呼吸系統臨床診斷
參考資料

胸腔內科 郭秋萍

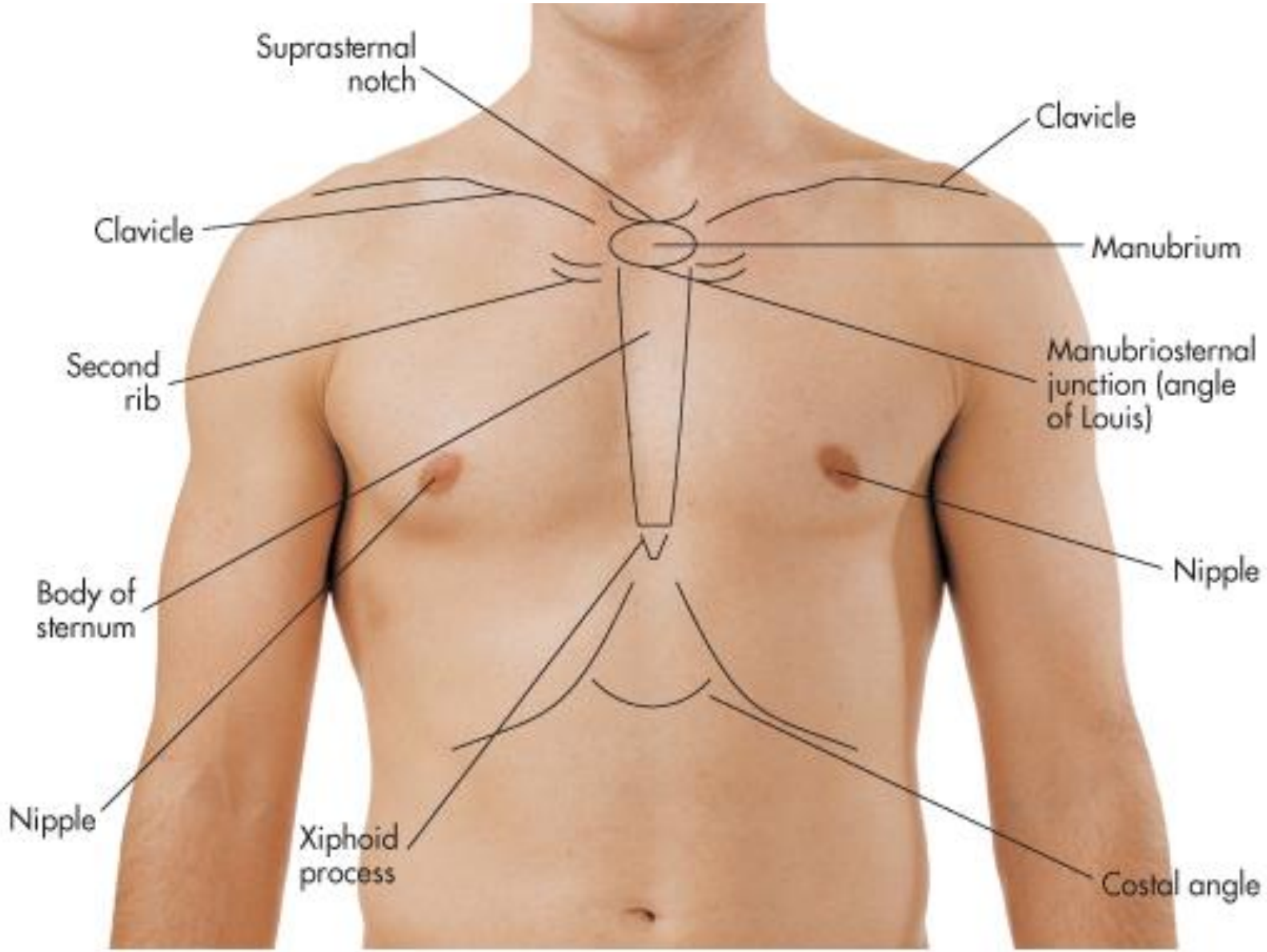
呼吸系統的臨床診斷工具

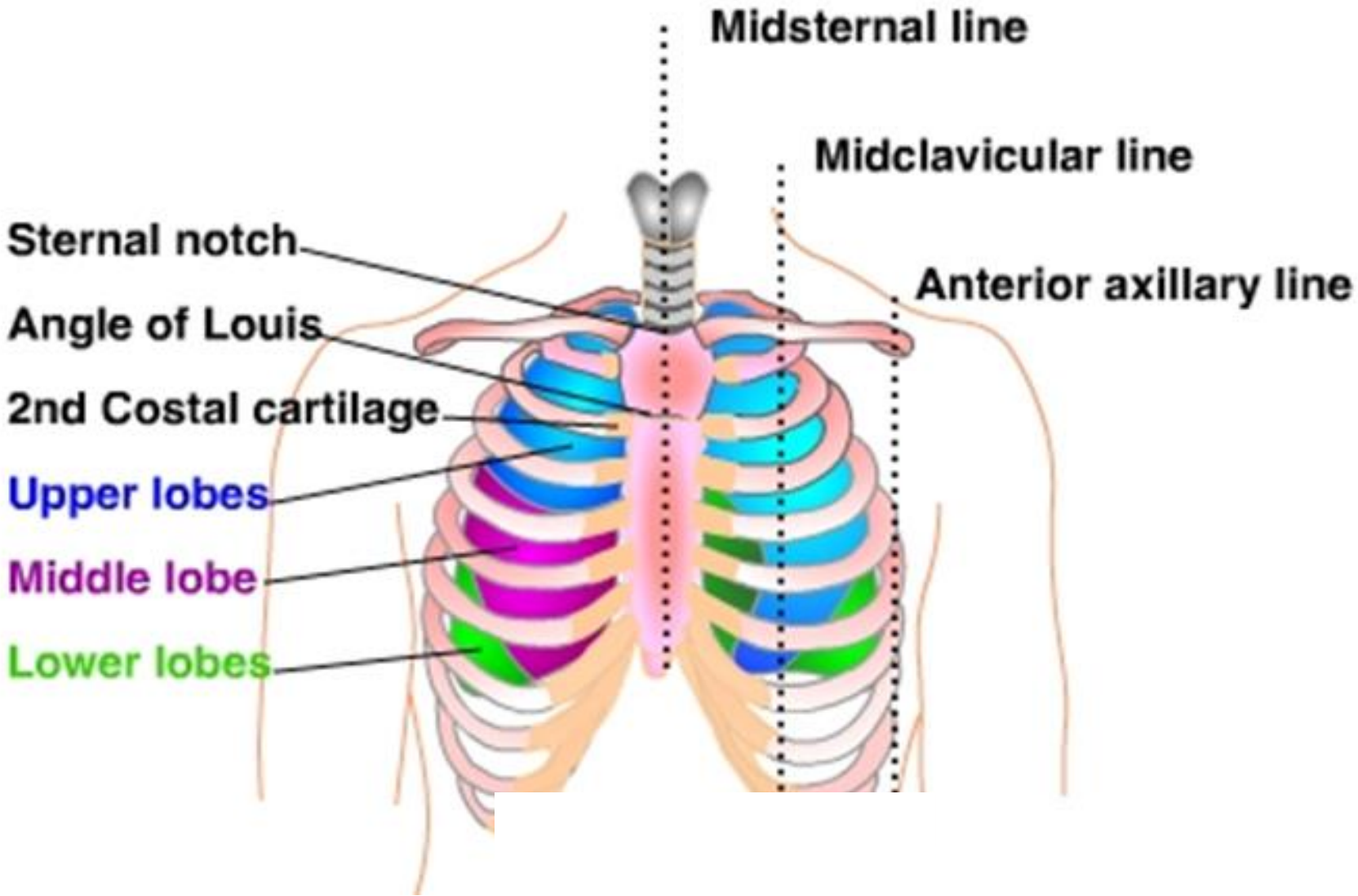
- History taking
- Physical examination
- Chest X-rays, CT scans, MRIs
- Pulse Oximeter, blood gas analysis, sputum evaluation
- Pulmonary function testing, Peak flow meter
- Chest ultrasonography
- Bronchoscopy
- PCNB (percutaneous needle biopsy):

