CHRONIC OBSTRUCTIVE PULMONARY DISEASE (COPD)

DEFINITION

- characterized by progressive development of airflow limitation that is irreversible/minimally reversible

- includes chronic bronchitis and emphysema; usually coexist to variable degrees in most patients

DEFINITION

- Fixed airflow obstruction
- Minimal or no reversibility with bronchodilators
- Minimal variability in day-to-day symptoms
- Slowly progressive and irreversible deterioration in lung function, leading to progressively worsening symptoms.

COPD

Chronic obstructive pulmonary disease (COPD) is a common, preventable and treatable disease that is characterized by persistent respiratory symptoms and airflow limitation that is due to airway and/or alveolar abnormalities usually caused by significant exposure to noxious particles or gases. [GOLD 2017][39]

Asthma-COPD overlap (ACO) – not a definition, but a description for clinical use

Asthma-COPD overlap (ACO) is characterized by persistent airflow limitation with several features usually associated with asthma and several features usually associated with COPD. Asthma-COPD overlap is therefore identified in clinical practice by the features that it shares with both asthma and COPD.

This is not a definition, but a description for clinical use, as asthma-COPD overlap includes several different clinical phenotypes and there are likely to be several different underlying mechanisms.

Box 5-2a.Usual features of asthma, COPD and asthma-COPD overlap

Feature	Asthma	COPD	Asthma-COPD overlap
Age of onset	Usually childhood onset but can commence at any age.	Usually > 40 years of age	Usually age ≥40 years, but may have had symptoms in childhood or early adulthood
Pattern of respiratory symptoms	Symptoms may vary over time (day to day, or over longer periods), often limiting activity. Often triggered by exercise, emotions including laughter, dust or exposure to allergens	Chronic usually continuous symptoms, particularly during exercise, with 'better' and 'worse' days	Respiratory symptoms including exertional dyspnea are persistent but variability may be prominent
Lung function	Current and/or historical variable airflow limitation, e.g. BD reversibility, AHR	FEV_1 may be improved by therapy, but post-BD $FEV_1/FVC < 0.7$ persists	Airflow limitation not fully reversible, but often with current or historical variability
Lung function between symptoms	May be normal between symptoms	Persistent airflow limitation	Persistent airflow limitation
Past history or family history	Many patients have allergies and a personal history of asthma in childhood, and/or family history of asthma	History of exposure to noxious particles and gases (mainly tobacco smoking and biomass fuels)	Frequently a history of doctor-diagnosed asthma (current or previous), allergies and a family history of asthma, and/or a history of noxious exposures
Time course	Often improves spontaneously or with treatment, but may result in fixed airflow limitation	Generally, slowly progressive over years despite treatment	Symptoms are partly but significantly reduced by treatment. Progression is usual and treatment needs are high
Chest X-ray	Usually normal	Severe hyperinflation & other changes of COPD	Similar to COPD
Exacerbations	Exacerbations occur, but the risk of exacerbations can be considerably reduced by treatment	Exacerbations can be reduced by treatment. If present, comorbidities contribute to impairment	Exacerbations may be more common than in COPD but are reduced by treatment. Comorbidities can contribute to impairment
Airway inflammation	Eosinophils and/or neutrophils	Neutrophils ± eosinophils in sputum, lymphocytes in airways, may have systemic inflammation	Eosinophils and/or neutrophils in sputum.

THREE MECHANISMS HAVE BEEN SUGGESTED FOR LIMITATION OF AIRFLOW IN SMALL AIRWAYS (< 2 MM IN DIAMETER).

- Loss of elasticity and alveolar attachments of airways due to emphysema. This reduces the elastic recoil and the airways collapse during expiration.
- Inflammation and scarring cause the small airways to narrow.
- Mucus secretion which blocks the airways.

PATHOPHYSIOLOGICAL PROCESSES

- Inflammatory narrowing of respiratory and membranous bronchioles
- Proteolytic digestion of connective tissue framework of the lung ►
  decreased parenchymal tethering of airways
- Loss of alveolar surface area and capillary bed
- Lung hyperinflation caused by loss of lung elastic recoil
- Increased pulmonary vascular resistance caused by vasoconstriction and loss of capillary bed

الآلية الامراضية

- التعرض للتدخين ◄ تحرر إيلاستاز
- التعرض للأبخرة ◄ تحرر إيلاستاز

- الامكانية المختلفة للاصابة ب COPD (البيئة ، المضيف)

- البروتياز ◄ الموت الخلوي مع غياب الاصلاح ◄ تخرب الأسناخ وتنخمص ◄ انتفاخ

- آلية أخرى : الالتهاب والتليف

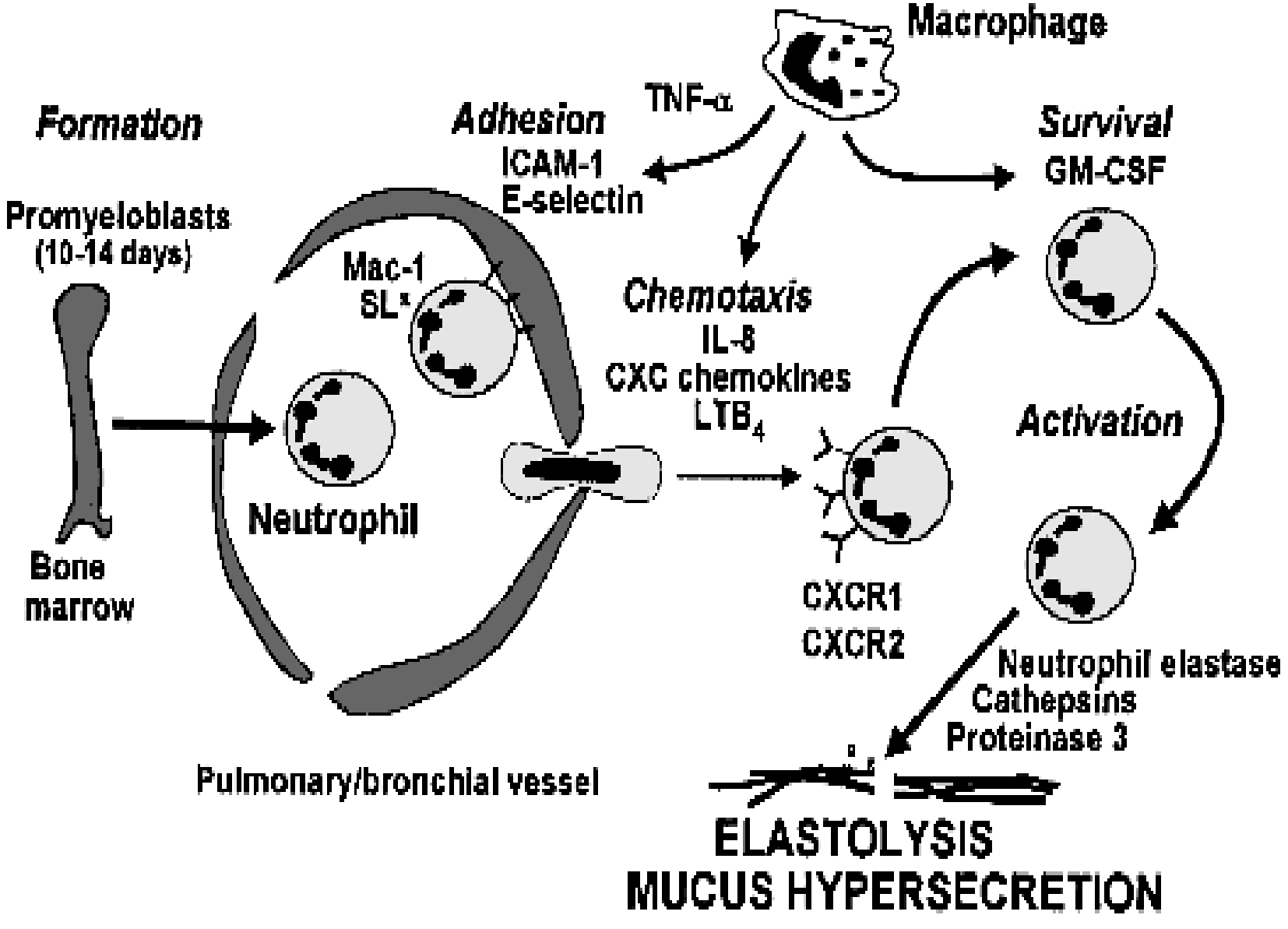
الآلية الامراضية

- التدخين ◄ تفعيل الخلايا الالتهابية (البالعات الكبيرة والعدلات) ◄ الموت الخلوي
- التدخين يضعف استجابة الاصلاح للخلايا الميزانشيمية والظهارية
- أشلاء الخلايا جاذبة للعدلات ◄ دورة معيبة
- ارتشاح البالعات الكبيرة للقصيبات التنفسية ◄ النفاخ الفصيصي المركزي
- الخلايا التائية ◄ الخلايا الظهارية المصابة بانتان فيروسي
- عوامل أخرى تؤدي إلى استمرار العملية الالتهابية : فقدان الأهداب + الاستعمار الجرثومي والفيروسي + أشلاء الخلايا

MECHANISMS OF NEUTROPHIL INFAMMATION IN COPD.

- Neutrophils formed in the bone marrow from promyeloblasts adhere in the bronchial and pulmonary circulations via adhesion molecules
- then traffic into the tissue under the direction of chemotactic factors, such as leukotriene B4 (LTB4) and interleukin 8 (IL-8).
- They survive in the airway due to growth factors such as granulocyte macrophage colony-stimulating factor (GM-CSF)
- then become activated to release mediators and proteinases.

MECHANISMS OF NEUTROPHIL INFLAMMATION IN COPD.



AETIOLOGY

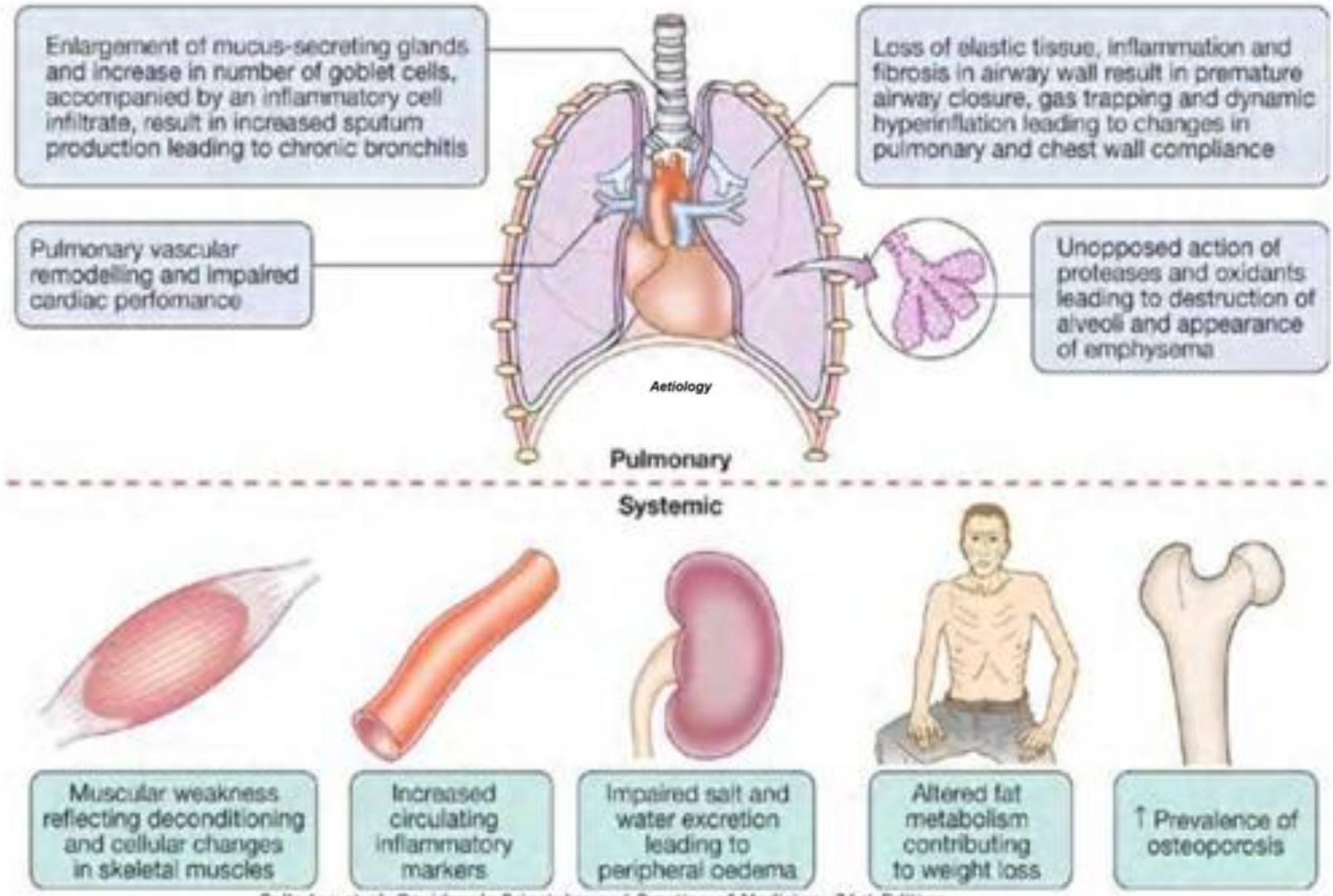


Figure 19.23 **The pulmonary and systemic features of COPD.**

التشريح المرضي

التهاب القصبات المزمن

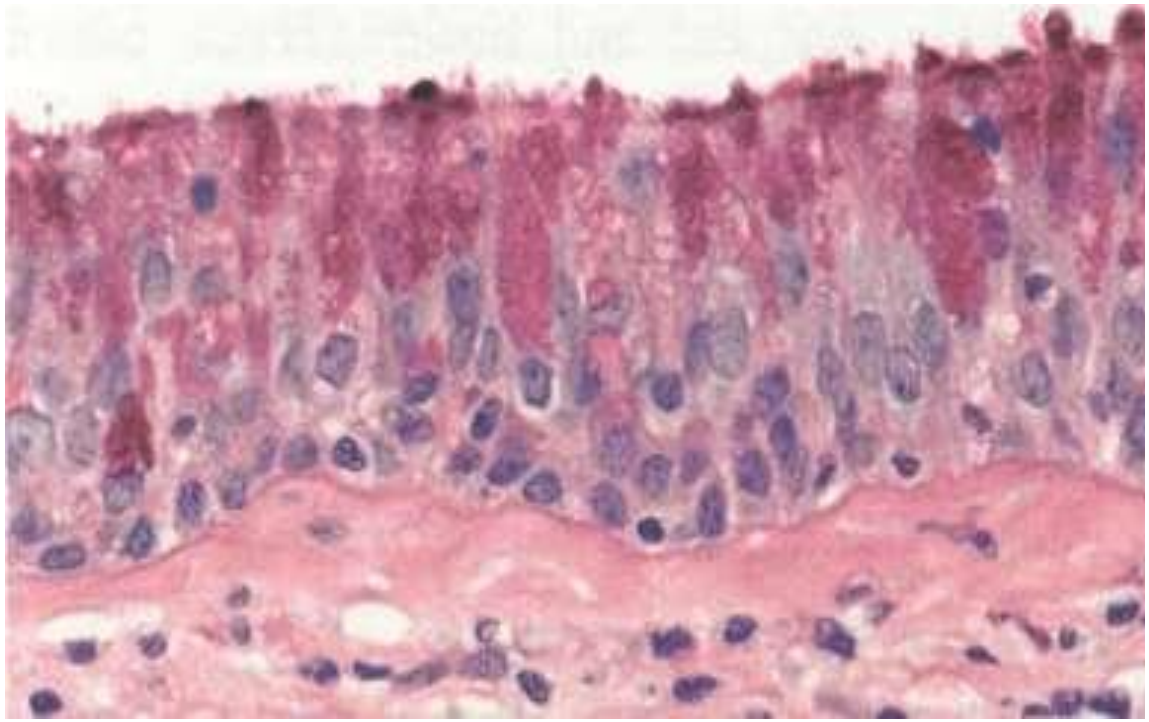
في القصبات :

