 mg/day for his persistent pedal edema?

Assessment by Cardiologist

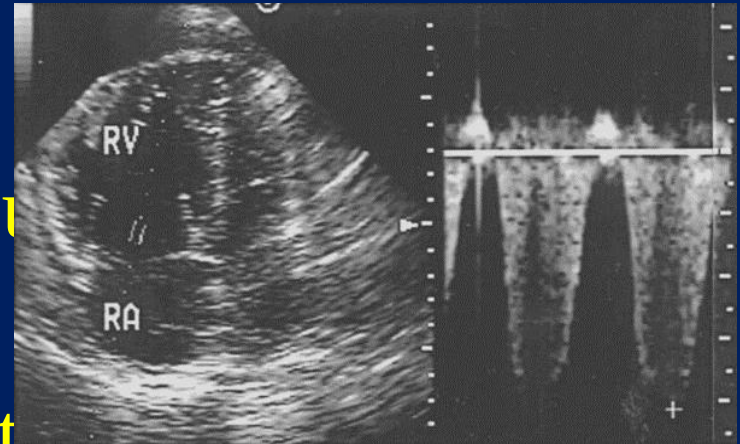
ECG

Sinus rhythm with evidence of right axis deviation “P pulmonale” and right ventricular hypertrophy



Echocardiogram

- The right ventricle (RV) is markedly dilated
- Normal left ventricular volume
- A 55 mm Hg peak systolic pressure gradient between the right ventricle and right atrium (RA)



Question

- What is your diagnosis for this patient given the results of these additional evaluations?

Cardiologist Actions

- Advice to stop smoking
- Continue the diuretic
- Administration of a β -blocker, and an angiotensin converting enzyme (ACE) inhibitor
- Pulmonologist consultation because of suspicion of COPD

Patient Progress

- Patient's blood pressure declines to 141/83 mm Hg,
- but both the cough and dyspnea worsen
- The cardiologist stops the ACE inhibitor and replaces it with an angiotensin receptor blocker (ARB)
 - ✓ This decreases the patient's cough somewhat, but there is no improvement in dyspnea

Assessment and Treatment by Pulmonologist

➤ Arterial blood gas Spirometry

- ✓ $\text{PaO}_2 = 55 \text{ mm Hg}$
- ✓ $\text{PaCO}_2 = 50 \text{ mm Hg}$
- ✓ $\text{pH} = 7.43$
- ✓ $\text{HCO}_3 = 32 \text{ mmol/L}$

Measure	L	%
FEV ₁	1.46	47.9
FVC	3.64	83.0
FEV ₁ /FVC	-	67.6
Change from pre- to post-bronchodilator FEV ₁	0.13	9.7

Questions

- What do these pulmonary function results indicate?
- How would you alter your management of this patient?

Diagnosis and Treatment

Probable diagnosis

- Moderate COPD complicated by right heart failure and hypertension based on
 - ✓ smoking history, breathlessness, and partially reversible impairment in lung function and emphysema in HRCT and echocardiography
 - ✓ Treatment for COPD is initiated with tiotropium and pulmonary rehabilitation
 - ✓ Start oxygen >20 hours/day and evaluation of long term oxygen therapy

Diagnosis and Treatment

- Hypercarbia in a patient with moderate COPD prompts evaluation of other potential reasons for respiratory failure
 - ✓ Role of BMI in hypoventilation?
 - Obesity Hypoventilation syndrome?
 - ✓ Night polysomnography shows severe obstructive sleep apnea
 - CPAP therapy