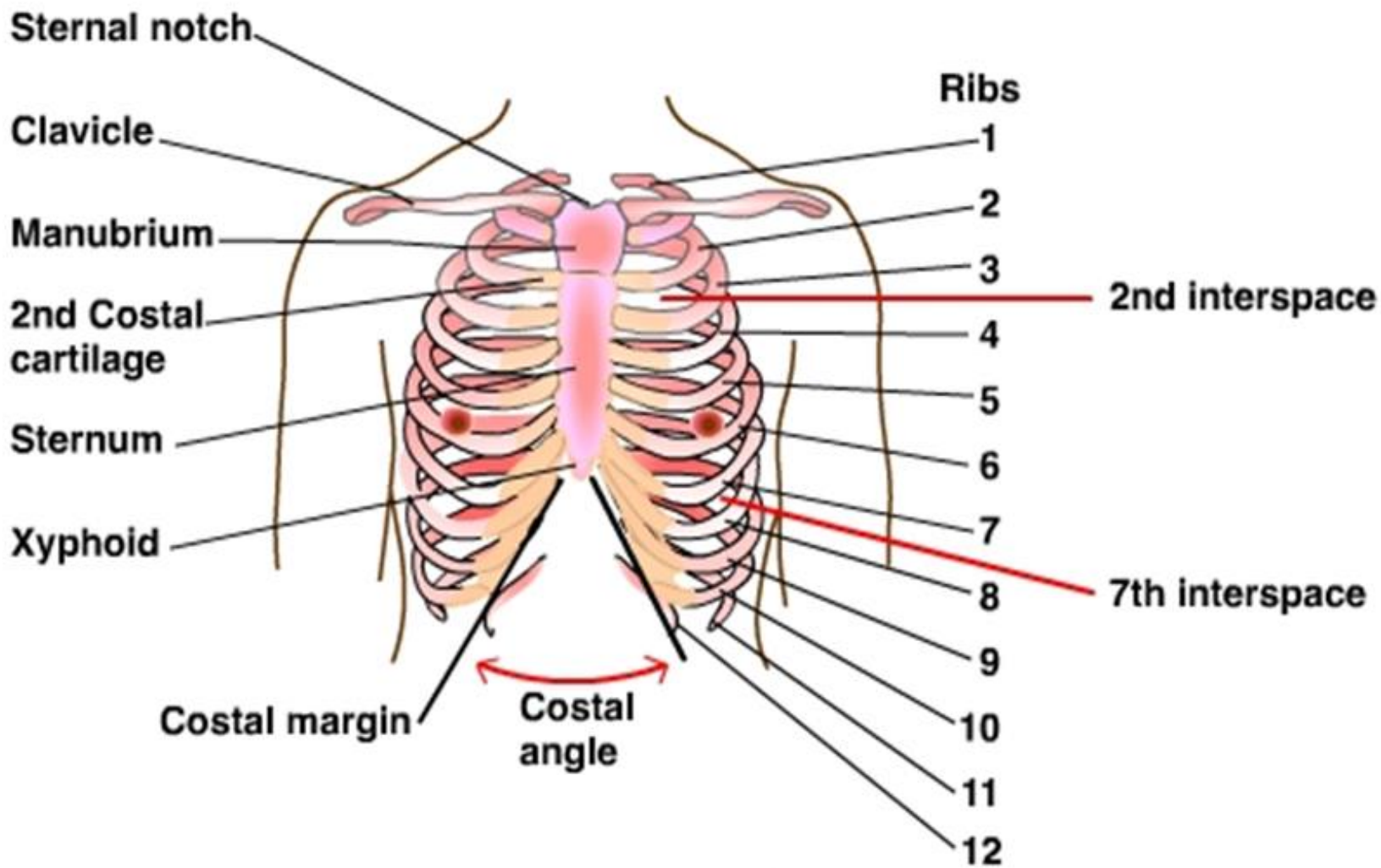
  Echo-guided; Fluoro-guided; CT-guided

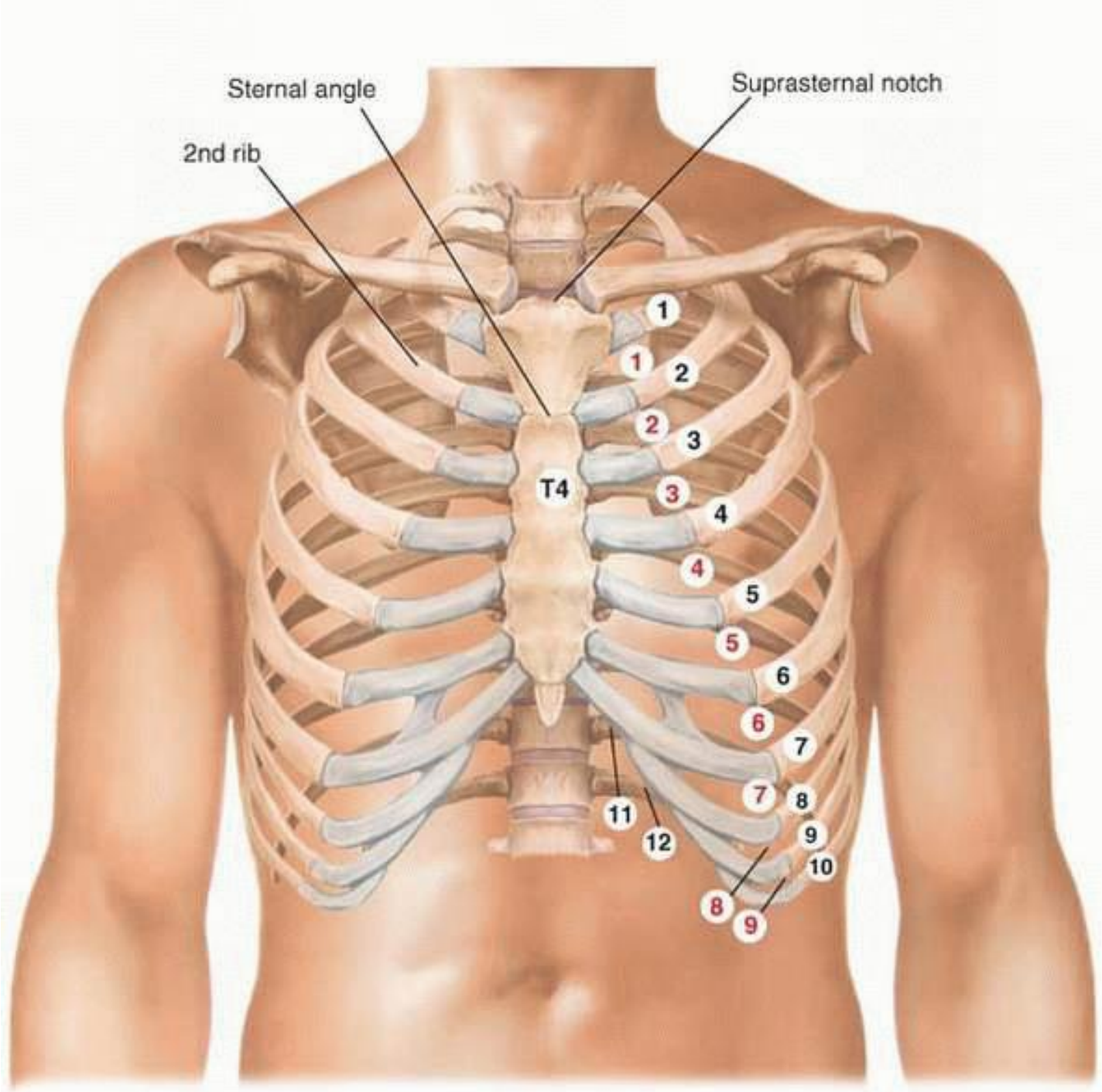
Lung topography

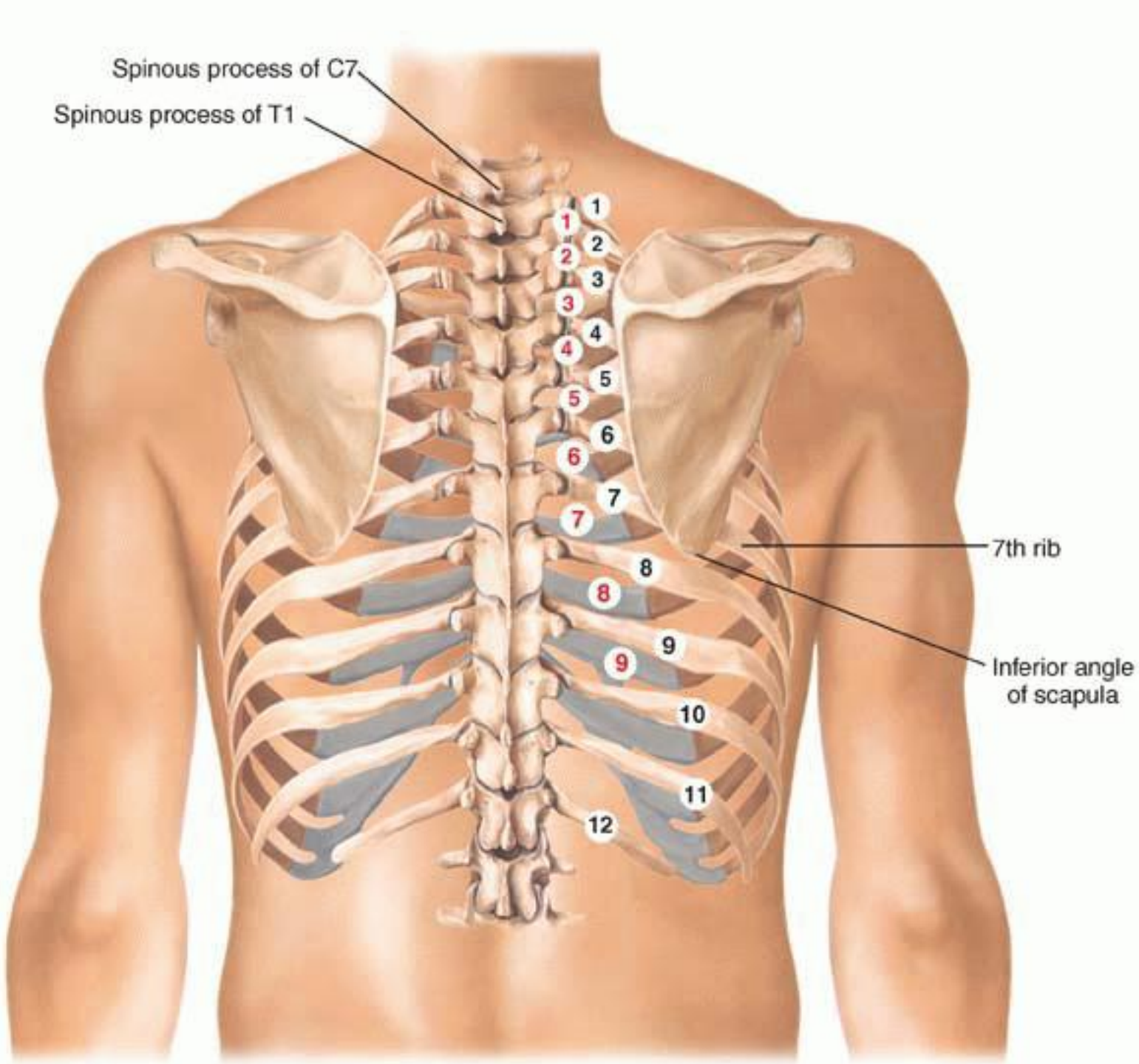
Imaginary lines	Thoracic cage landmarks	Lung fissures
1. Midsternal 2. Midclavicular 3. Anterior, mid, posterior axillary 4. Left & right midscapular	1. Suprasternal notch 2. Angle of Louis 3. C7, T1	1. Right: oblique & horizontal 2. Left: oblique

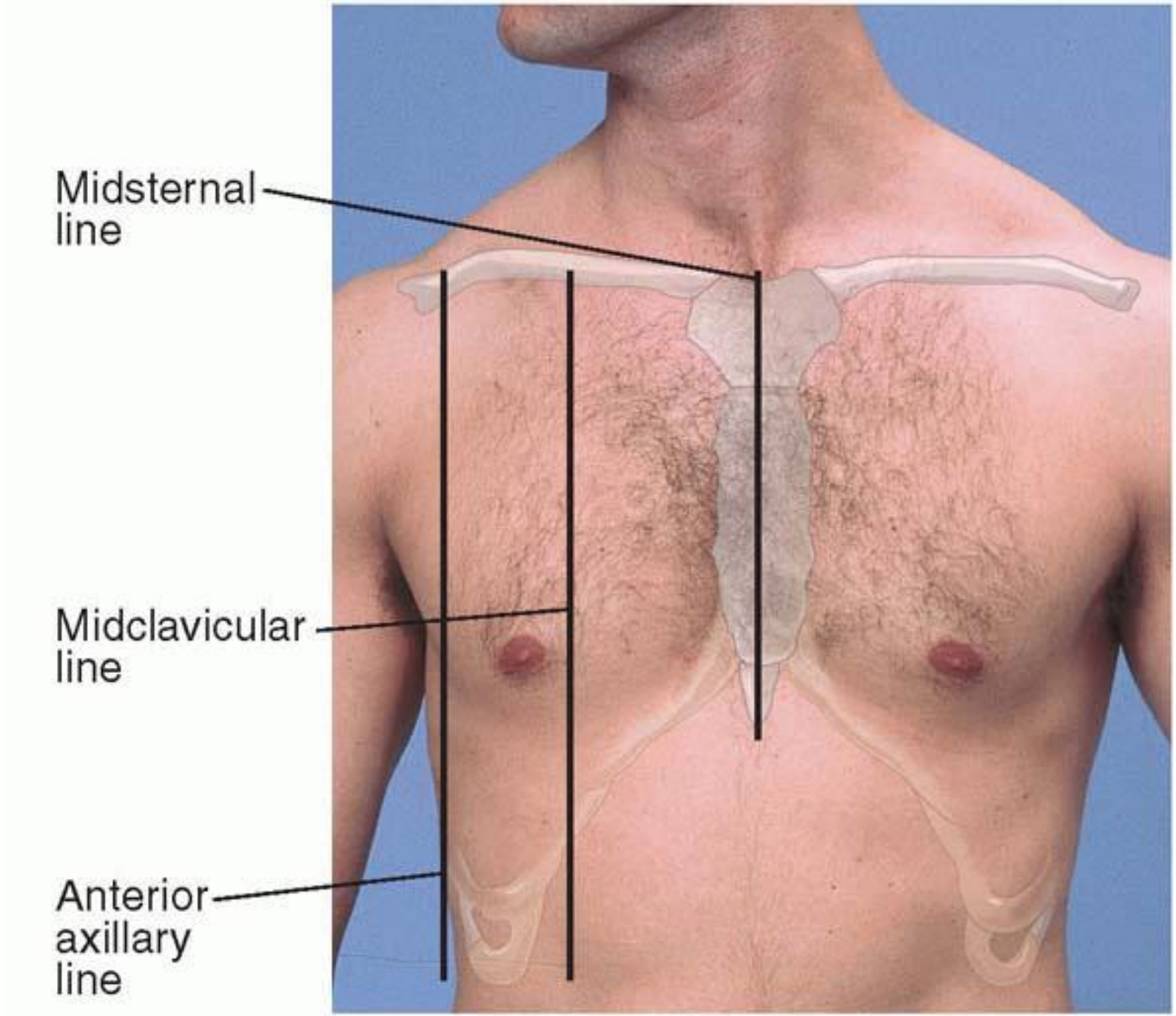

Suprasternal notch
Clavicle
Clavicle
Manubrium
Second rib
Manubriosternal junction (angle of Louis)
Body of sternum
Nipple
Nipple
Xiphoid process
Costal angle