- **ضخامة الغدد تحت المخاطية حسب Reid**
- **بؤر من الحؤول الشائك الخلايا**
- **ارتشاح جدار الطرق الهوائية بالخلايا الالتهابية (الوحيدات واللمفاويات وبشكل أقل الأيوزينيات)**
- **فرط تصنع العضلات الملس**

القصيبات :

- **انسداد بالمخاط والحؤول الخلوي والخلايا الالتهابية والخلايا العضلية الملساء والتخرب**

COPD. SECTION OF BRONCHIAL MUCOSA STAINED FOR MUCUS GLANDS BY PAS SHOWING INCREASE IN MUCUS-SECRETING GOBLET CELLS



RISK FACTORS

- ❑ smoking is the most important risk factor.
- ❑ minor risk factors include:
  - environmental factors:
    air pollution, occupational exposure, IV drug abuse or talcosis
  - treatable factors:
    low BMI, α-1-antitrypsin deficiency, bronchial hyperactivity
  - demographic factors:
    age, family history, male sex
  - history of childhood respiratory infections and socioeconomic status

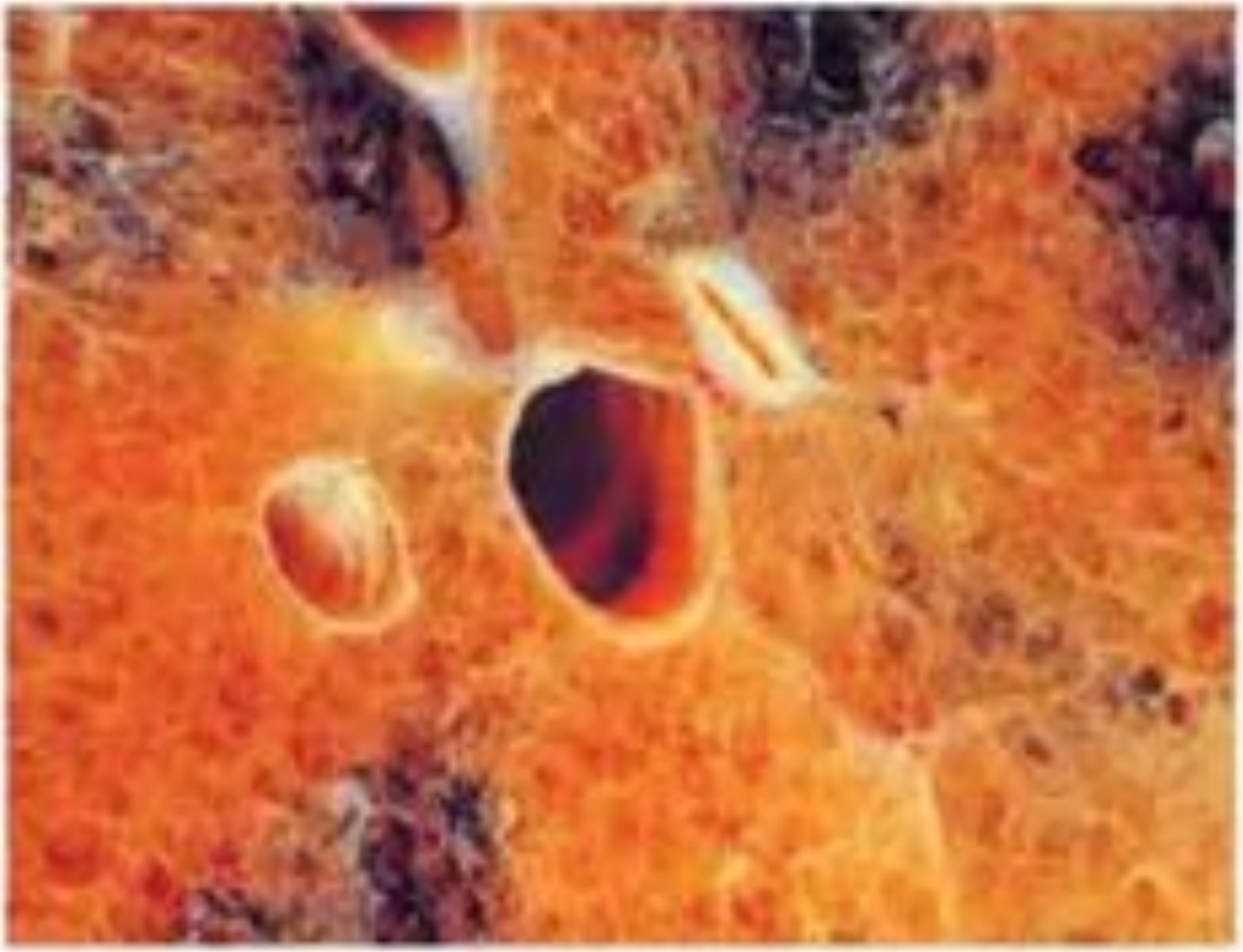
EMPHYSEMA

- ❑ pathologic definition:

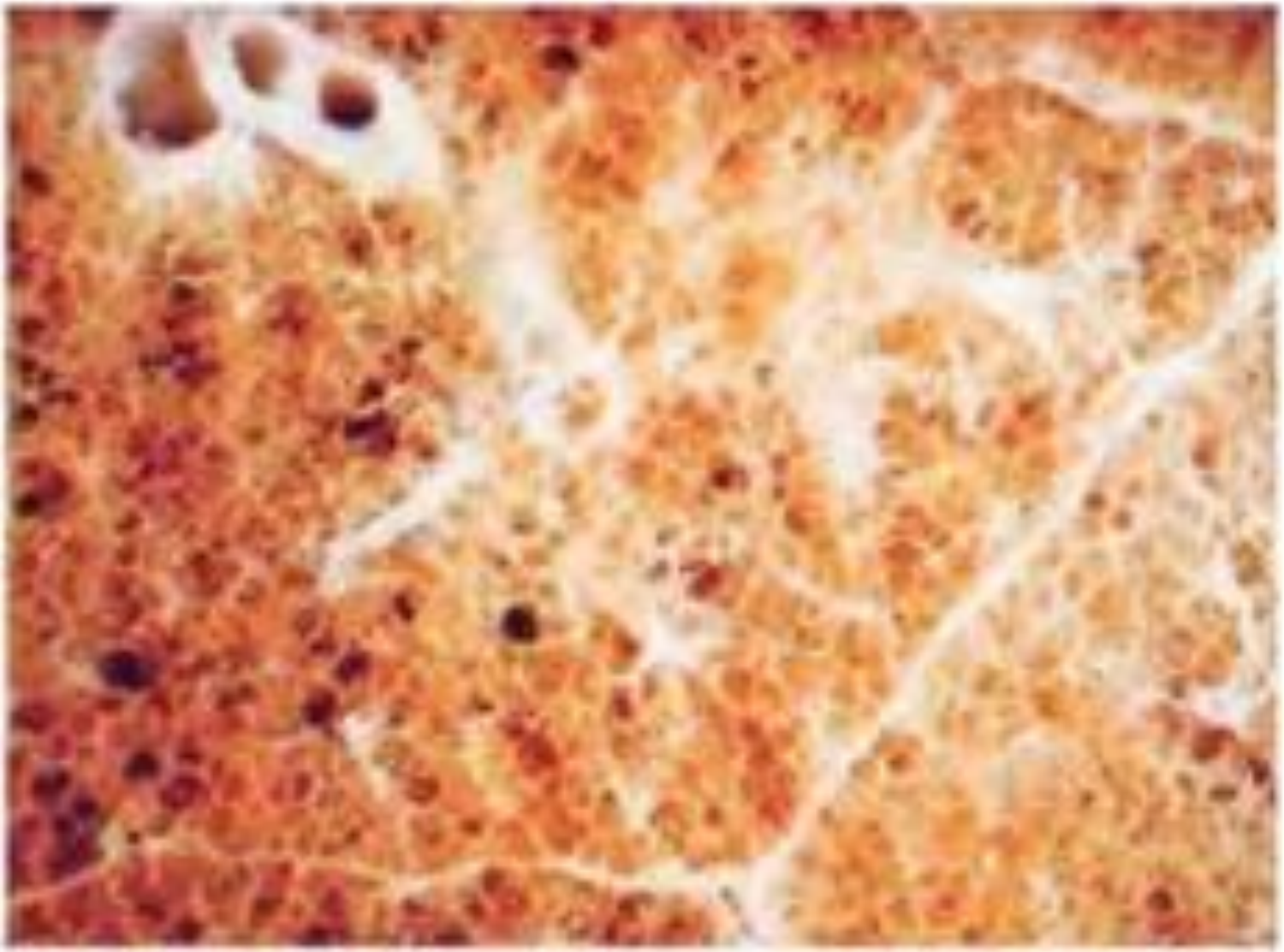
  dilatation and destruction of air spaces distal to the terminal bronchiole without obvious fibrosis

❑ decreased elastic recoil of lung parenchyma causes decreased expiratory driving pressure, airway collapse, and air trapping