COPD as a missed Dx

He admitted last year by after flu symptoms by

➤ Fever and labored breathing with expiratory wheezing

The probable Dx

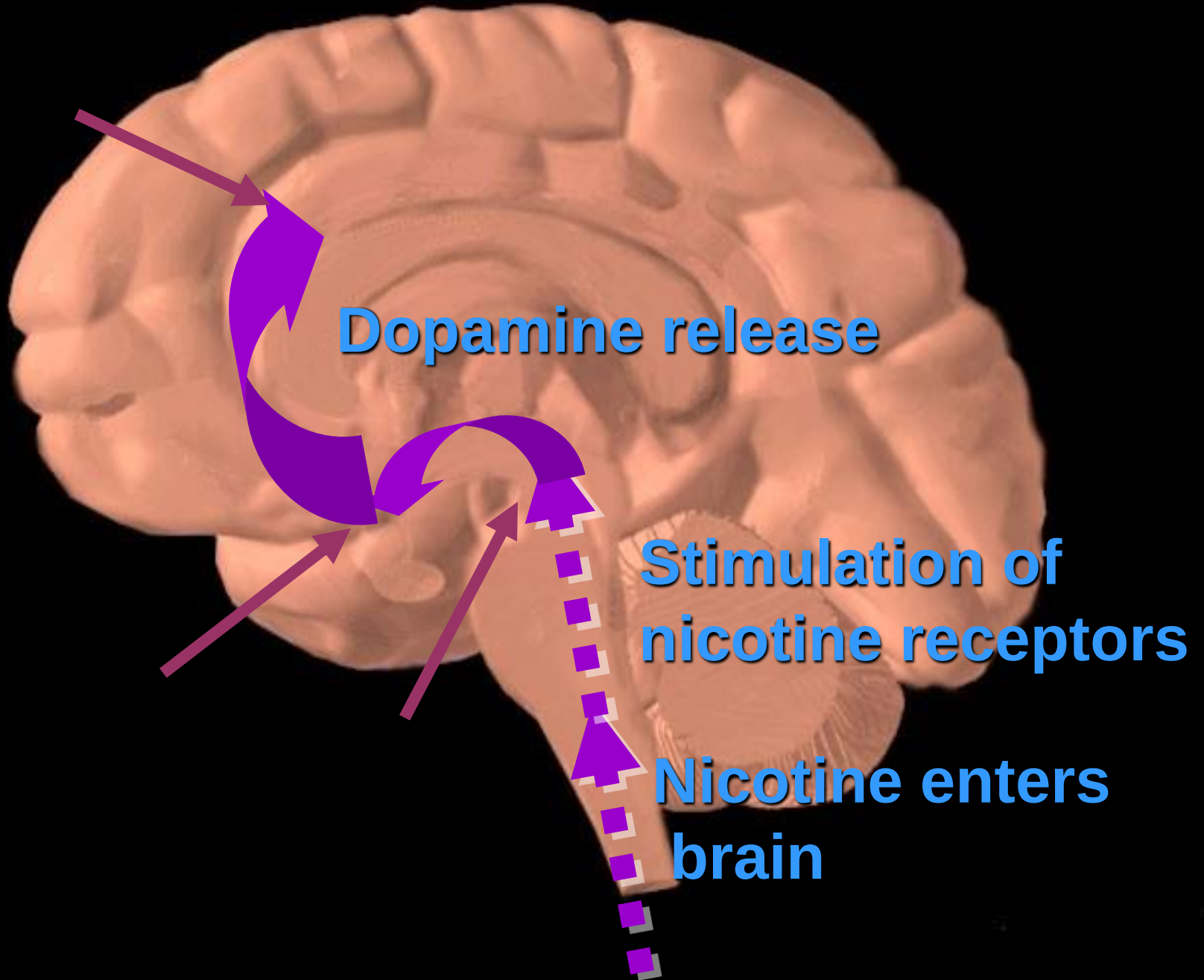
COPD exacerbation after respiratory infection

Management

General Points

- Only smoking cessation and O₂ therapy (when indicated) have been shown to prolong survival
- Other therapies aimed at relieving symptoms, improving quality of life, reducing exacerbations and need for hospitalizations

Dopamine Reward Pathway



Management

- Smoking cessation
- Oxygen
- Corticosteroids
- Bronchodilators
- Mucolytics
- Antibiotics
- Mechanical devices (BIPAP/CPAP, Endobronchial Valves,..)

A large, mature tree with a thick trunk and a wide, spreading canopy of leaves in vibrant autumn colors (yellow, orange, and red) dominates the scene. The ground is covered in a thick layer of fallen leaves. In the background, other trees and a glimpse of a building are visible through the foliage. The word "THANKS" is overlaid in a large, white, serif font, centered horizontally and slightly above the middle vertically.

THANKS

For adverse events reporting of any GSK products, kindly call:
(021) 88664496 or (021) 88208129
or E-mail: pv@cobeldarou.com

For full Prescribing Information and any Medical Information
queries please email: medinfo@cobeldarou.com