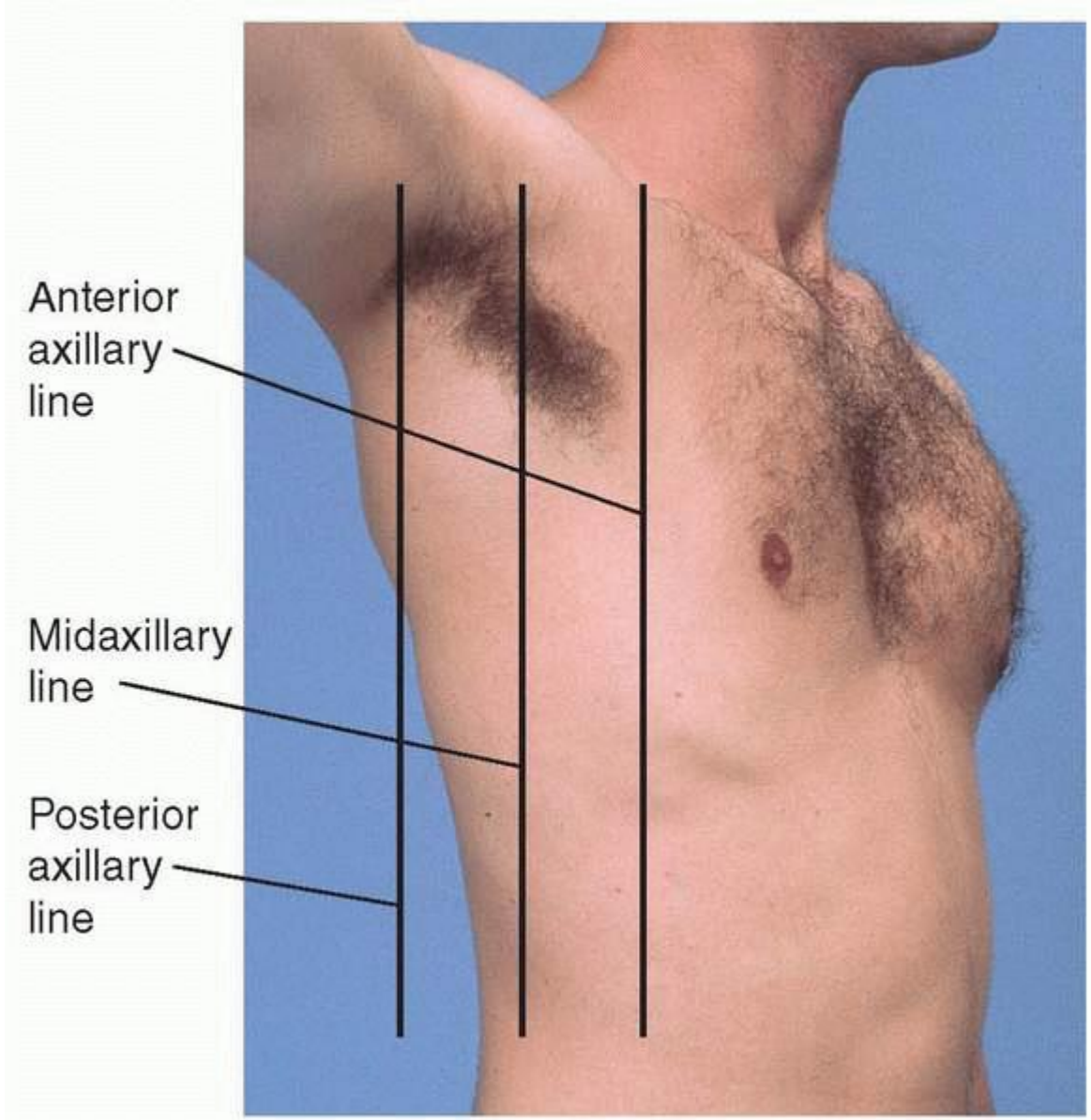

Midsternal line
Midclavicular line
Anterior axillary line
Sternal notch
Angle of Louis
2nd Costal cartilage
Upper lobes
Middle lobe
Lower lobes

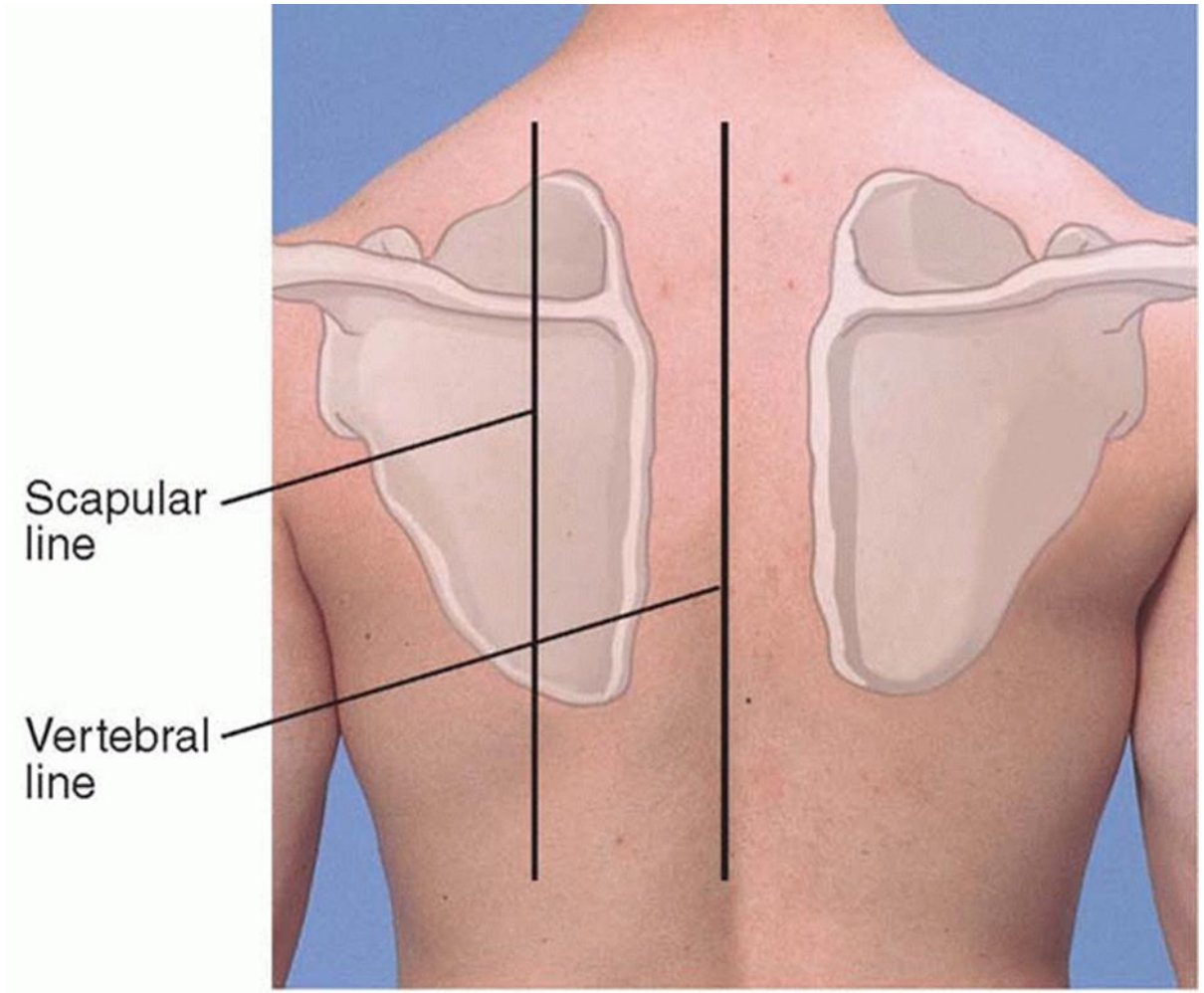

Sternal notch
Clavicle
Manubrium
2nd Costal cartilage
Sternum
Xyphoid
Costal margin
Costal angle
Ribs
1
2
3
2nd interspace
4
5
6
7
7th interspace
8
9
10
11
12

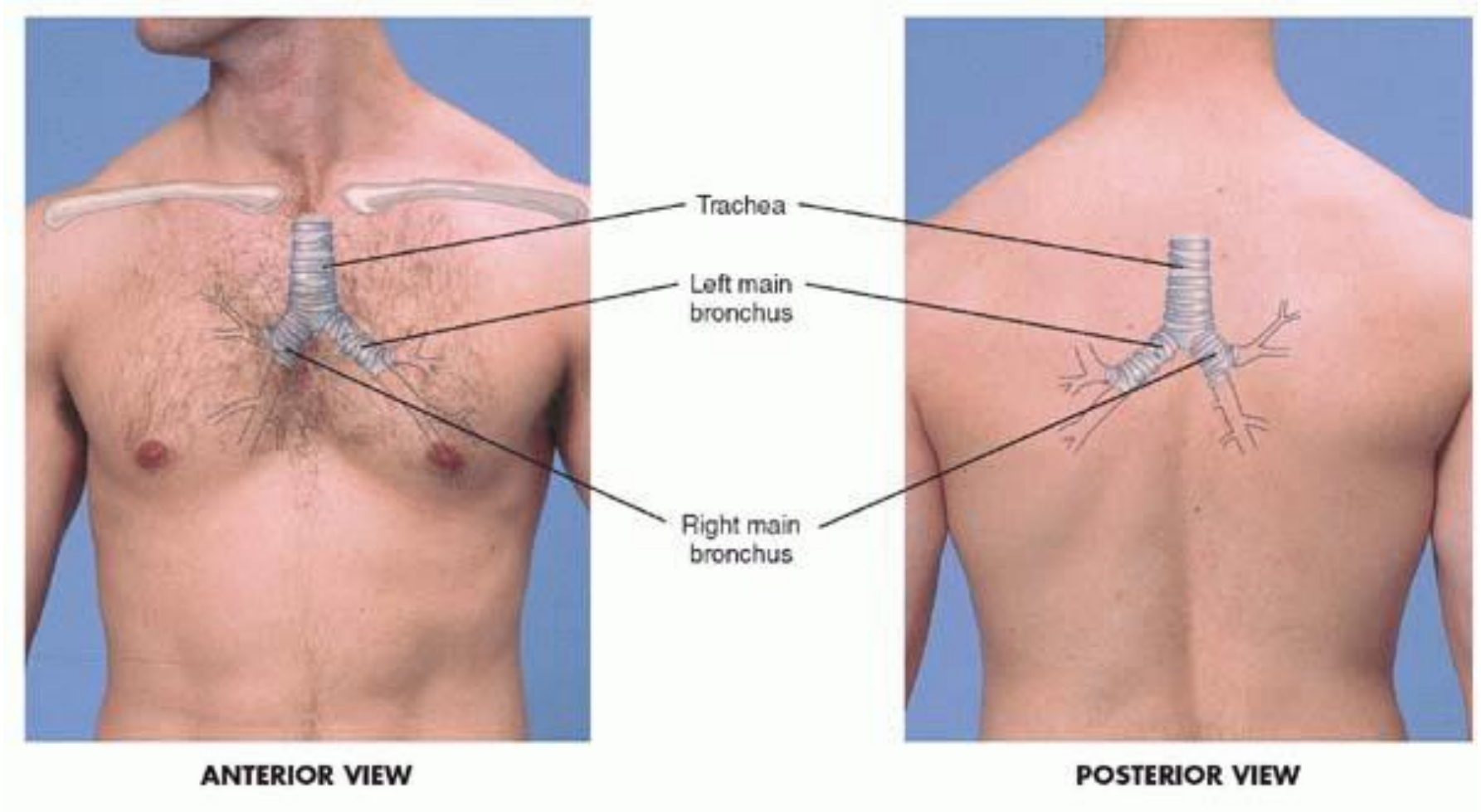

Sternal angle
Suprasternal notch
2nd rib
T4
1
1
2
2
3
3
4
4
5
5
6
6
7
7
8
9
10
11
12
8
9