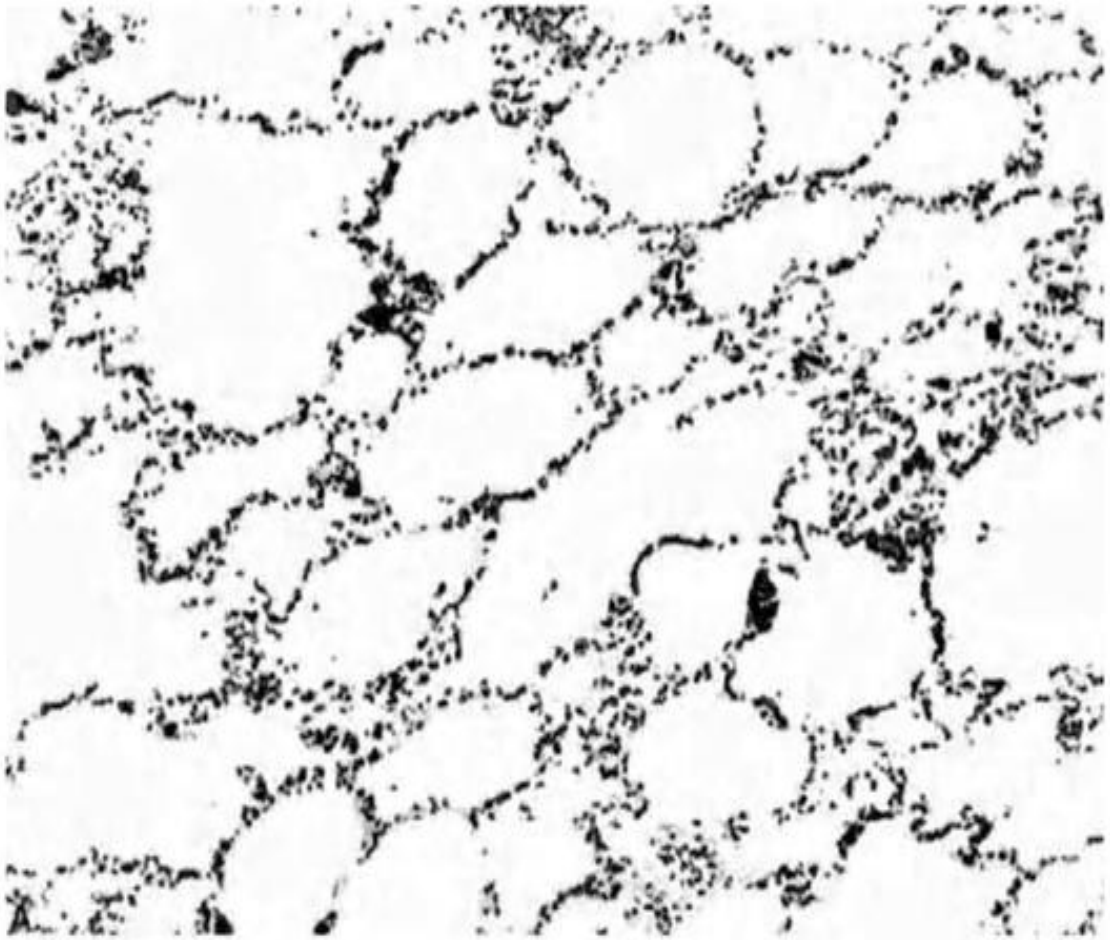
NORMAL LUNG



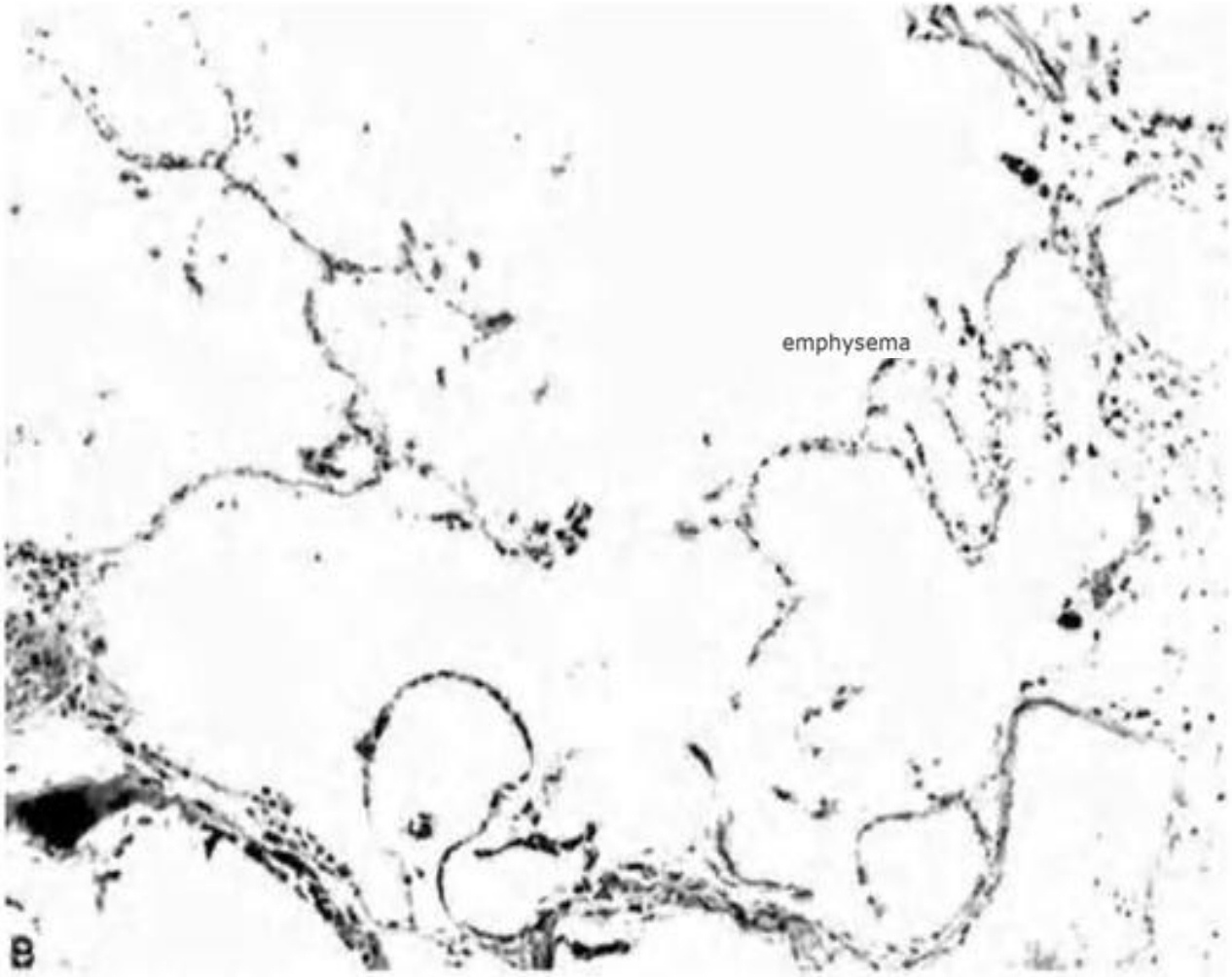
EMPHYSEMA



Normal lung



EMPHYSEMA



TYPES OF EMPHYSEMA

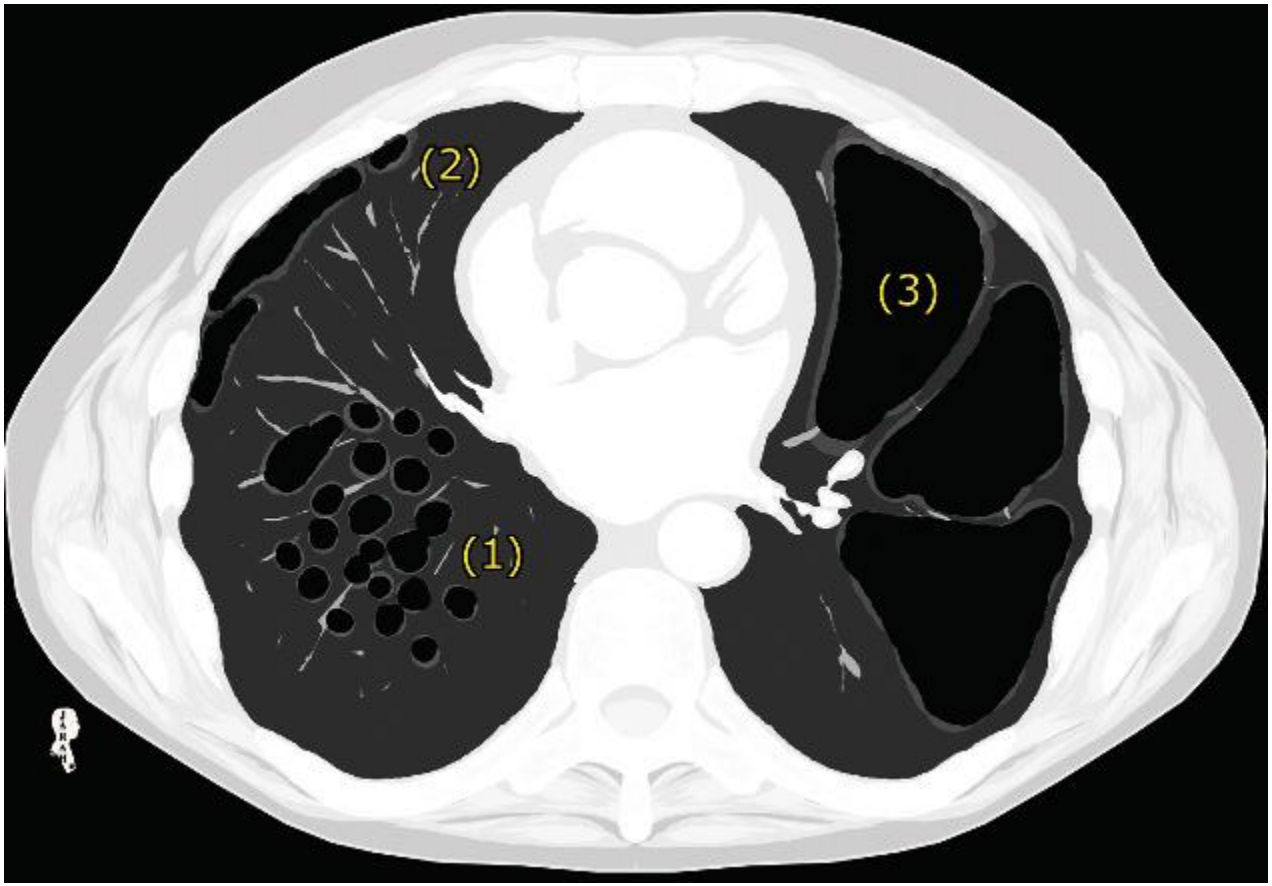
- centriacinar
  (respiratory bronchioles predominantly affected):
  - typical form seen in smokers
  - primarily affects upper lung zones

- panacinar
  (respiratory bronchioles, alveolar ducts,and alveolar sacs affected) :
  - responsible for less than 1% of emphysema cases
  - primarily affects lower lobes
  - think of α-1-antitrypsin deficiency

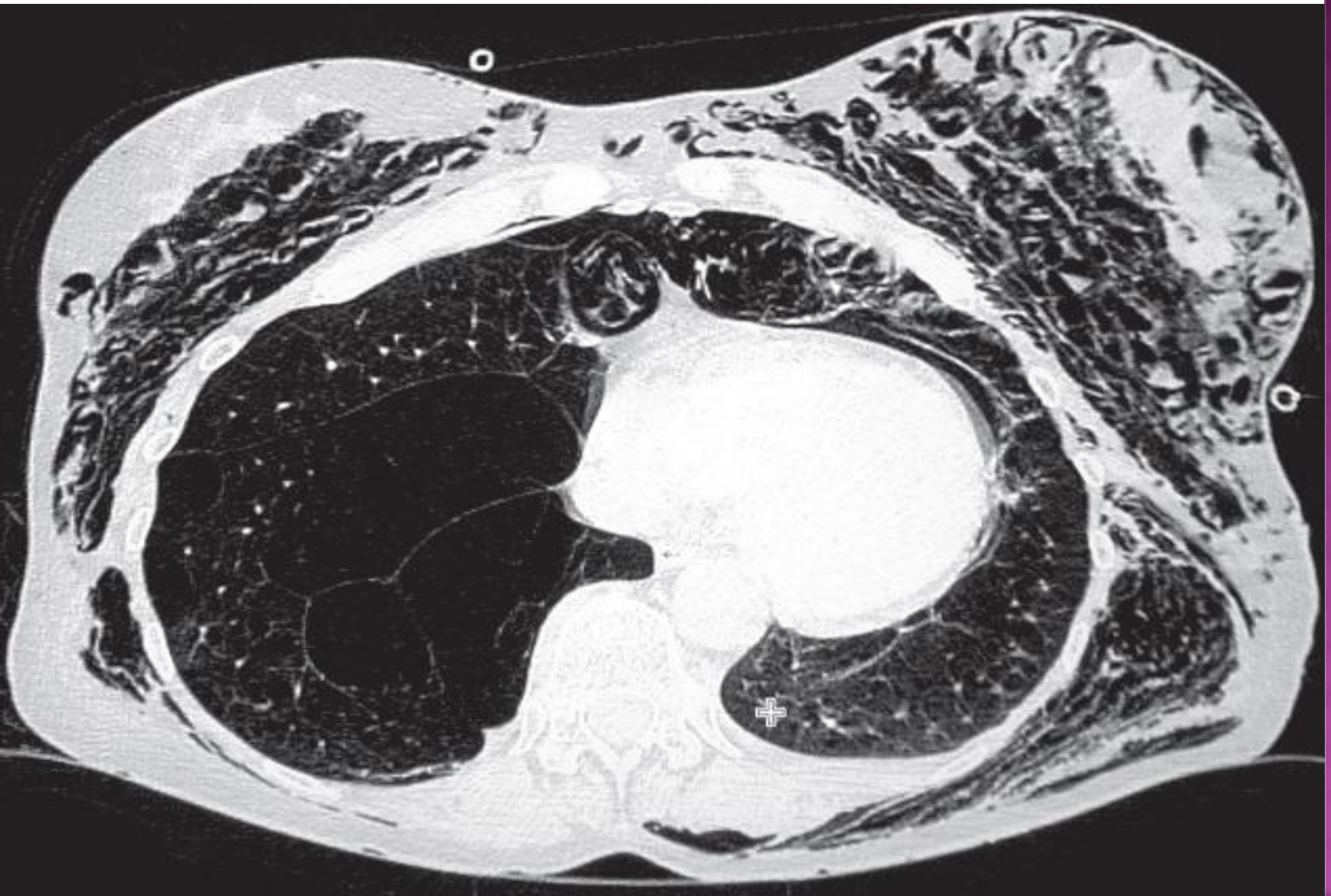
  (normal (MM), heterozygote (MZ),homozygote (ZZ))

  - ZZ can develop emphysema in their thirties, especially smokers

AXIAL THORACIC HRCT ILLUSTRATION DEMONSTRATES TYPES OF EMPHYSEMA ON HRCT: (1) CENTRILOBULAR, (2) PARASEPTAL, AND (3) PANLOBULAR



AXIAL THORACIC HRCT OF A FEMALE PATIENT WITH AIRLEAK SYNDROME SHOWS RIGHT PANLOBULAR EMPHYSEMA, SUBCUTANEOUS EMPHYSEMA AFFECTING THE THORACIC WALL AND BREASTS BILATERALLY, AND MILD PNEUMOPERICARDIUM



CHRONIC BRONCHITIS

- clinical diagnosis
- definition:

chronic cough and sputum production on most days for at least 3 months in 2 consecutive years

CHRONIC BRONCHITIS

- obstruction due to narrowing of the airway lumen by mucosal thickening and excess mucus
- usually due to smoking (80%) but air pollution increasingly important
- exacerbations due to :
  respiratory tract infections (typically viral), air pollution, bronchospasm, mucus plugging, and CHF
- some have features of asthma and chronic bronchitis (asthmatic bronchitis)

SYMPTOMS AND SIGNS

- present in the fifth or sixth decade of life
- excessive cough, sputum production, and shortness of breath.
- Symptoms have often been present for 10 years or more.
- frequent exacerbations of illness that result in absence from work and eventual disability.
- Pneumonia, pulmonary hypertension, cor pulmonale, and chronic respiratory failure characterize the late stage of COPD.

SIGNS & SYMPTOMS

- Fifteen percent develop progressively

  disabling symptoms

  in their 40s and 50s.

CLINICAL PRESENTATION OF CHRONIC BRONCHITIS AND EMPHYSEMA

	Symptoms	Signs	Complications
Bronchitis **Blue bloater**	• chronic productive cough • purulent sputum, hemoptysis • mild dyspnea initially	• cyanotic (secondary to hypoxemia and hypercapnia) • peripheral edema from RVF (cor pulmonale) • crackles, wheezes • prolonged expiration if obstructive • frequently obese	• secondary polycythemia due to hypoxemia • pulmonary HTN due to reactive vasoconstriction from hypoxemia • cor pulmonale from chronic pulmonary HTN
Emphysema **Pink puffer**	• dyspnea (+/- exertion) • minimal cough • increased minute ventilation • tachypnea	• pink skin • pursed-lip breathing • accessory muscle use • cachectic appearance due to anorexia + increased work of breathing • hyperinflation/barrel chest, hyperresonant percussion • decreased breath sounds, diaphragmatic excursion	• pneumothorax due to formation of bullae • weight loss due to work of breathing • weight loss due to more work of breathing than bronchitis patients

19.28 Modified MRC dyspnoea scale

Grade	Degree of breathlessness related to activities
0	No breathlessness except with strenuous exercise
1	Breathlessness when hurrying on the level or walking up a slight hill
2	Walks slower than contemporaries on level ground because of breathlessness or has to stop for breath when walking at own pace
3	Stops for breath after walking about 100 m or after a few minutes on level ground
4	Too breathless to leave the house, or breathless when dressing or undressing

Figure 2.3. CAT Assessment

For each item below, place a mark (✗) in the box that best describes you currently. Be sure to only select one response for each question.

			SCORE
Example:	I am very happy	0 ✗ 2 3 4 5 I am very sad	
I never cough	0 1 2 3 4 5	I cough all the time	
I have no phlegm (mucus) in my chest at all	0 1 2 3 4 5	My chest is completely full of phlegm (mucus)	
My chest does not feel tight at all	0 1 2 3 4 5	My chest feels very tight	
When I walk up a hill or one flight of stairs I am not breathless	0 1 2 3 4 5	When I walk up a hill or one flight of stairs I am very breathless	
I am not limited doing any activities at home	0 1 2 3 4 5	I am very limited doing activities at home	
I am confident leaving my home despite my lung condition	0 1 2 3 4 5	I am not at all confident leaving my home because of my lung condition	
I sleep soundly	0 1 2 3 4 5	I don't sleep soundly because of my lung condition	
I have lots of energy	0 1 2 3 4 5	I have no energy at all	
		TOTAL SCORE	

Reference: Jones et al. ERJ 2009; 34 (3): 648–54.

الفحص السريري

- موجودات قليلة
- الخراخر الجافة والزلة : تسمع خلال الشهيق والزفير
- الوزيز : علامة غير دائمة ولا تتعلق بشدة الانسداد
- تطاول زمن الزفير : مؤشر الانسداد
- الصدر البرميلي والتنفس مع الشفاه المطبقة والنحول ووضعية الجلوس مع الانحناء للأمام (وضعية ثلاثي القوائم)
- احتداد S2 الرئوي وخفوت الأصوات القلبية

INVESTIGATIONS AND FINDINGS IN CHRONIC BRONCHITIS AND EMPHYSEMA

Investigation	PFT	CXR
Bronchitis	↓flow rates (FVC, FEV1, FEV1/FVC, FEF25-75) normal TLC ↑RV/TLC prolonged FVC no change in FEV1 with bronchodilator (rise in FEV if asthma) Increased or normal DCO	AP normal or increased bronchovascular markings Enlarged heart with cor pulmonale
Emphysema	↓flow rates (FVC, FEV1, FEV1/FVC, FEF25-75) ↑lung volumes (RV, TLC, RV/TLC) prolonged FVC no change in FEV1 with bronchodilator (rise in FEV if asthma) decreased DCO	• AP hyperinflated chest • increased AP diameter • flat hemidiaphragm (on lateral) • decreased heart shadow • increased retrosternal space • decreased peripheral vascular markings • bullae

PULMONARY FUNCTION TESTS

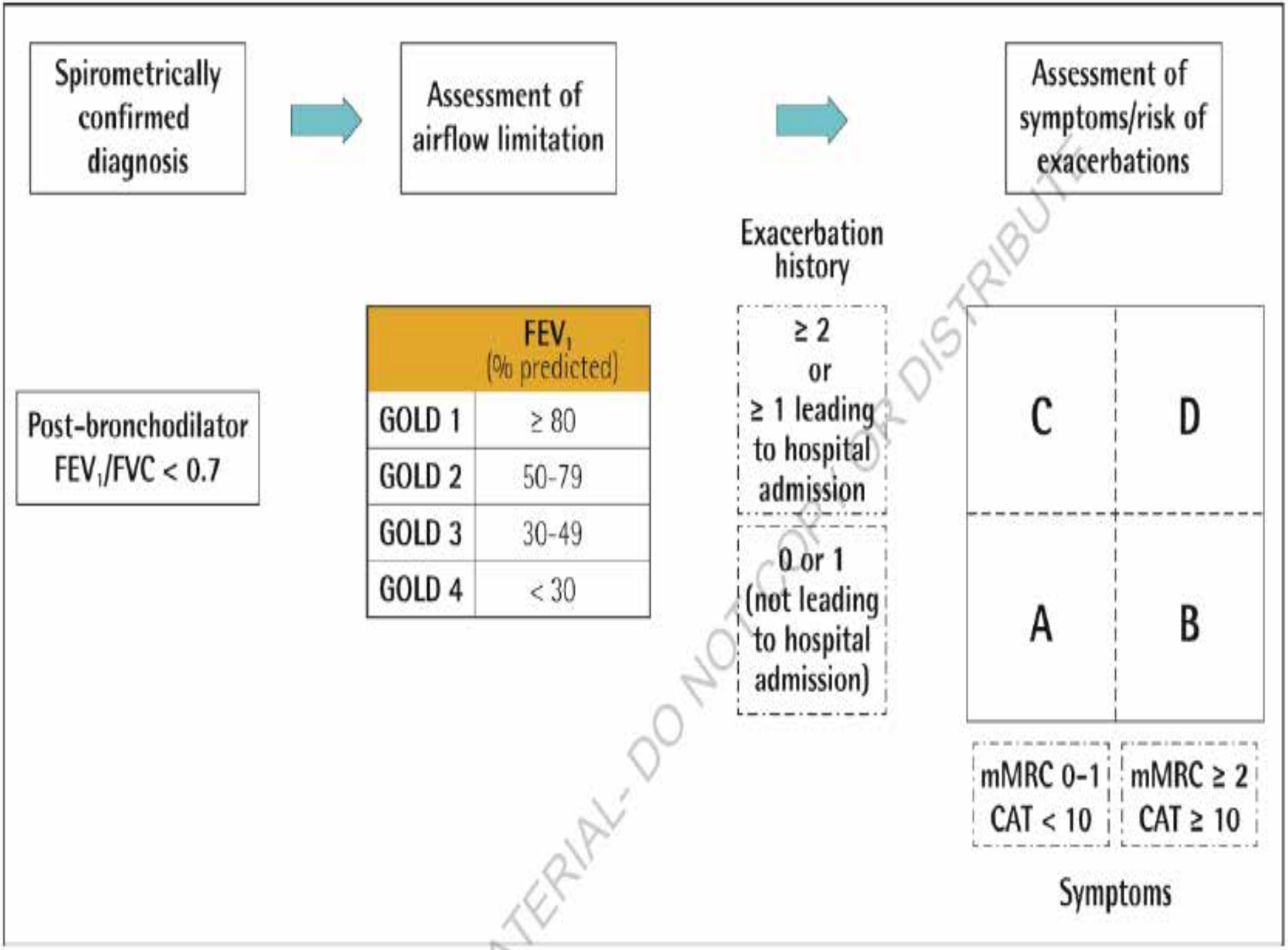
- Obstructive spirometry and flow-volume loops
- Reduced FEV_1 to <80% predicted
- FEV_1/FVC <0.7
- Minimal bronchodilator reversibility (<15%, usually <10%) and minimal steroid reversibility
- Raised total lung volume, FRC, and residual volume because of emphysema, air trapping, and loss of elastic recoil
- Decreased DLCO

19.29 Spirometric classification of COPD severity based on post-bronchodilator FEV1

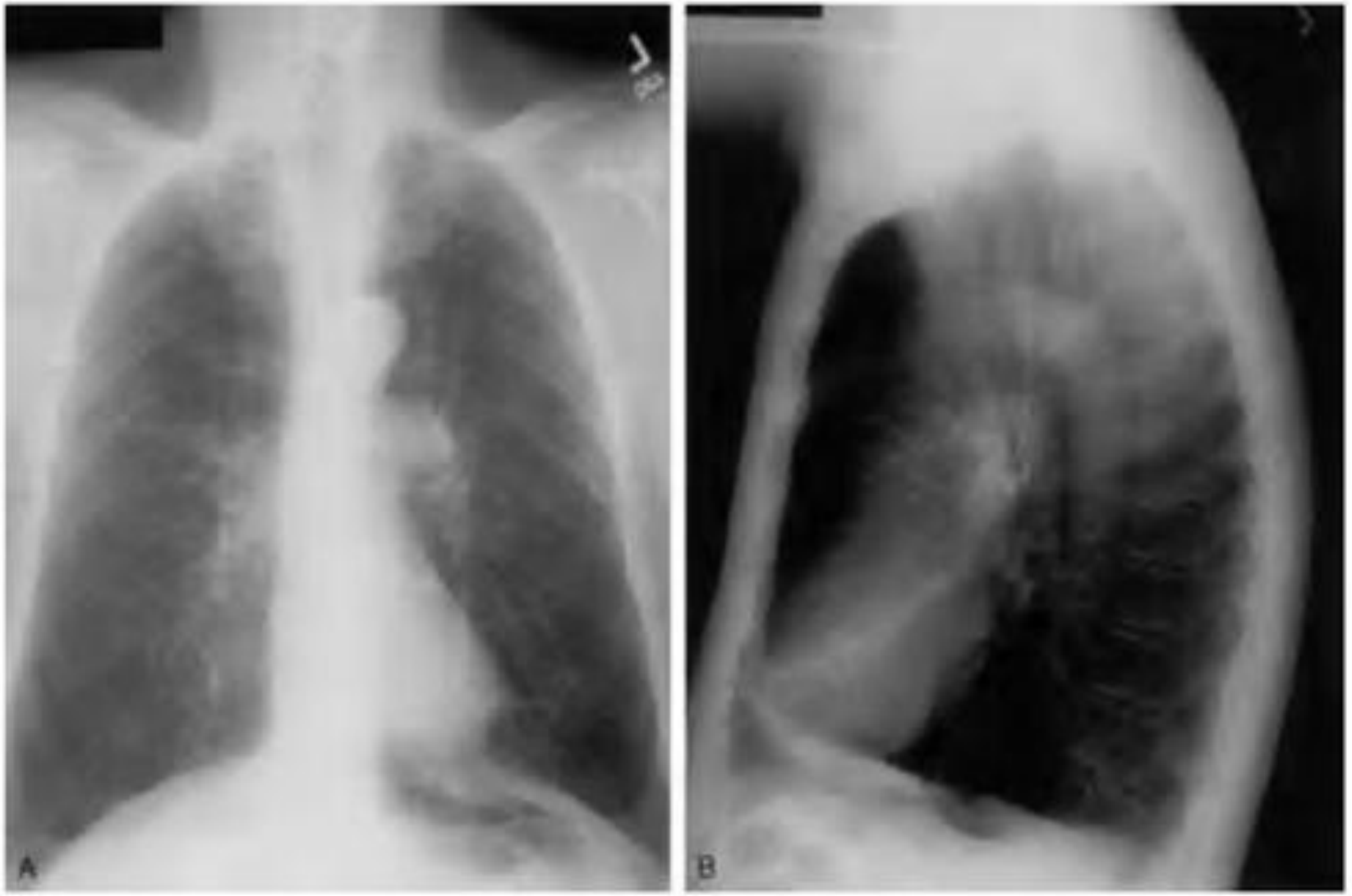
Stage	Severity	FEV_1
I	Mild	$FEV_1/FVC < 0.70$
		$FEV_1 \geq 80\%$ predicted
II	Moderate	$FEV_1/FVC < 0.70$
		$50\% \leq FEV_1 < 80\%$ predicted
III	Severe	$FEV_1/FVC < 0.70$
		$30\% \leq FEV_1 < 50\%$ predicted
IV	Very severe	$FEV_1/FVC < 0.70$
		$FEV_1 < 30\%$ predicted or $FEV_1 < 50\%$ predicted plus chronic respiratory failure

Classification of severity of COPD

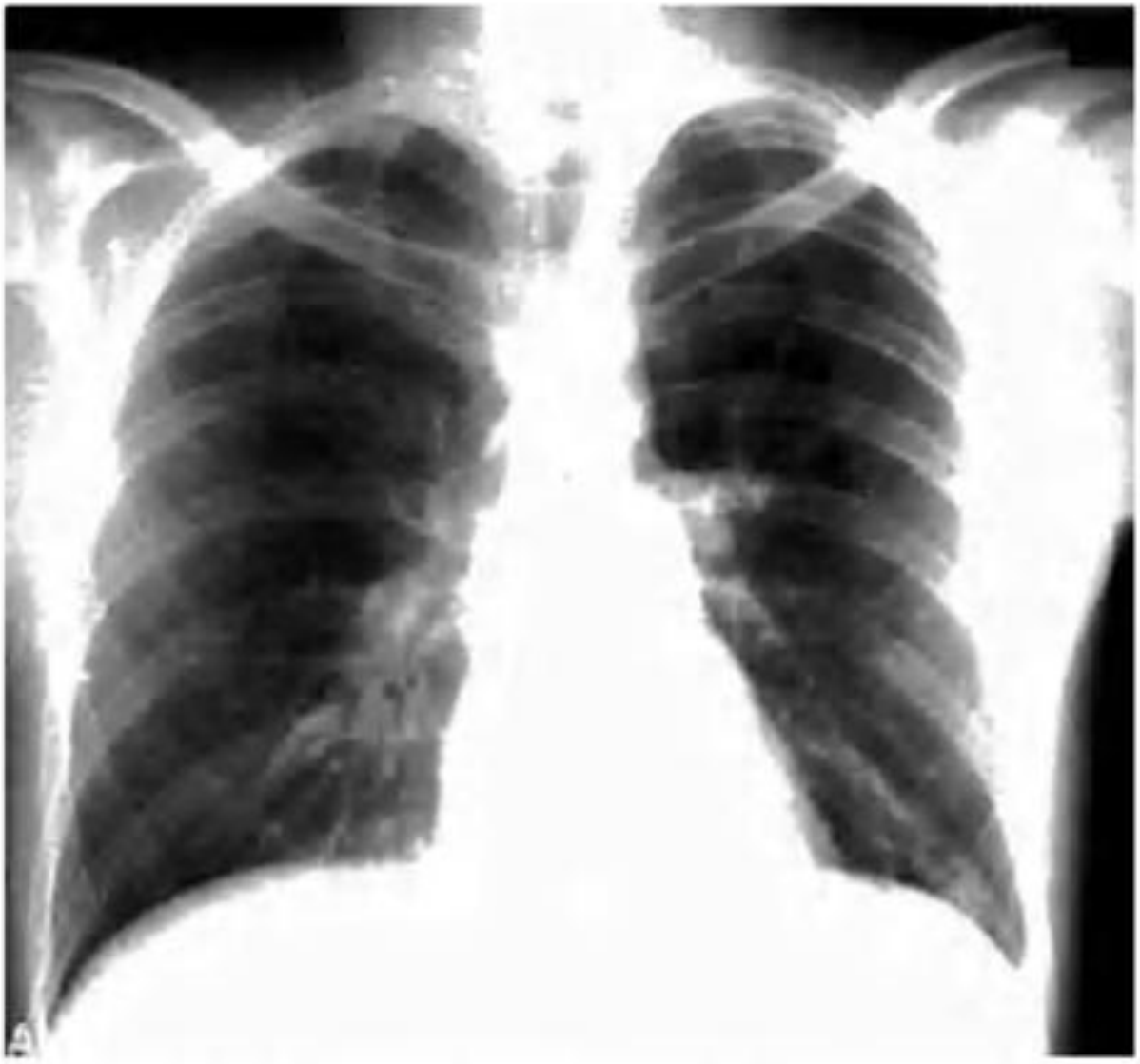
Stage	Characteristics
I: Mild COPD	FEV1/FVC <70 percent
	FEV1 ≥80 percent predicted
II: Moderate COPD	FEV1/FVC <70 percent
	50 percent ≤FEV1 <80 percent predicted
III: Severe COPD	FEV1/FVC <70 percent
	30 percent ≤FEV1 <50 percent predicted
IV: Very Severe COPD	FEV1/FVC <70 percent
	FEV1 <30 percent predicted or FEV1 <50 percent predicted plus chronic respiratory failure