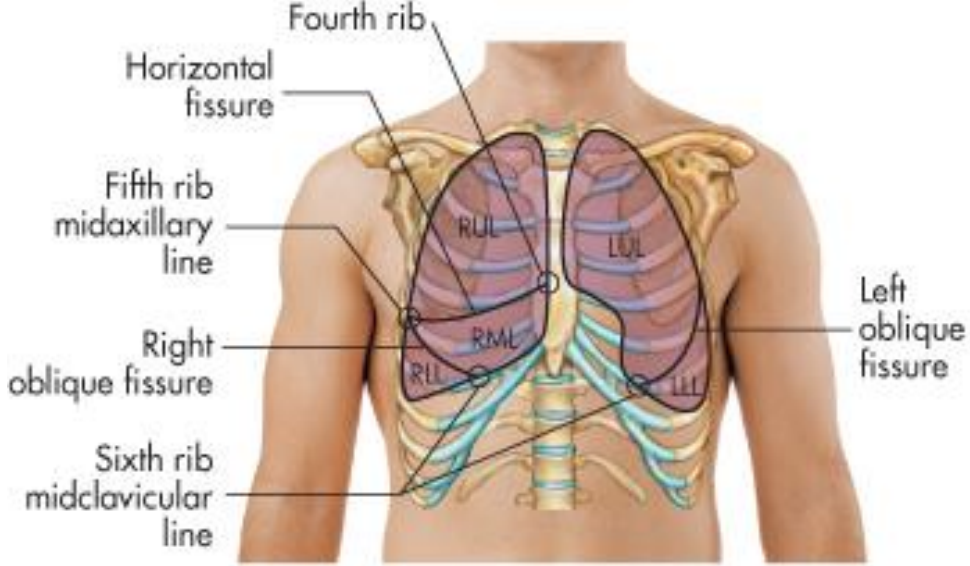

Spinous process of C7
Spinous process of T1
1
2
3
4
5
6
7
8
9
10
11
12
7th rib
Inferior angle of scapula


Midsternal line
Midclavicular line
Anterior axillary line

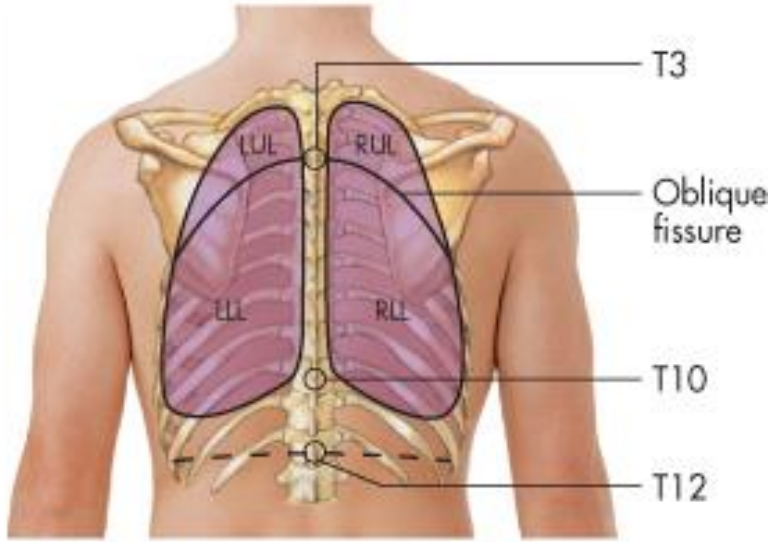

Anterior
axillary
line
Midaxillary
line
Posterior
axillary
line


Scapular line
Vertebral line

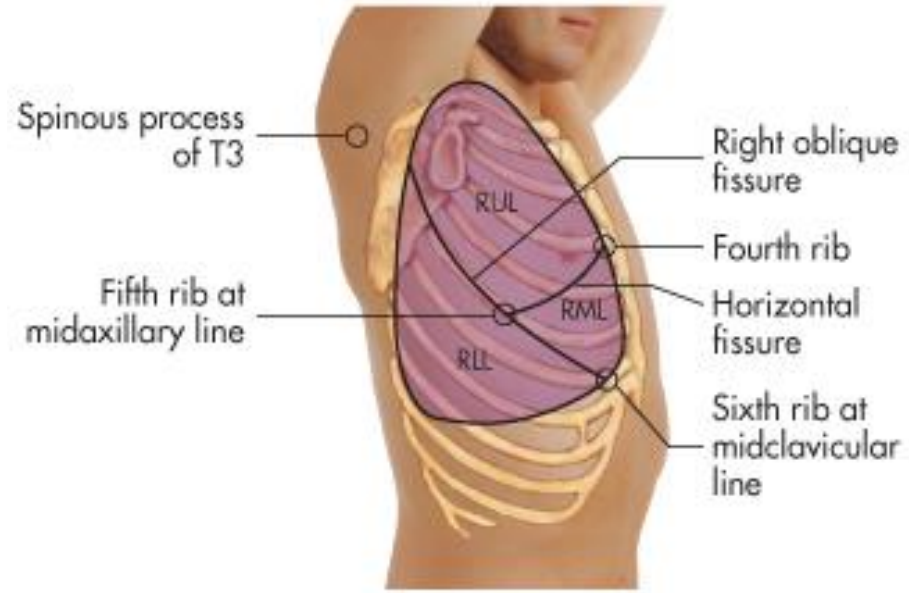

Trachea
Left main bronchus
Right main bronchus
ANTERIOR VIEW
POSTERIOR VIEW



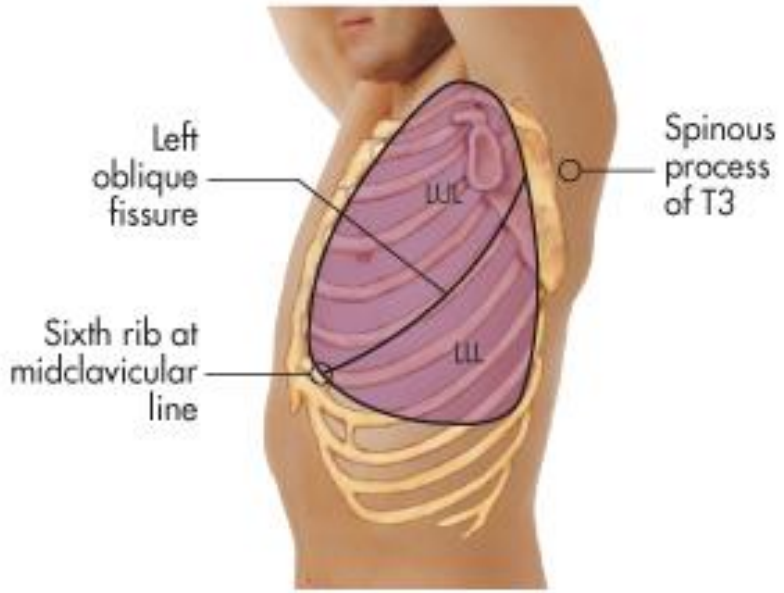
Anterior



Posterior



Right lateral



Left lateral

Conduct & Interpretation of the basic chest exam

- Exposure/draping
- Lighting/position
- Inspection
- Palpation
- Percussion
- Auscultation

請勿隔著衣服檢查病人，因為……:

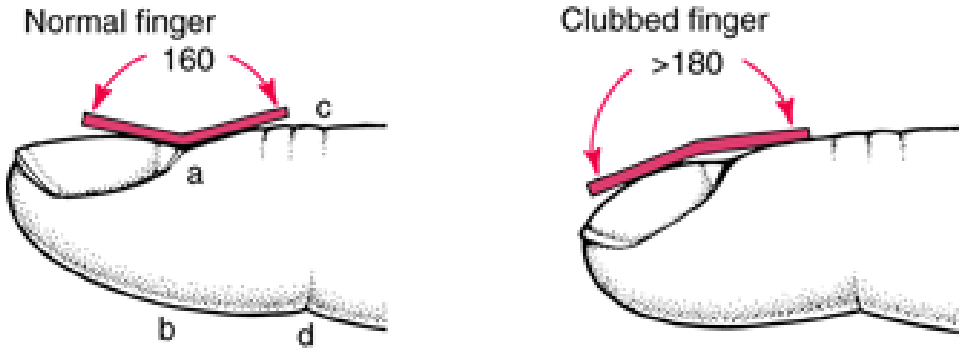
- 那表示您的技巧不夠好
- 您會錯過一些發現
- 您的分數不會很高

Inspection

- (從第一眼開始)

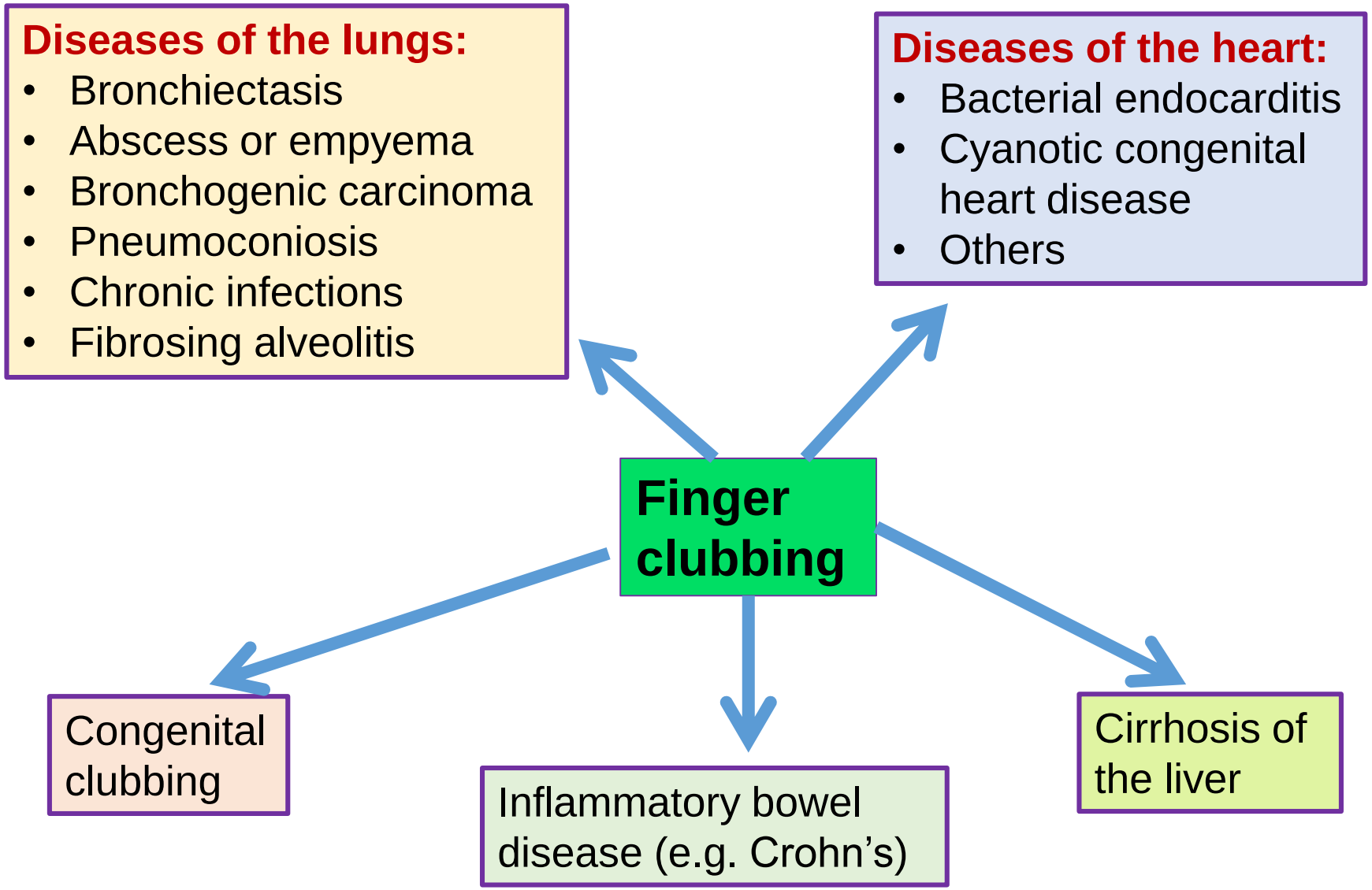
1. Is the patient using the accessary muscles of respiration?
2. Is the trachea deviated from a midline position?
3. Are there any chest wall structural abnormalities such as kyphosis or scoliosis?
4. Is chest expansion of the two hemithoraces symmetric, or asymmetric?