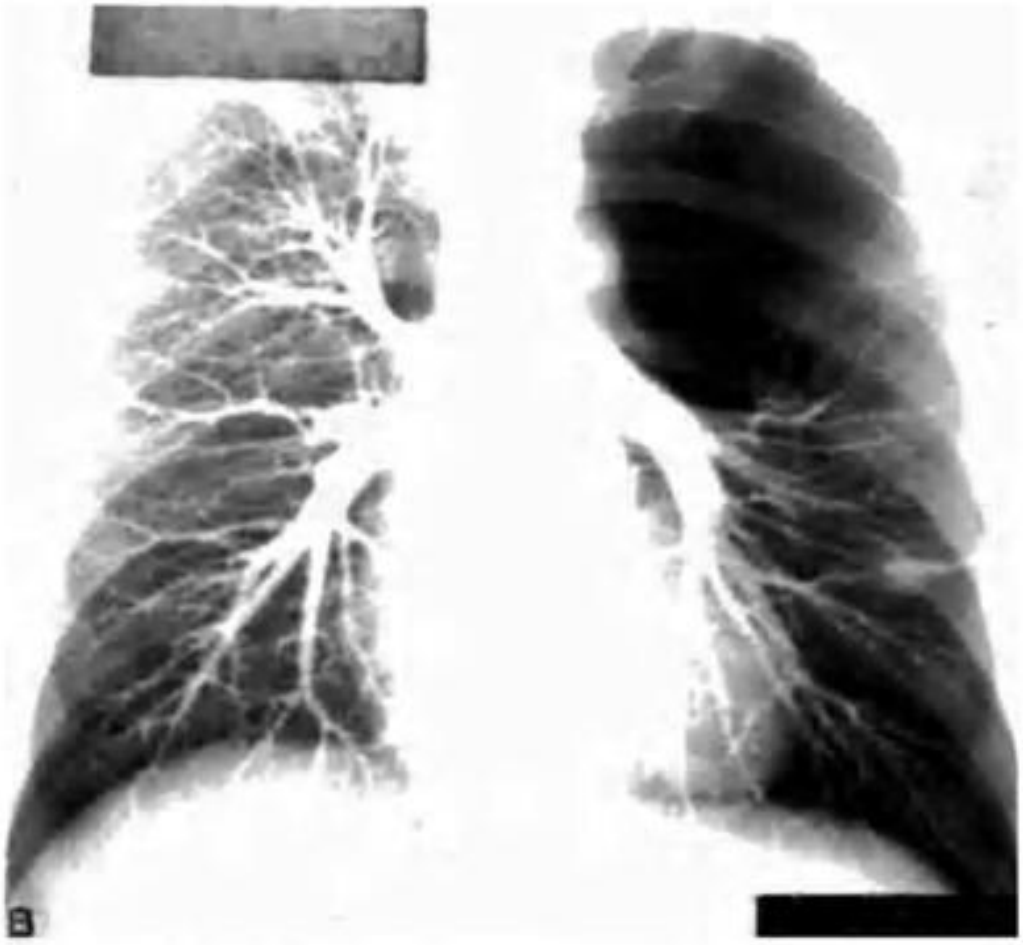
POSTEROANTERIOR AND LATERAL RADIOGRAPHS OF THE THORAX IN A PATIENT WITH EMPHYSEMA



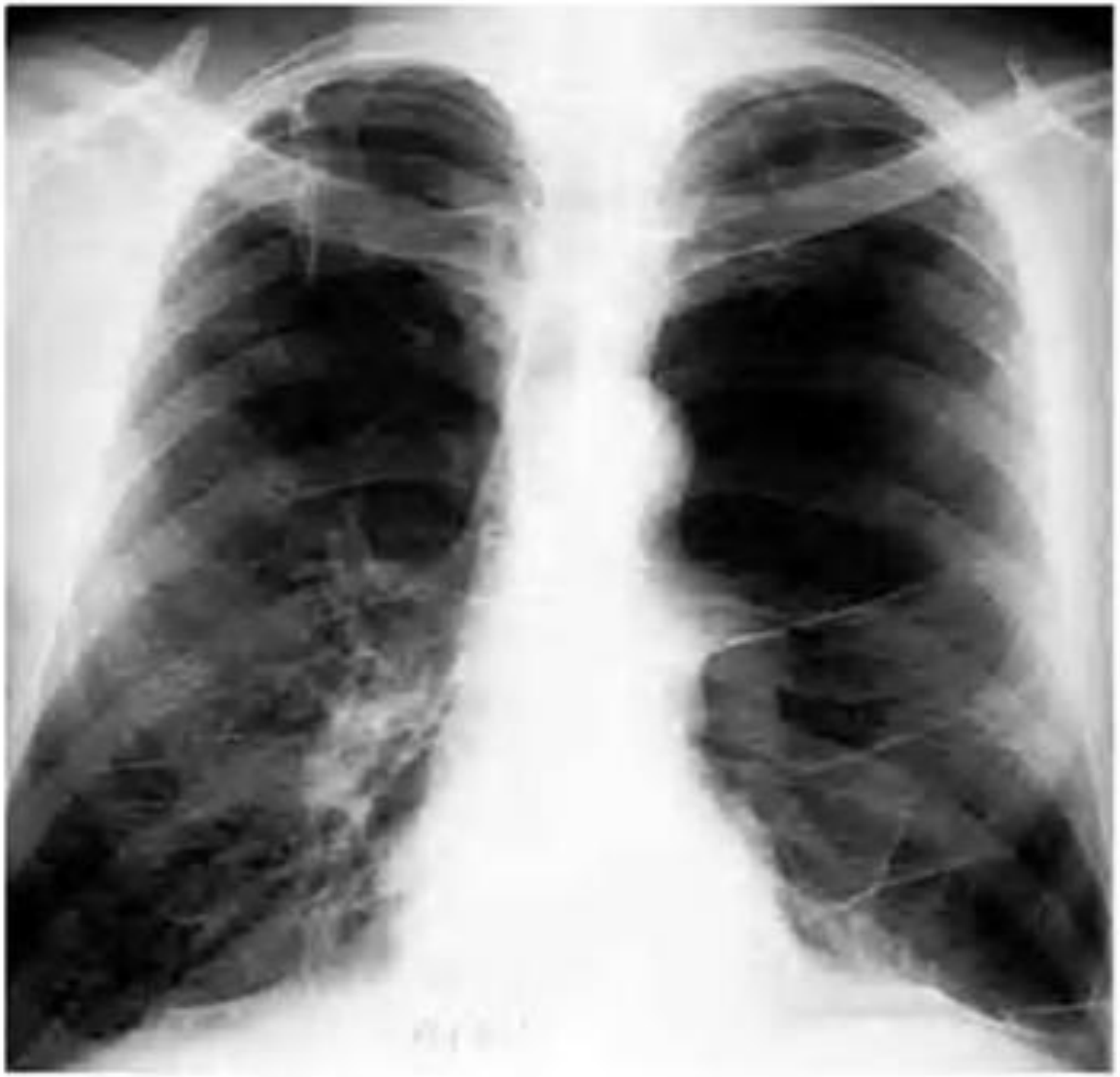
EMPHYSEMATOUS BULLAE OF LEFT LUNG.



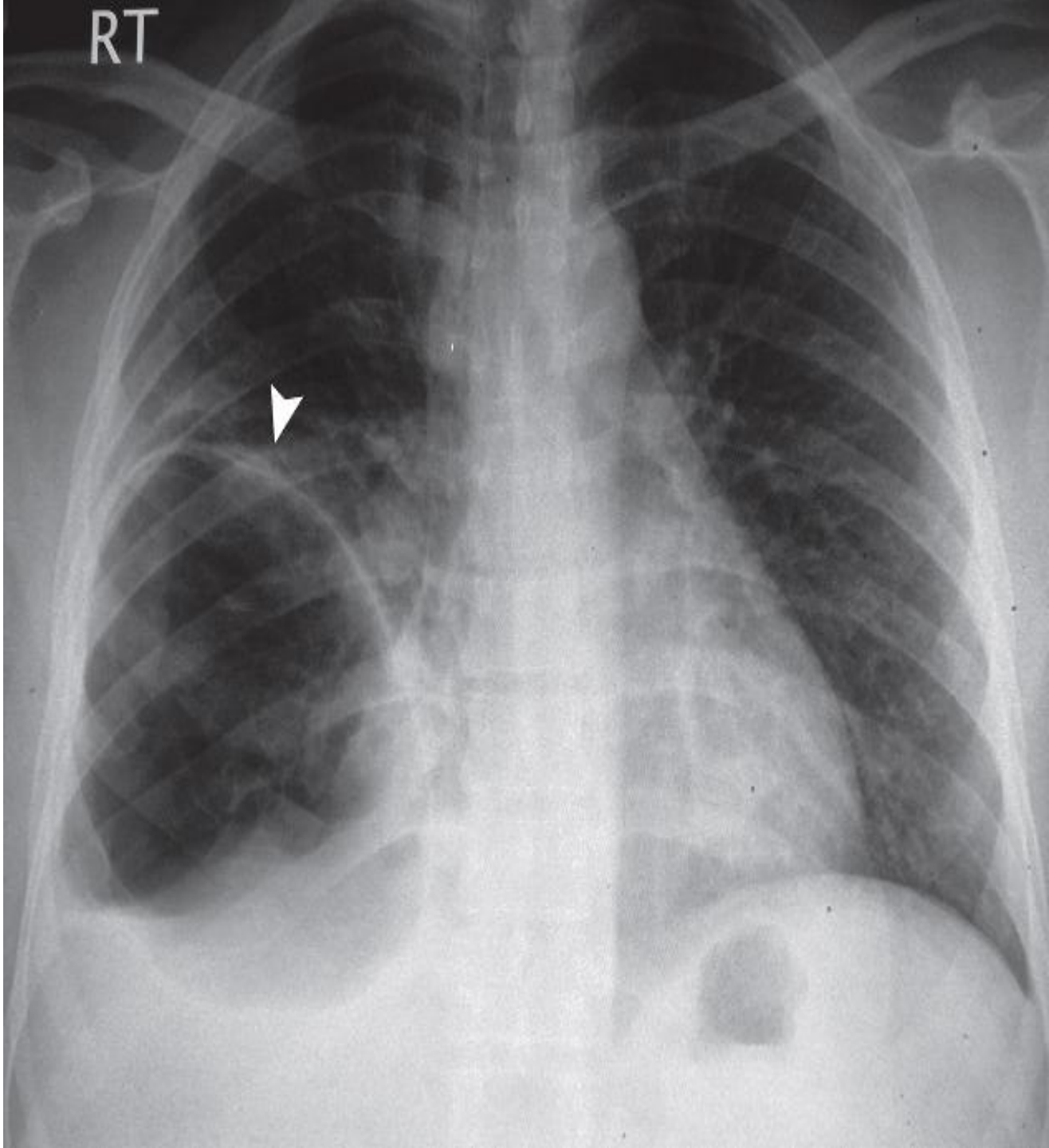
EMPHYSEMATOUS BULLAE OF LEFT LUNG.(PULMONARY ANGIOGRAM)



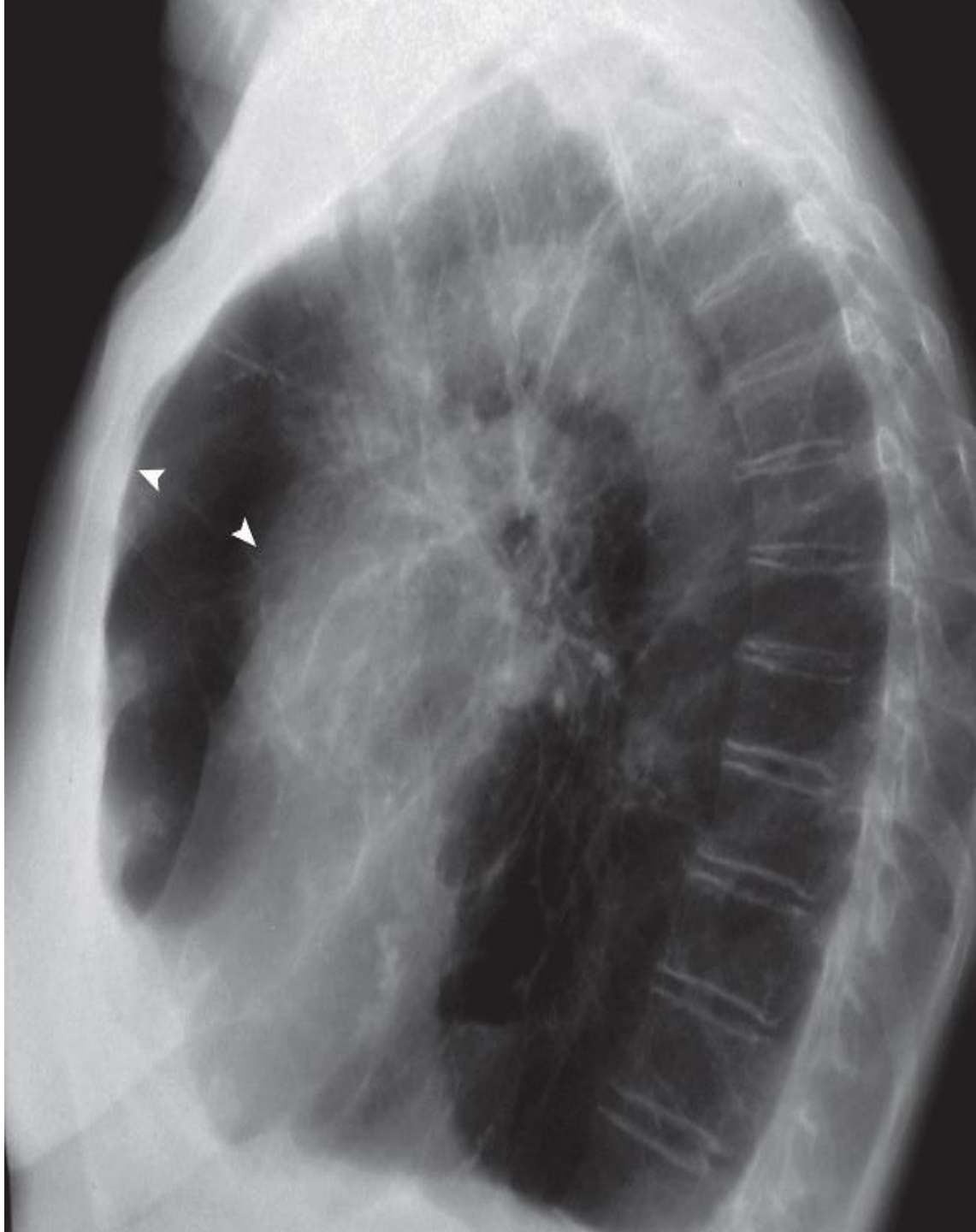
BULLOUS DISEASE. THERE IS ALMOST A COMPLETE PAUCITY OF LUNG MARKINGS IN BOTH LUNGS. THE EDGE OF SOME BULLAE CAN BE SEEN IN THE LEFT LUNG.



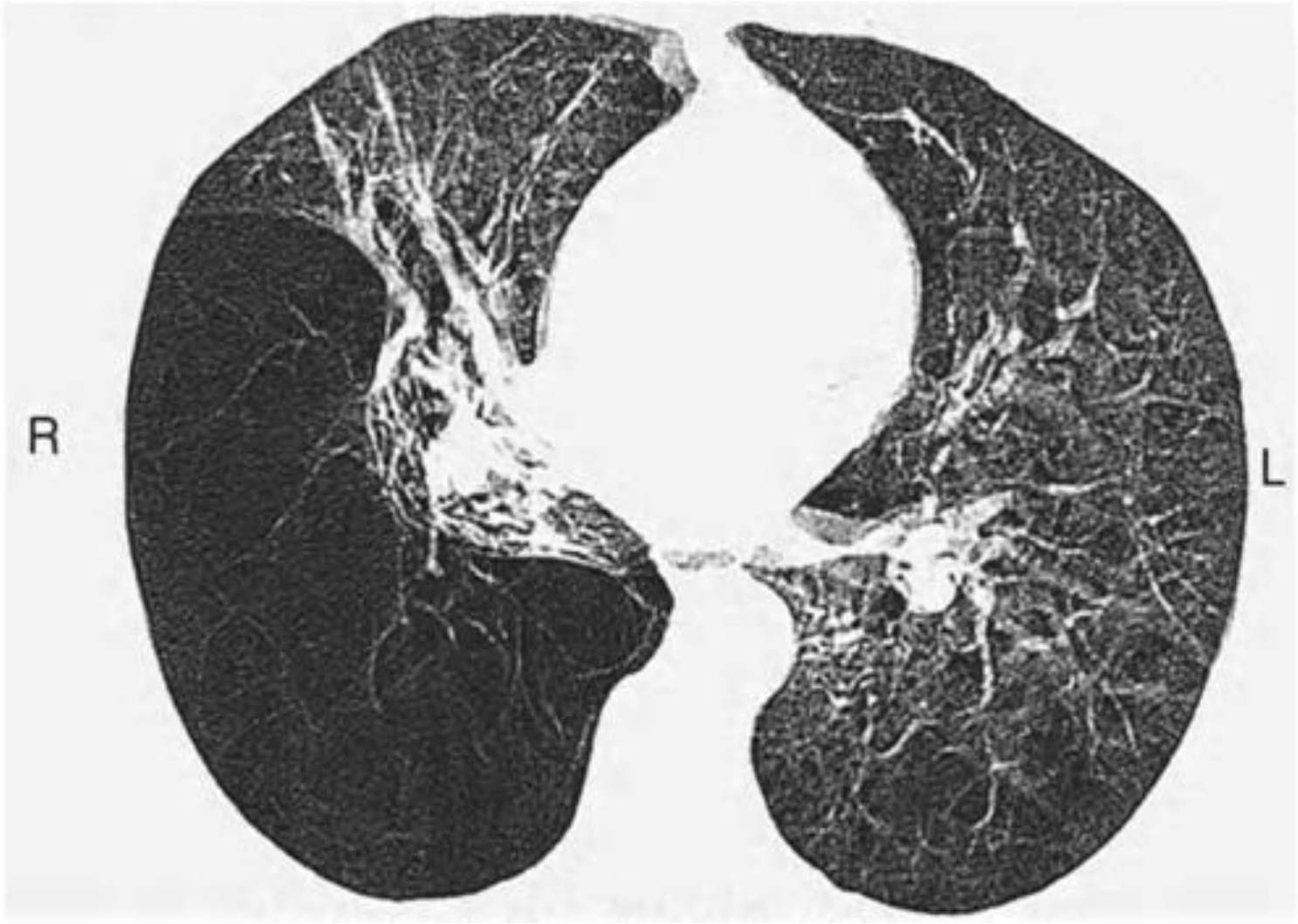
POSTEROANTERIOR PLAIN CHEST RADIOGRAPH SHOWS LARGE RIGHT LOWER ZONE BULLA (*ARROWHEAD*)



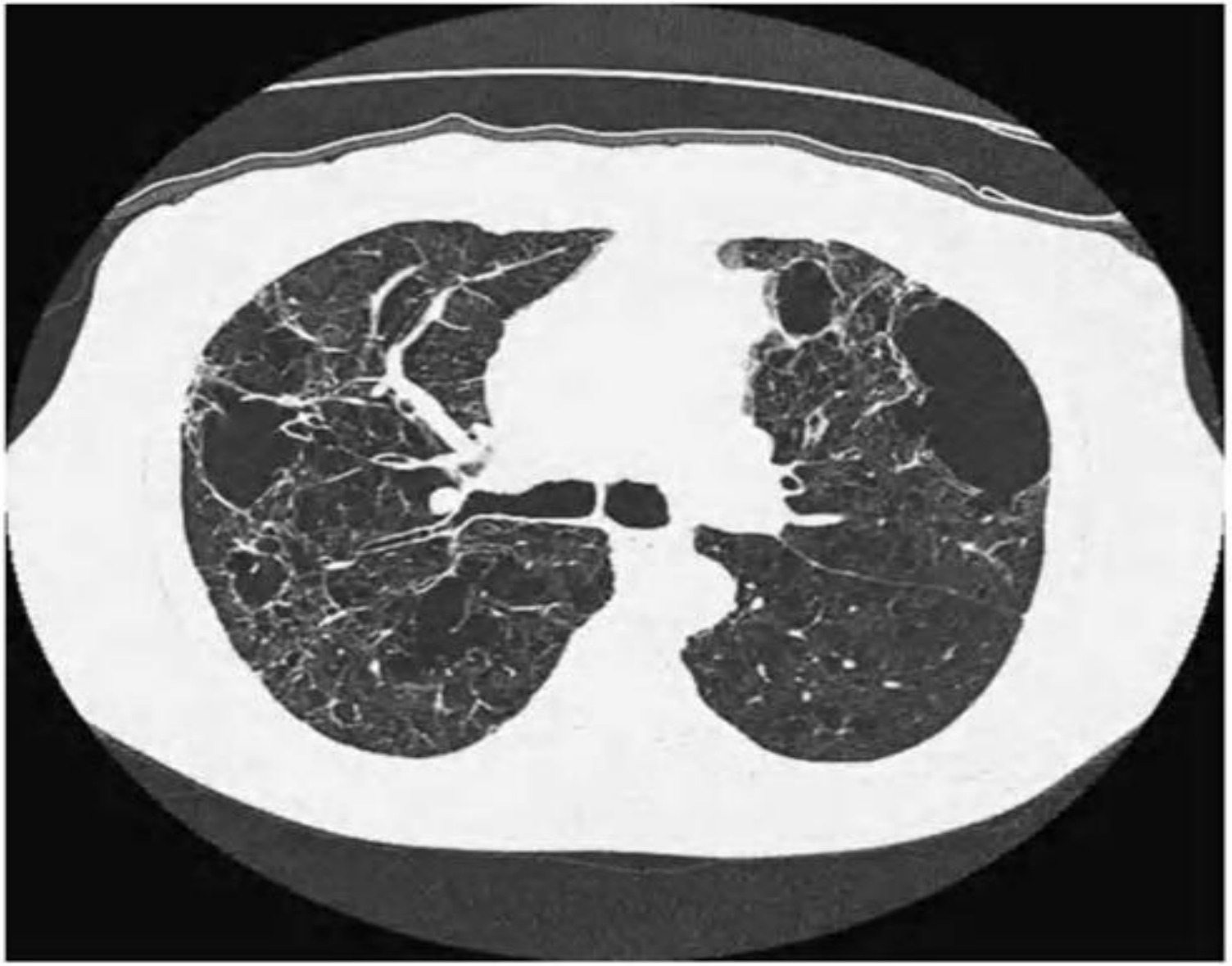
LATERAL PLAIN CHEST RADIOGRAPH OF A PATIENT WITH CONGENITAL A -1 ANTITRYPSIN DEFI CIENCY DISEASE SHOWS INCREASED RETROSTERNAL SPACE DUE TO EMPHYSEMA



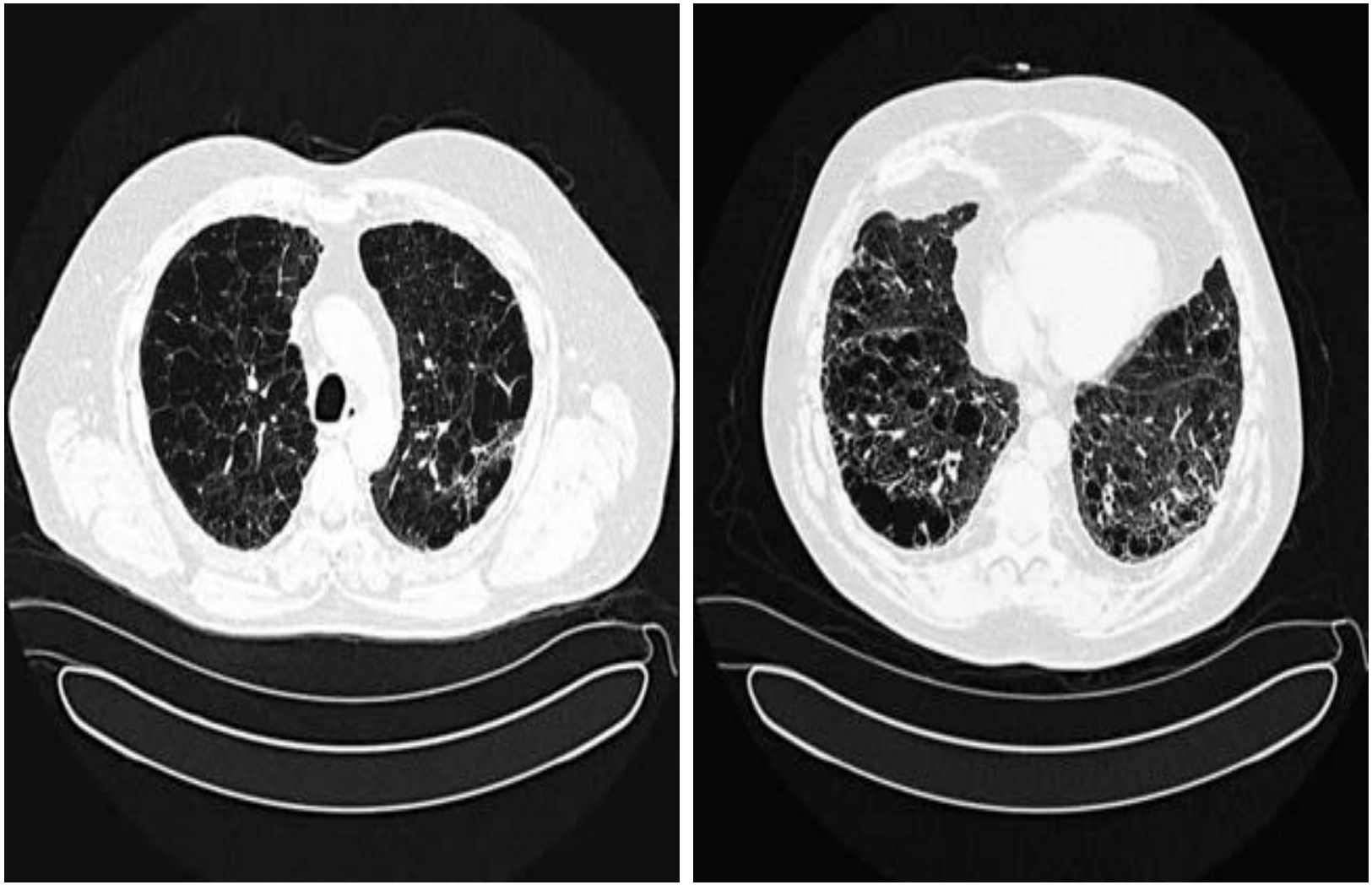
HRCT (EMPHYSEMA IN RLL)



HIGH-RESOLUTION AXIAL CT SCAN OF A 1-MM SECTION OF THE THORAX OF A PATIENT WITH EMPHYSEMA AT THE LEVEL OF THE TRACHEAL CARINA.



High-resolution CT (HRCT) scans of emphysema. HRCT images obtained at two levels from a patient with severe centrilobular emphysema.



TREATMENT OF COPD
NON PHARMACOLOGICAL

- patient education:
  enables patients to take control of their disease and improves compliance

- smoking cessation:
  decreases rate of decline of FEV1, reduce cough and sputum

- eliminate respiratory irritants/allergens (occupational/environmental)

- exercise rehabilitation to improve physical endurance

TREATMENT OF COPD NON PHARMACOLOGICAL

- nutrition: poor nutrition is associated with increased mortality
- intermittent mechanical ventilation to relieve dyspnea and rest respiratory muscles
- CPAP is used as an adjunct to weaning patients from mechanical ventilation and minimize dyspnea during exercise

PHARMACOLOGICAL TREATMENT

- **vaccination** with pneumovax and yearly H. *influenza*
- **bronchodilators**: mainstay of current drug therapy increase airflow and **reduce dyspnea**
- **corticosteroids** eg. beclomethasone, dexamethasone, flunisolide :
  - inhaled, oral or IV
  - COPD airways are usually inflamed, but **NOT** generally responsive to steroids
  - **slightly reduce** the severity and length of hospitalization in **acute exacerbations**

PHARMACOLOGICAL TREATMENT

- **Inhaled corticosteroids (ICS)**

  - reduce the frequency and severity of exacerbations

  - <u>recommended in</u>

    * patients with severe disease **(FEV_1 < 50%)**
    * who report **two or more exacerbations** requiring antibiotics or oral steroids per year.

Bronchodilators

- **Beta2-agonists:**

  short-acting (SABA) and long-acting (LABA), improve FEV1 and lung volumes, dyspnea, health status, exacerbation rate and number of hospitalizations, but have no effect on mortality or rate of decline of lung function.