The view from the door !

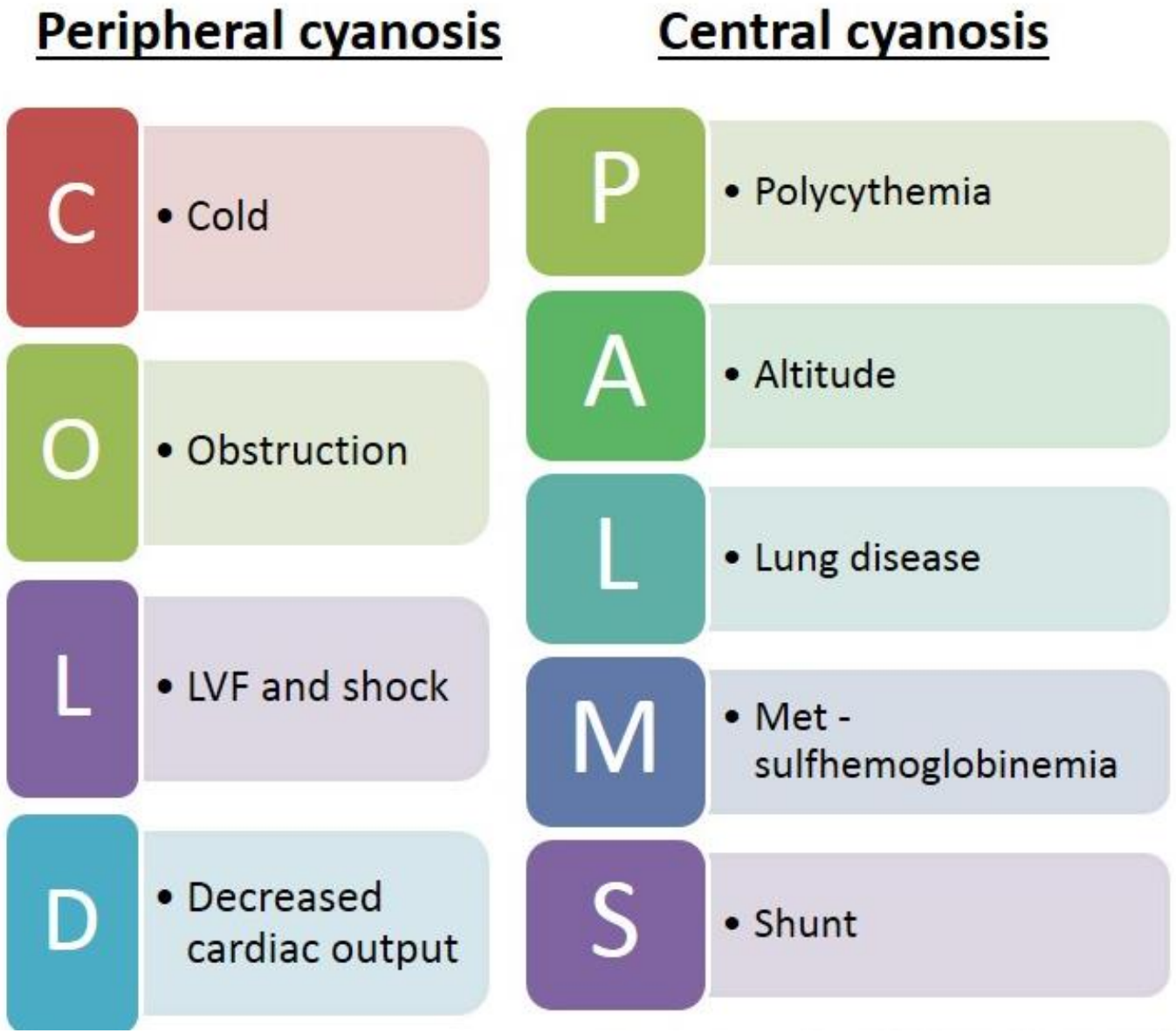


Digital clubbing

Cyanosis

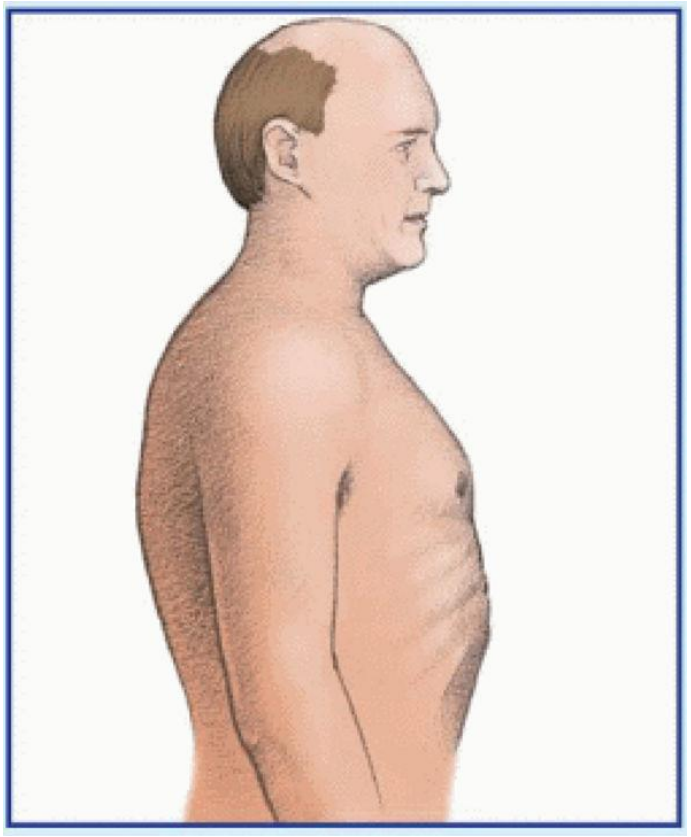

Diseases of the lungs:
• Bronchiectasis
• Abscess or empyema
• Bronchogenic carcinoma
• Pneumoconiosis
• Chronic infections
• Fibrosing alveolitis
Diseases of the heart:
• Bacterial endocarditis
• Cyanotic congenital heart disease
• Others
Finger clubbing
Congenital clubbing
Inflammatory bowel disease (e.g. Crohn's)
Cirrhosis of the liver

Differential diagnosis of Cyanosis



Abnormal Thoracic Configuration

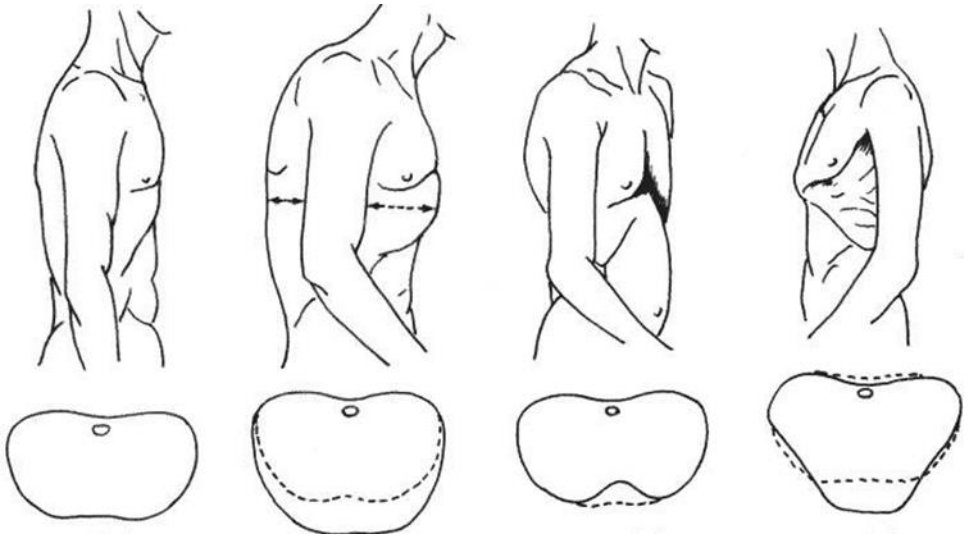
- Increased A-P diameter
  - ➢ "Barrel chest"