BRONCHODILATORS

- ✓ **Antimuscarinic drugs:** Short-acting (SAMAs) and long-acting (LAMAs).

- ◉ ipratropium alone provided small benefits over short-acting beta2- agonist in terms of lung function, health status and requirement for oral steroids.

- ◉ greater effect on exacerbation rates for LAMA treatment (tiotropium) versus LABA treatment.

BRONCHODILATORS

- **Combination bronchodilator therapy:**
- may increase the degree of bronchodilation improving FEV1 and symptoms with a lower risk of side-effects compared to increasing the dose of a single bronchodilator.

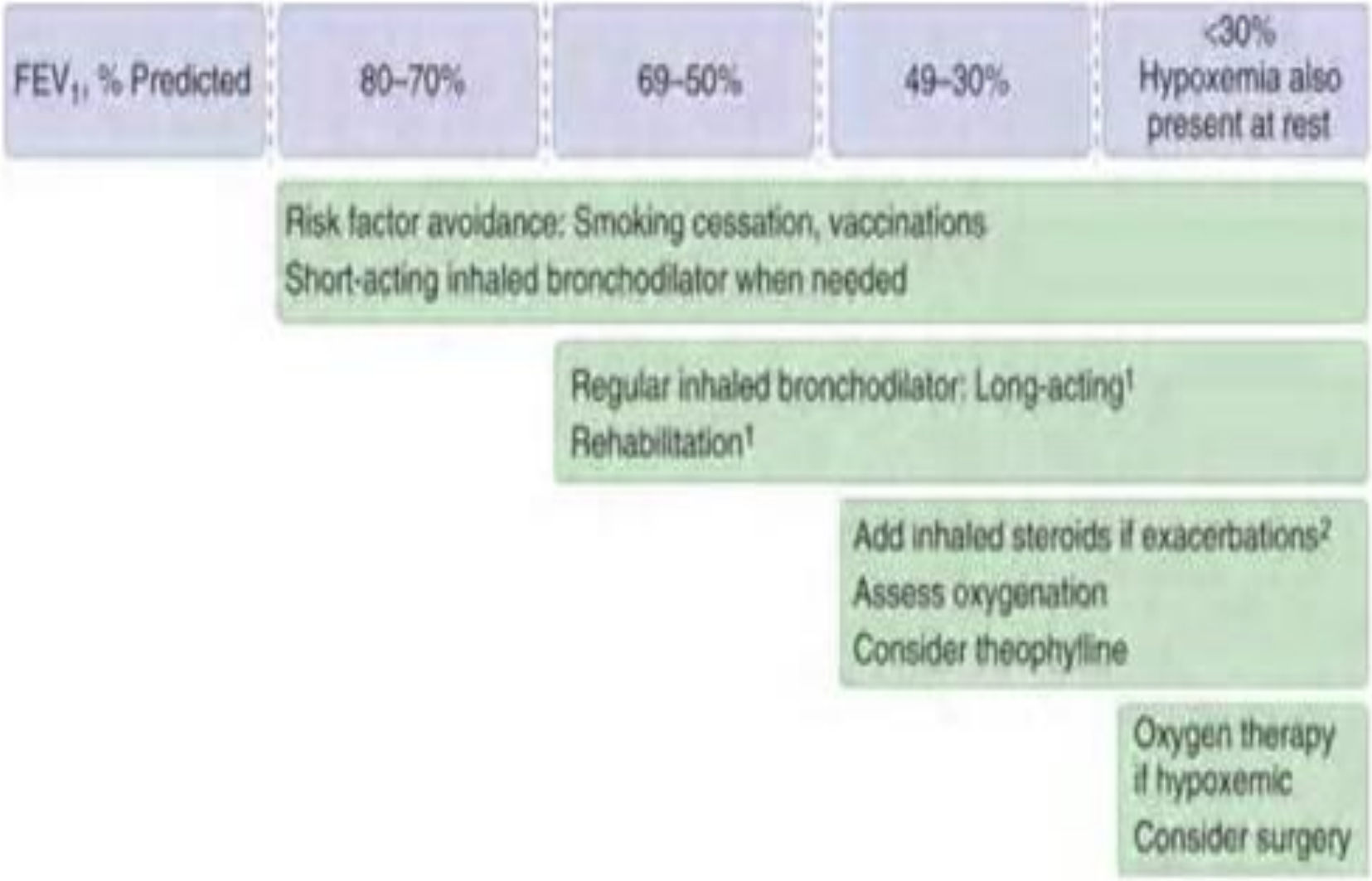
- Combination LABA plus LAMA in patients with history of exacerbations decrease exacerbation to a greater extent than an ICS/LABA combination.

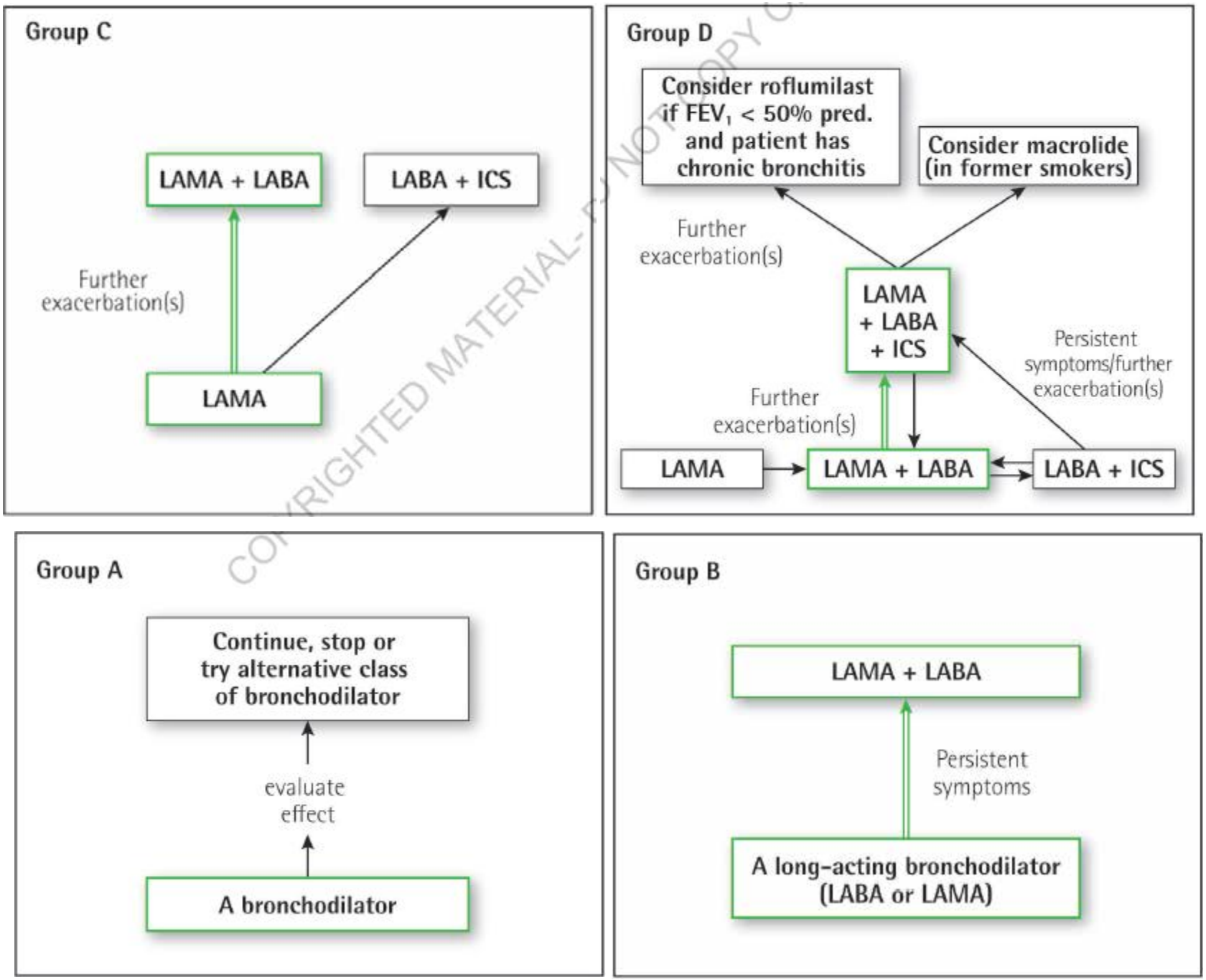
NONINVASIVE VENTILATION (NIV)

- Decrease morbidity and mortality in patients hospitalized with an exacerbation of COPD and acute respiratory failure.

- ***In Stable patient:*** may improve hospitalization-free survival in selected patients after recent hospitalization, particularly in those with pronounced daytime persistent hypercapnia PCo2>55mmgh, or concomitant OSA.

FLOW DIAGRAM FOR THE MANAGEMENT OF STABLE COPD





Stop Smoking

Break the Chains

By Mark Jordan

PHARMACOLOGICAL TREATMENT

- **nicotine replacement** therapy (gum or patch) may aid in smoking cessation :
  - buproprion (zyban) has been shown to be most effective in smoking cessation especially when used in conjunction with nicotine replacement

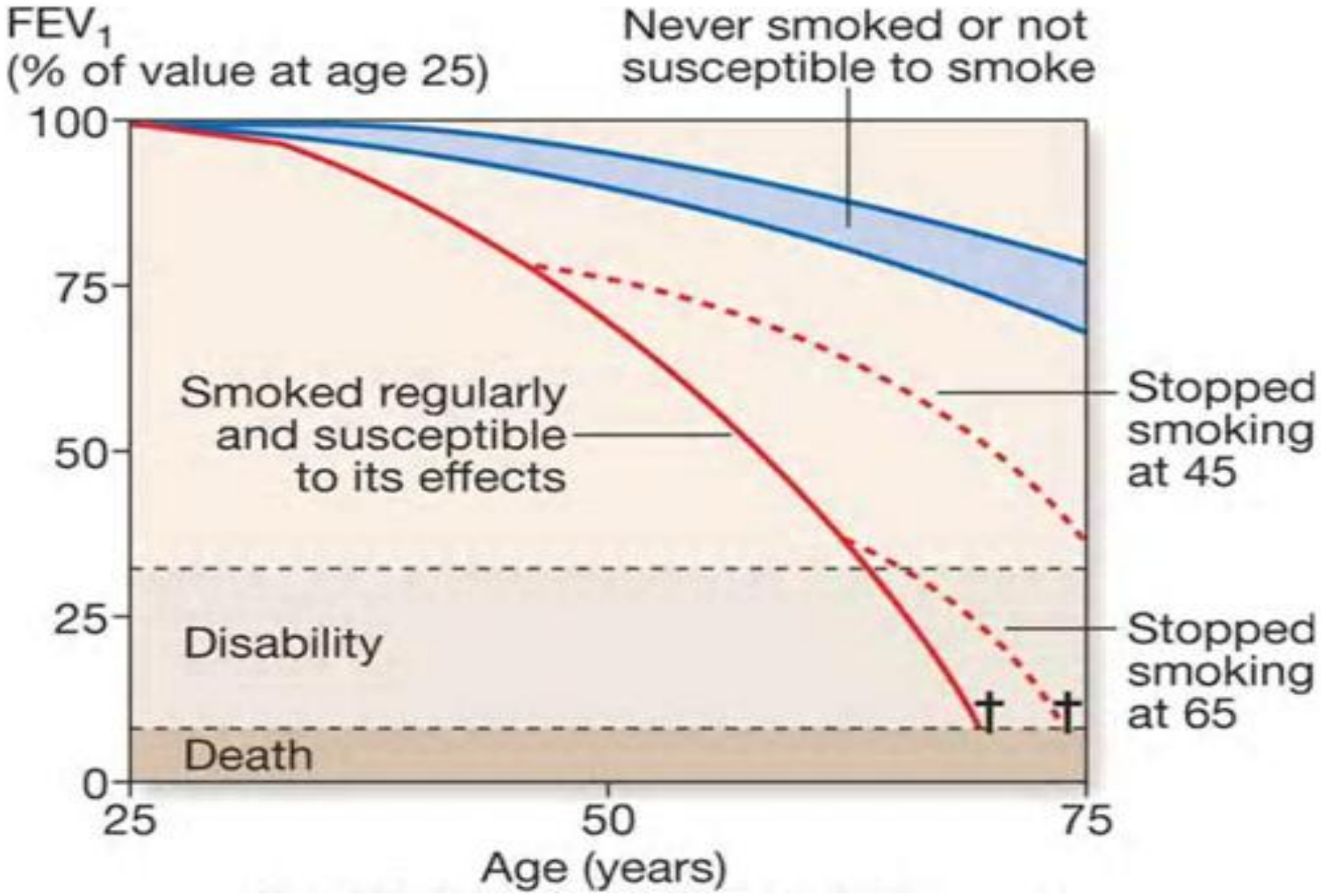
- **antibiotics** are commonly used during acute exacerbations
  - but not all are due to bacterial infections and therefore treatment is not always warranted

- **diuretics** in patients with right heart failure to avoid excess water retention

- **α-1-antitrypsin replacement** for documented deficiency

  (evidence is lacking that lung preservation is achieved with long term replacement and treatment is very expensive)

MODEL OF DECLINE IN FEV1 BY SMOKERS & NONSMOKERS



BRONCHODILATORS

- **anticholinergics** eg. ipratropium bromide:
    - inhaled
    - more effective than ß2-agonists with fewer side effects.
    - slow onset of action take daily .