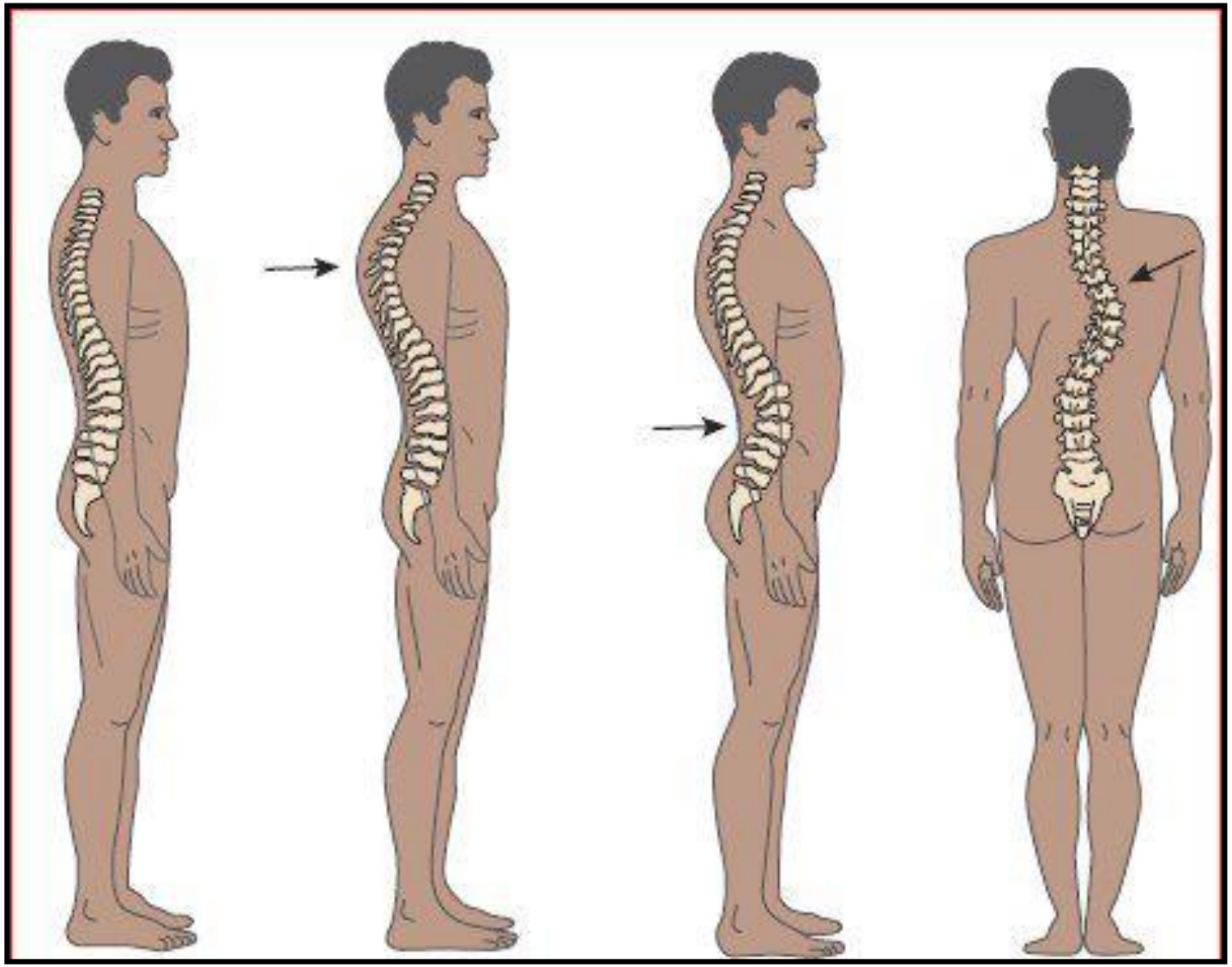
- Pectus Carinatum
  - ➢ Pigeon chest

- Pectus excavatum

➢ Funnel Chest



Curvature of the Spine



Normal kyphosis Lordosis Scoliosis

Muscles of ventilation

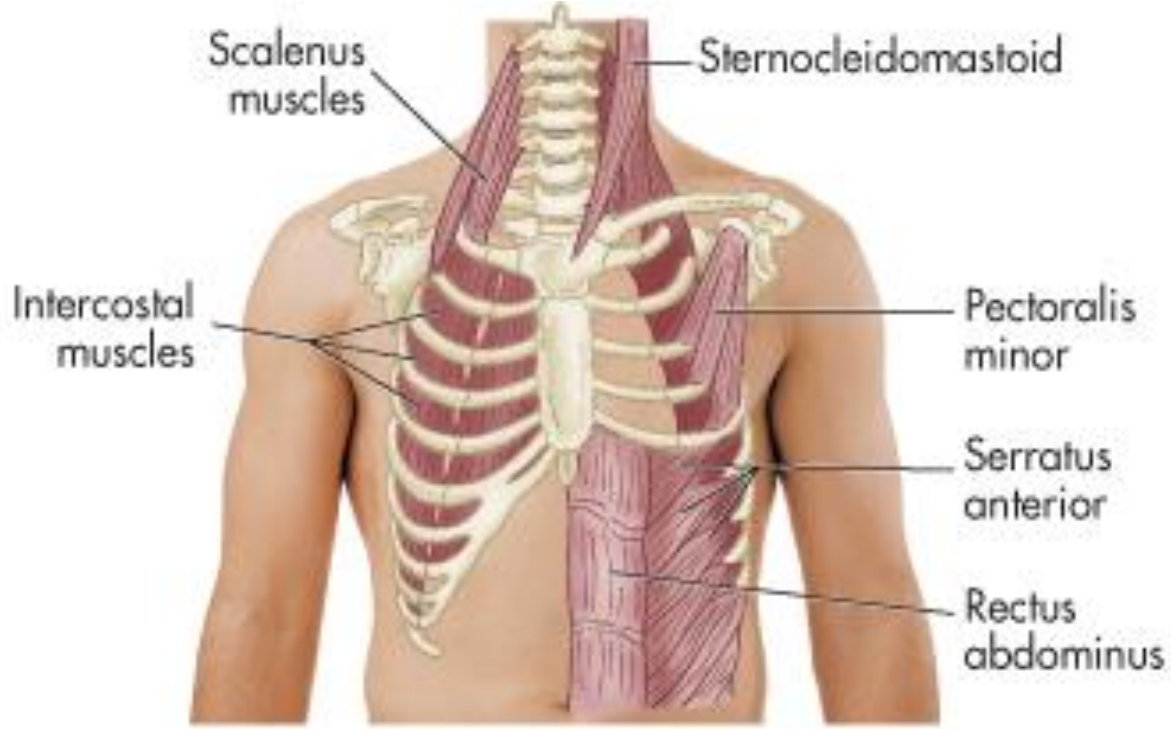
- **Main muscles of inspiration**:
  1. diaphragm
  2. external intercostal muscles,
  3. parasternal intercartilaginous muscles

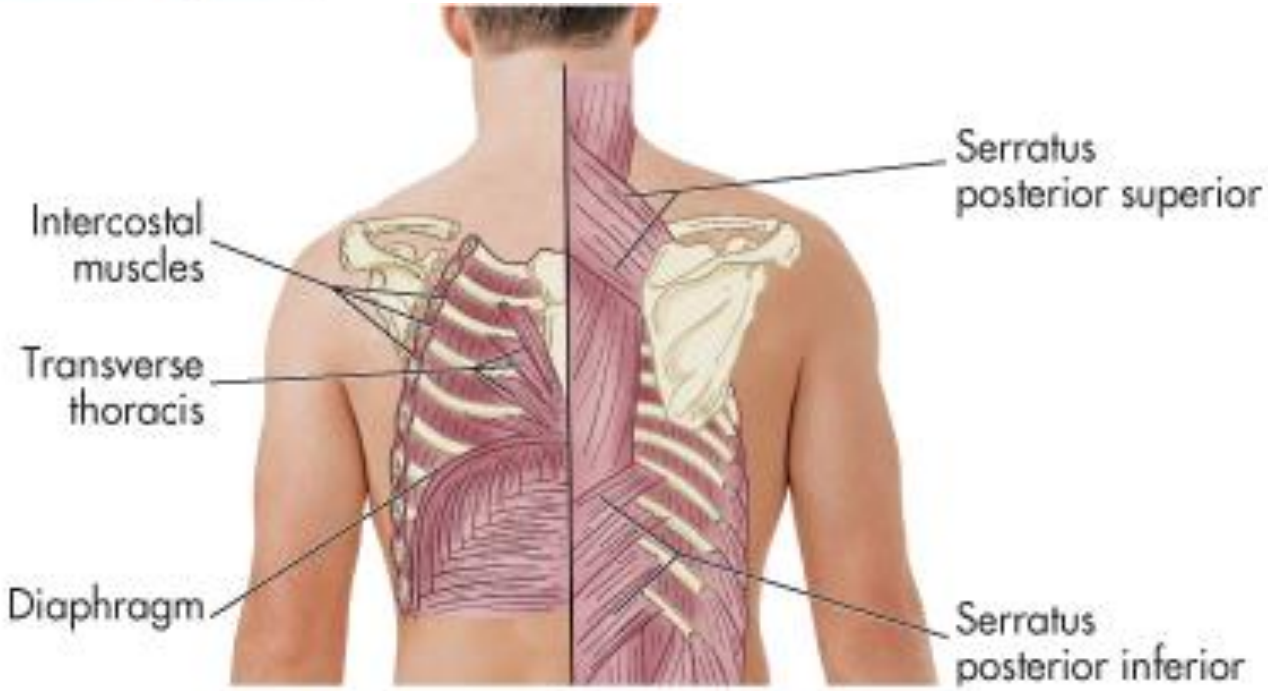
- **The accessory muscles of inspiration**:
  1. sternocleidomastoid
  2. scalenus

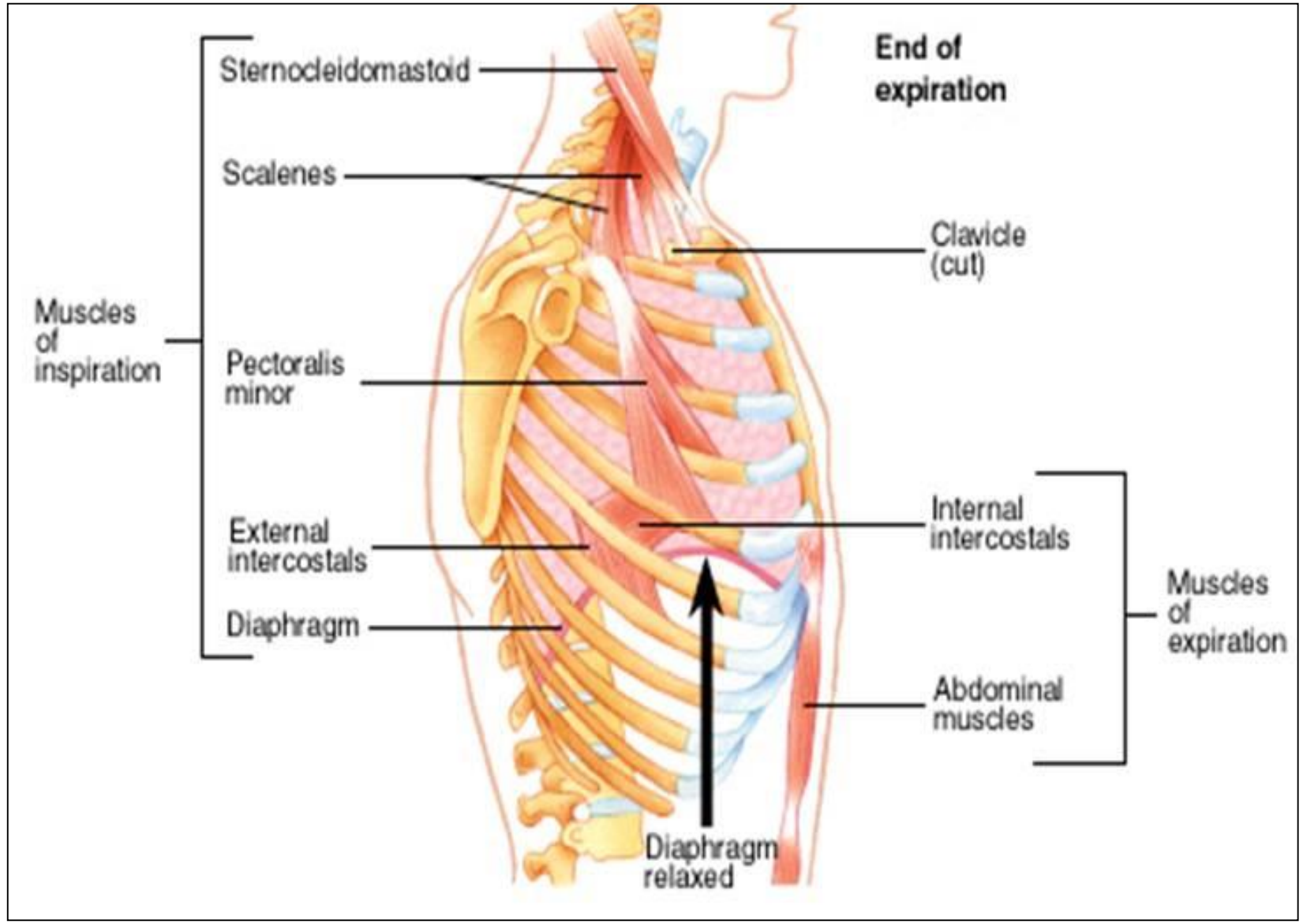
Muscles of ventilation

- **Unforced expiration is a passive process**

- **Forced expiration**:
  1. internal intercostal muscles
  2. rectus abdominis
  3. external oblique
  4. internal oblique
  5. transversus abdominis