- **inhaled ß2-agonist** eg. salbutamol and albuterol, salmeterol :
    - inhaled, injected or taken orally
    - rapid onset of action
    - significant side effects such as hypokalemia when used at high doses

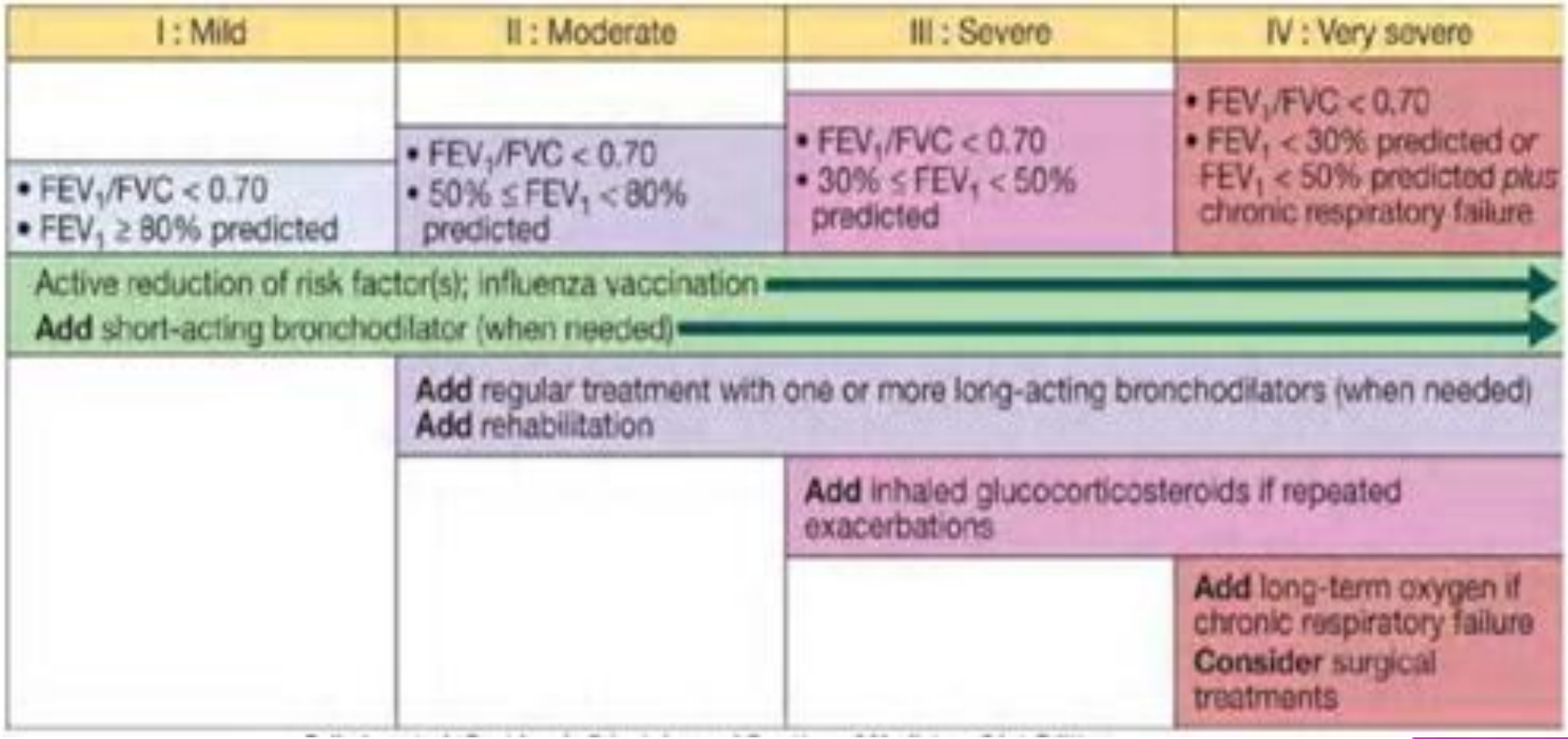
BRONCHODILATORS

- **methylxanthines** eg. Theophylline :
  - IV, orally or rectal
  - increases strength of respiratory muscles, ventilatory stimulation
  - increases mucociliary clearance
  - may even reduce airway inflammation
  - side effects include nervous tremor, tachycardia,arrhythmias, sleep changes, gastric acid, toxicity

MUCOLYTICS (CARBOCISTEINE, MECYSTEINE HYDROCHLORIDE)

- facilitate expectoration by reducing sputum viscosity.
- Prescribe for a **4-week trial period** and only **continue** if there is evidence of improvement.
- cause a significant **decrease in the number** of COPD **exacerbations** and decrease the number of days of disability

GOLD CRITERIA FOR THE TREATMENT OF COPD



SURGICAL TREATMENT

- bullectomy of emphysematous parts of lung to improve ventilatory function

- lung transplant

ACUTE EXACERBATIONS

- defined as increase in dyspnea, effort intolerance, change in cough/volume of sputum
- etiology most often viral but PE, MI, CHF must be considered
- assess ABCs, consider assisted ventilation if decreasing LOC or poor ABGs
- supplemental O2 (controlled FiO2)
- 1st line: sympathomimetics (rapid onset of action and have minimal side effects with inhalation therapy)

ACUTE EXACERBATIONS

- ❑ anticholinergics are used concurrently with ß2-agonist
- ❑ theophylline: 3rd line agent
- ❑ corticosteriods

  (prednisolone 30 mg/day for 1 to 2 weeks)

  for all patients who are admitted to hospital or are significantly more breathless than usual.
- ❑ antibiotics often used to treat precipitating infection

(sputum purulent, pyrexial, high CRP, new changes on CXR)

ACUTE EXACERBATIONS

- Non-invasive ventilation (NIV):

  - when maximal medical treatment has not been effective.

  - Appropriate for conscious patients with ongoing respiratory acidosis (pH 7.35 or less), hypoxia, and hypercapnia.

COMMONLY USED MEDICATIONS FOR ACUTE EXACERBATIONS OF CHRONIC OBSTRUCTIVE PULMONARY DISEASE

Drug	Mode of Delivery	Dose	Frequency
Bronchodilators			
β-Adrenergic agonist			
Albuterol	Metered-dose inhaler	100–200 µg	4 times daily
	Nebulizer	0.5–2.0 mg	4 times daily
Metaproterenol	Nebulizer	0.1–0.2 mg	4 times daily
Terbutaline	Metered-dose inhaler	400 µg	4 times daily
Anticholinergic agent			
	Ipratropium bromide	Metered-dose inhaler	18–36 µg 4 times daily
	Nebulizer	0.5 mg	4 times daily
Methylxanthines			
Aminophylline [*]	Intravenous	0.9 mg/kg of body weight/hr	Infusion
Theophylline	Pill (sustained-release preparations)	150–450 mg [†]	Twice daily
Corticosteroids			
Methylprednisolone succinate	Infusion, then pill	125 mg	Every 6 hours for 3 days, then
		60 mg	Daily for 4 days
		40 mg	Daily for 4 days
		20 mg	Daily for 4 days
Prednisone (for outpatients)	Pill	30–60 mg	Daily for 5 to 10 days
Limited-spectrum antibiotics			
Trimethoprim-sulfamethoxazole	Pill	160 mg and 800 mg	Twice daily for 5 to 10 days
Amoxicillin	Pill	250 mg	4 times daily for 5 to 10 days
Doxycycline	Pill	100 mg	2 tablets first day, then 1 tablet/day for

INDICATIONS FOR HOME O2

- O2 has been shown to decrease COPD complications such as cor pulmonale and to **improve survival**
- **PaO2 < 55 mm Hg** or **PaO2 < 60 mm Hg with erythrocytosis (Hct > 55%) cor pulmonale**, or O2 saturation < 88% on exertion/sleep
- hypoxemia must persist after 3 weeks of maximal therapy in an otherwise stable patient
- PaO2 maintained between 65-80 mm Hg during wakeful rest and increased by 1 L/minute during exercise or sleep as determined by oximetry

HOME O2

- patients should be instructed to use oxygen for a **minimum of 15 hours/day**; greater benefits are seen in patients who receive > 20 hours/day.

- Oxygen flow rates should be adjusted to maintain SaO_2 above 90%.

Table 9–7. Home oxygen therapy: requirements for Medicare coverage.[1]

Group I (any of the following):

1. $Pao_2 \leq 55$ mm Hg or $Sao_2 \leq 88\%$ taken at rest breathing room air, while awake.

2. During sleep (prescription for nocturnal oxygen use only):

a. $Pao_2 \leq 55$ mm Hg or $Sao_2 \leq 88\%$ for a patient whose awake, resting, room air Pao_2 is ≥ 56 mm Hg or $Sao_2 \geq 89\%$,

or

b. Decrease in $Pao_2 > 10$ mm Hg or decrease in $Sao_2 > 5\%$ associated with symptoms or signs reasonably attributed to hypoxemia (eg, impaired cognitive processes, nocturnal restlessness, insomnia).

3. During exercise (prescription for oxygen use only during exercise):

a. $Pao_2 \leq 55$ mg Hg or $Sao_2 \leq 88\%$ taken during exercise for a patient whose awake, resting, room air Pao_2 is ≥ 56 mm Hg or $Sao_2 \geq 89\%$,

and

b. There is evidence that the use of supplemental oxygen during exercise improves the hypoxemia that was demonstrated during exercise while breathing room air.

Group II[2]:

$Pao_2 = 56–59$ mm Hg or $Sao_2 = 89\%$ if there is evidence of any of the following:

1. Dependent edema suggesting congestive heart failure.
2. P pulmonale on ECG (P wave > 3 mm in standard leads II, III, or aVF).
3. Hematocrit > 56%.

PROGNOSIS IN COPD

- factors :
  - severity of airflow limitation (FEV1)
  - development of complicating factors such as hypoxemia or cor pulmonale
- 5-year survival :
  - FEV1 < 1 L = 50%
  - FEV1 < 0.75 L = 33%
- average decline in FEV1 :
  - 25 mL/year in normal healthy people
  - 75 mL/year for COPD (this rate approaches the normal rate with cessation of smoking)

BODE INDEX

19.33 Calculation of the BODE index

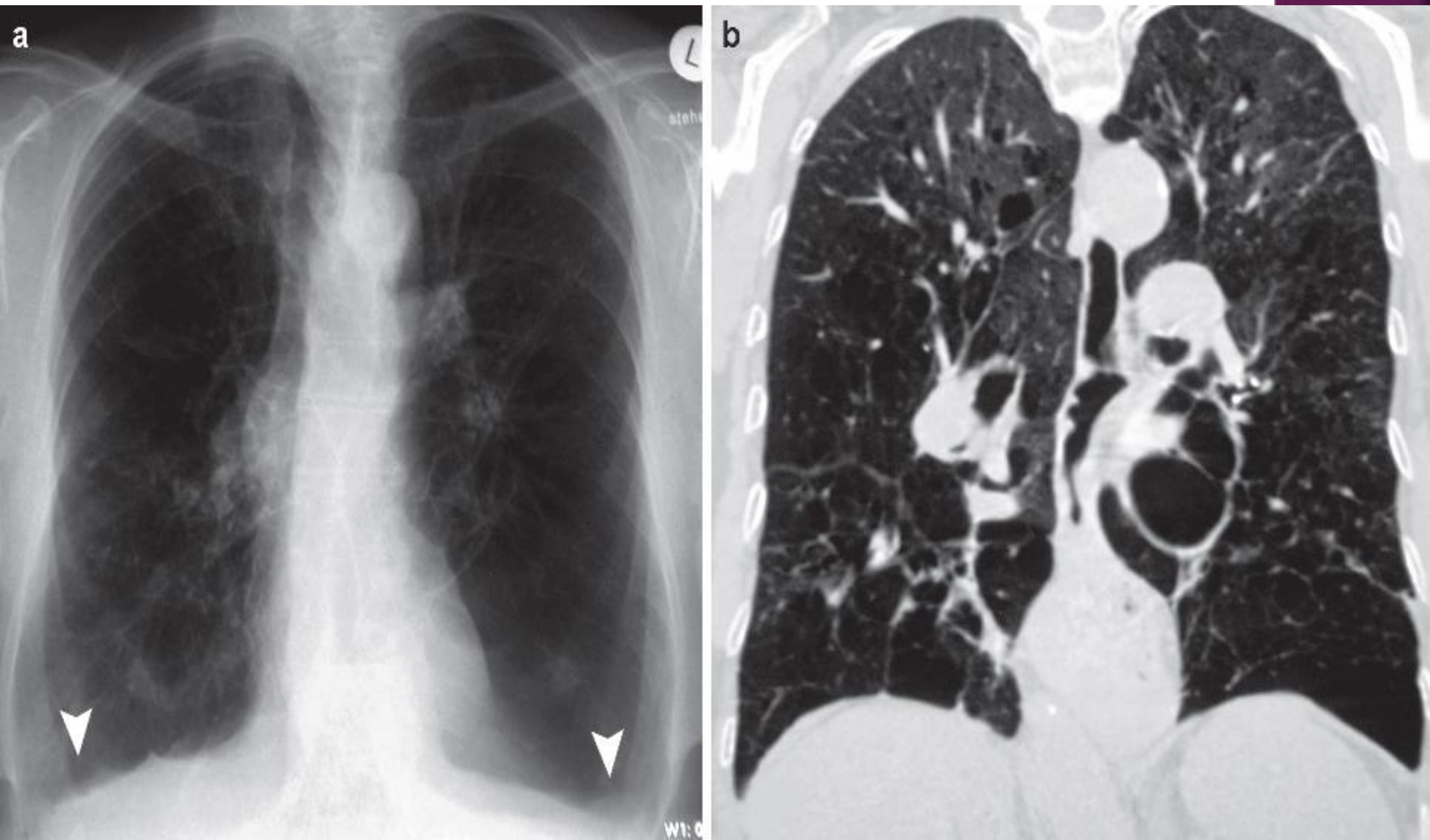
Variable	Points on BODE index 0	1	2	3
FEV_1	≥ 65	50-64	36-49	≤ 35
Distance walked in 6 min (m)	≥ 350	250-349	150-249	≤ 149
MRC dyspnoea scale*	0-1	2	3	4
Body mass index	> 21	≤ 21		

BODE index	mortality rate
0 – 2	10 % at 52 months
7 – 10	80 % at 52 months

A_1-ANTITRYPSIN (A_1-AT) DEFICIENCY

- inherited condition :
  (autosomal co-dominant disorder)
- MS, MZ have 50-70% of normal A_1-protease inhibitor (Pi) levels
- SZ, SS have 35-50% of normal levels. 20-50% risk of emphysema
- Homozygous ZZ has only 10-20% of normal levels. 80-100% risk of emphysema
- estimated 1 in 2000-5000 individuals
- it is often asymptomatic in non-smokers.
- worse in smokers and can cause COPD at a young age (40s and 50s).
- associated liver dysfunction, chronic hepatitis, cirrhosis, and hepatoma

POSTEROANTERIOR PLAIN CHEST RADIOGRAPH (A) AND CORONAL CHEST HRCT (B) OF TWO PATIENTS WITH CONGENITAL A -1 ANTITRYPSIN DEFI CIENCY DISEASE SHOWS FL ATTENED DIAPHRAGM IN (A) (*ARROWHEADS*), AND BILATERAL PANLOBULAR AND CENTRILOBULAR EMPHYSEMA IN (B)



TREATMENT

- usual therapy for COPD

- **augmentation therapy:**
  with weekly/2-weekly/monthly infusions of purified α_1-AT from pooled human plasma.
  (reduced mortality , slowing of lung function decline , It is expensive and cost-effective

- Inhaled α_1-AT ?

- Gene therapy is under development