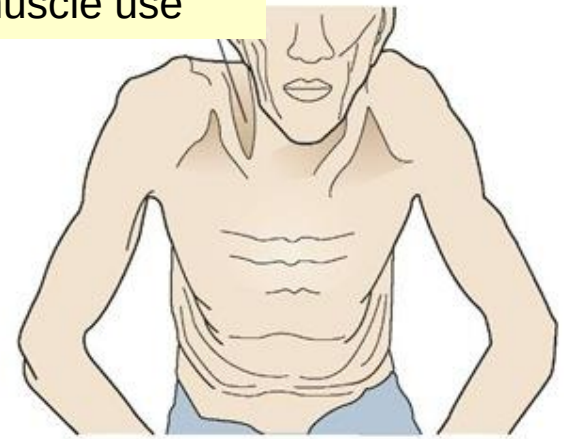

Scalenus muscles
Sternocleidomastoid
Intercostal muscles
Pectoralis minor
Serratus anterior
Rectus abdominus


Serratus posterior superior
Intercostal muscles
Transverse thoracis
Diaphragm
Serratus posterior inferior


End of expiration
Sternocleidomastoid
Scalenes
Clavicle (cut)
Muscles of inspiration
Pectoralis minor
External intercostals
Diaphragm
Internal intercostals
Muscles of expiration
Abdominal muscles
Diaphragm relaxed

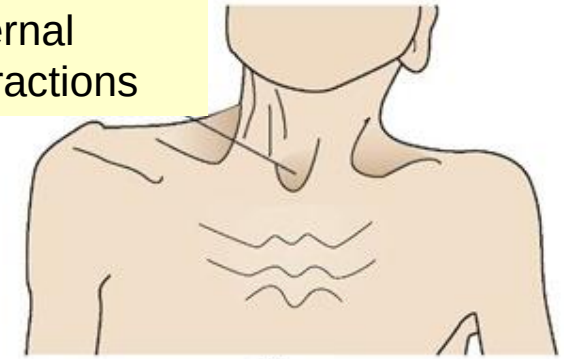
Signs of increased work of breathing

Accessory muscle use



(a)

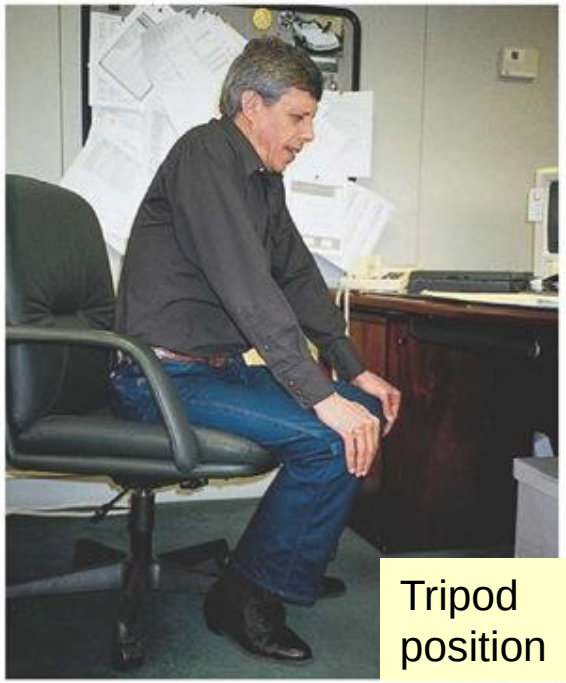
Sternal retractions



(b)

Rib retractions

(c)



Tripod position

(d)

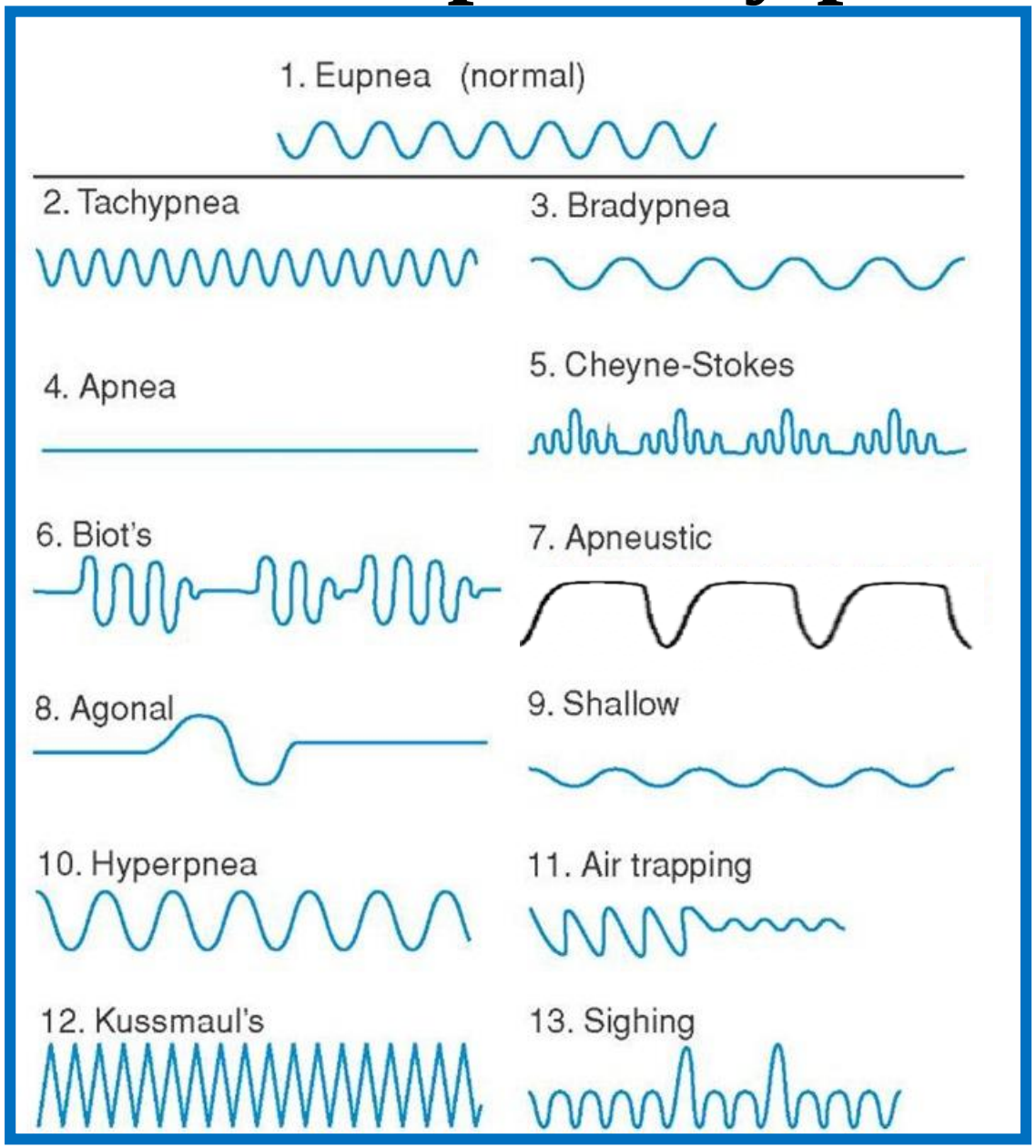
Pursed lip breathing

(e)

Normal Respiratory Rate by Age

Patient Age (yr)	Breaths/Minute
Infant (birth-1)	Initially 40-60; rate drops to 30-40 after a few minutes; slows to 20-30 by 1 year
Toddler (1-3)	20-30
Preschooler (3-5)	20-30
School-ager (6-10)	15-30
Adolescent (11-14)	12-20
Young or middle-aged adult (15-64)	12-20
Older adult (65+)	Depends on patient's health

Abnormal respiratory patterns



Selected Abnormal Respiratory Patterns

Pattern	Description and Cause
Cheyne-Stokes	Gradually increasing rate and tidal volume, which increases to a maximum, then gradually decreases; occurs in brain stem injuries
Biot's	Irregular pattern and volume, with intermittent periods of apnea; found in patients with increased intracranial pressure
Agonal	Slow, shallow, irregular respiration; results from brain anoxia
Kussmaul's	Deep gasping respirations, representing hyperventilation, "blowing off" of excess carbon dioxide and compensation for an abnormal accumulation of metabolic acids in the blood; though possible in any patient with metabolic acidosis, best known with diabetic ketoacidosis
Central neurogenic hyperventilation	Deep, rapid, regular respiration; found in patients with increased intracranial pressure

- Abdominal paradox
  - ➢ Abdominal wall moves in as chest wall moves out
  - ➢ Impending ventilatory failure

- Respiratory alternans
  - ➢ Chest /abdomen alternate movement with each inspiration

Quiz

What’s CO2 flap ?

Palpation

1. Identification of tender areas
2. Assessment of observed abnormalities
3. Further assessment of chest expansion
4. Assessment of tactile fremitus

Tracheal Alignment Abnormality

- Pneumothorax – shifts to unaffected side
- Pleural Effusion – shifts to unaffected side
- Fibrosis or Atelectasis – shifts towards affected side
- Pulmonary consolidation – no shift

Test chest expansion

Normal Movement:
3-5 cm

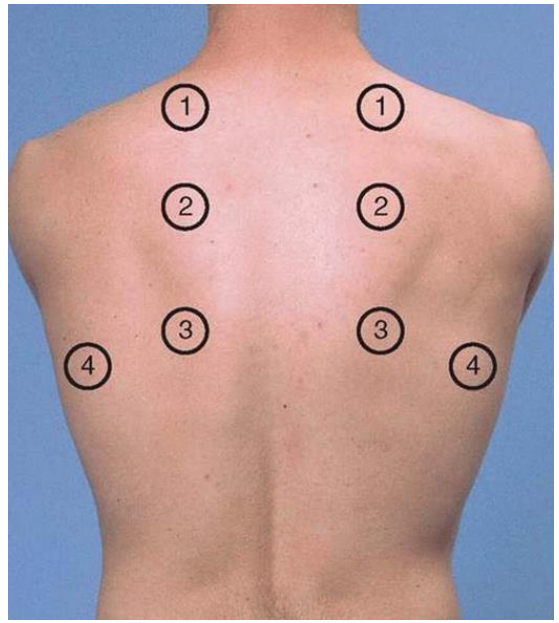
Vocal Fremitus

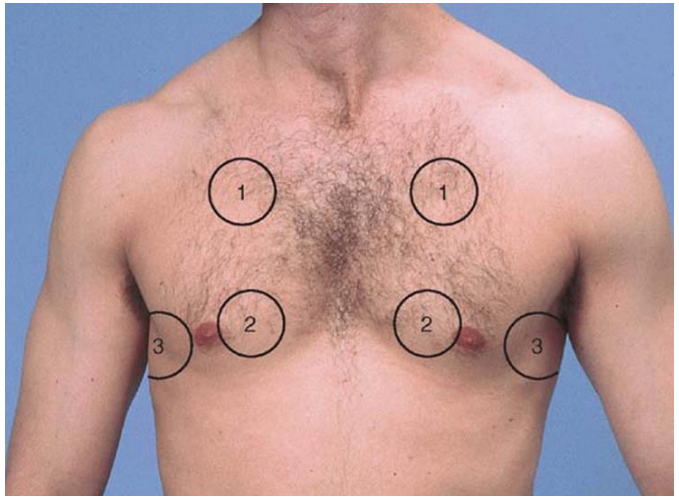
- BILATERAL comparison of vocal vibrations

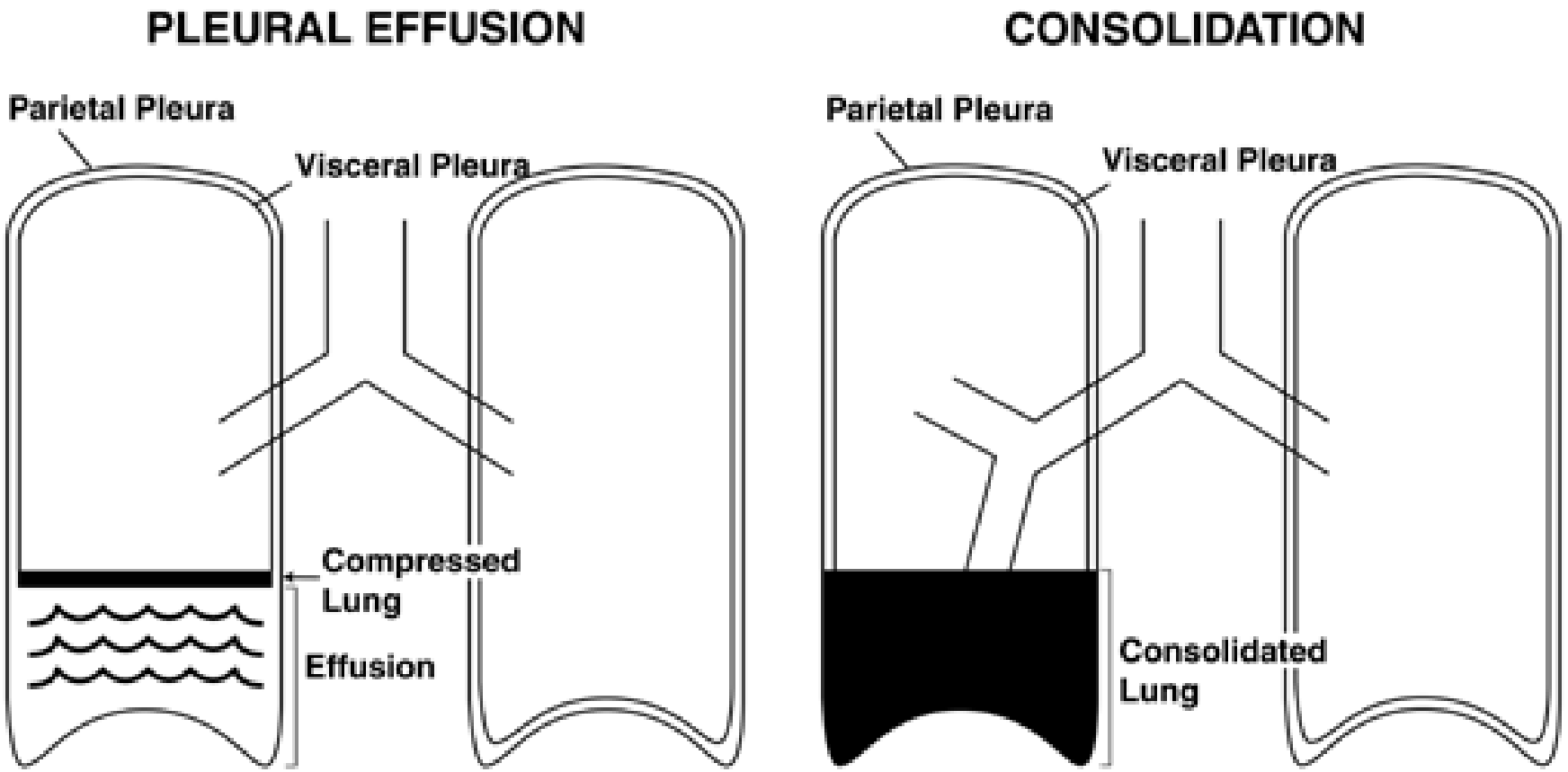
Increased with alveolar consolidation, atelectasis

Decreased with increased distance between lung and chest wall

- Pneumothorax, Pleural effusion

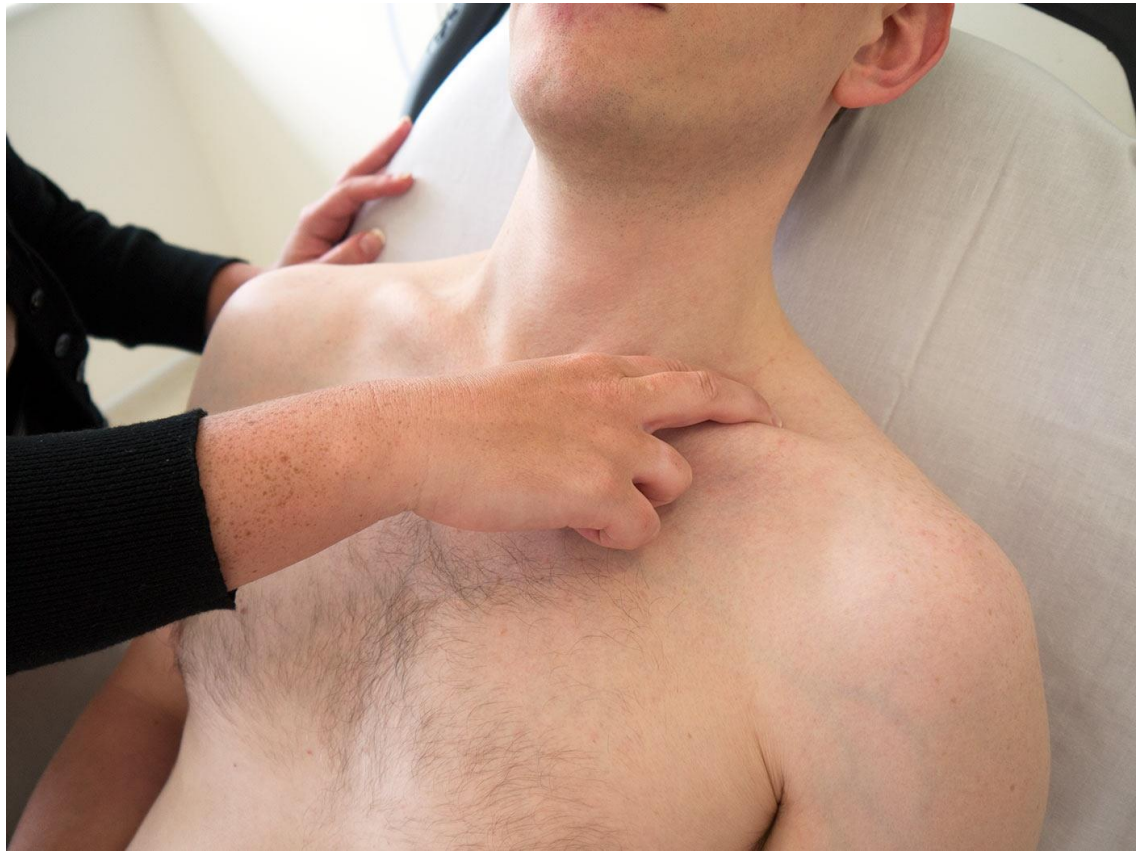





PLEURAL EFFUSION
Parietal Pleura
Visceral Pleura
Compressed Lung
Effusion
CONSOLIDATION
Parietal Pleura
Visceral Pleura
Consolidated Lung

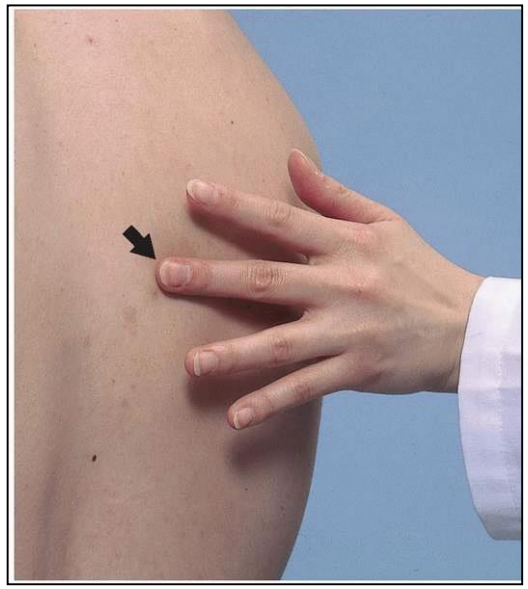
Quiz

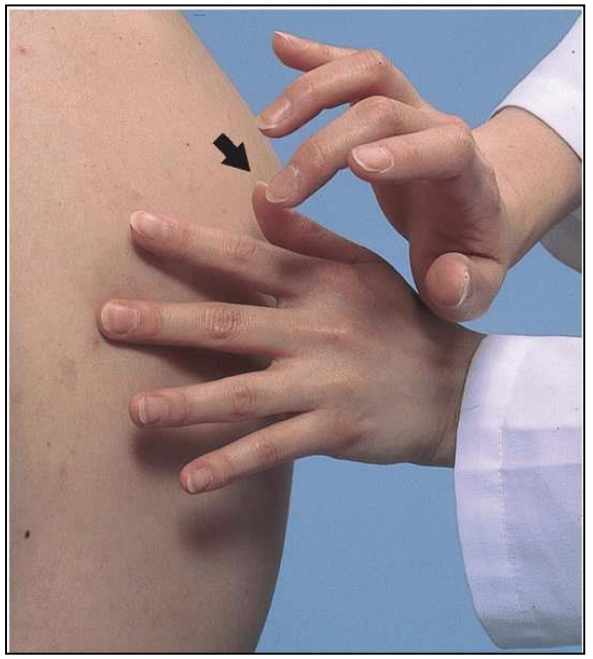
What's Troisier's Sign?

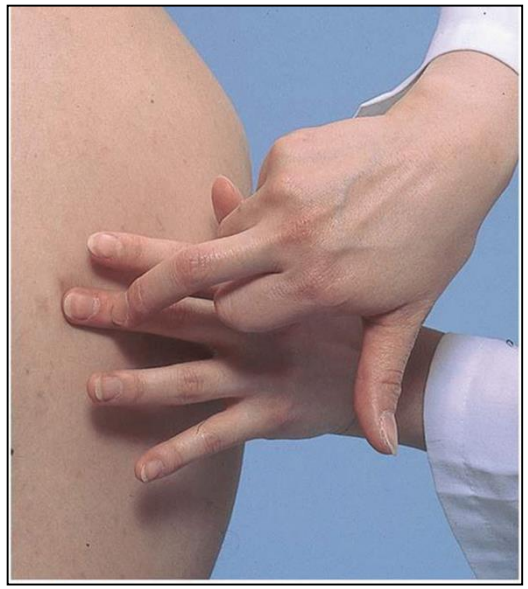


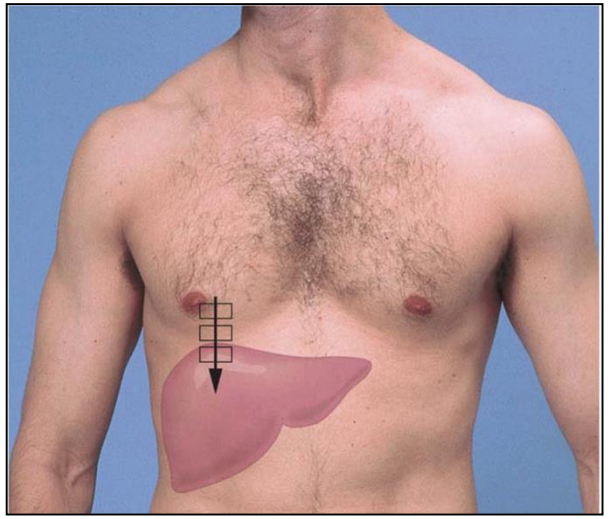
Percussion

Percussion (Assess density of underlying tissue)









	Relative Intensity	Relative Pitch	Relative Duration	Example of Location	Pathologic Examples
Flatness	Soft	High	Short	Thigh	Large pleural effusion
Dullness	Medium	Medium	Medium	Liver	Lobar pneumonia
Resonance	Loud	Low	Long	Healthy lung	Simple chronic bronchitis
Hyperresonance	Very loud	Lower	Longer	Usually none	COPD, pneumothorax
Tympany	Loud	High*	*	Gastric air bubble or puffed-out cheek	Large pneumothorax

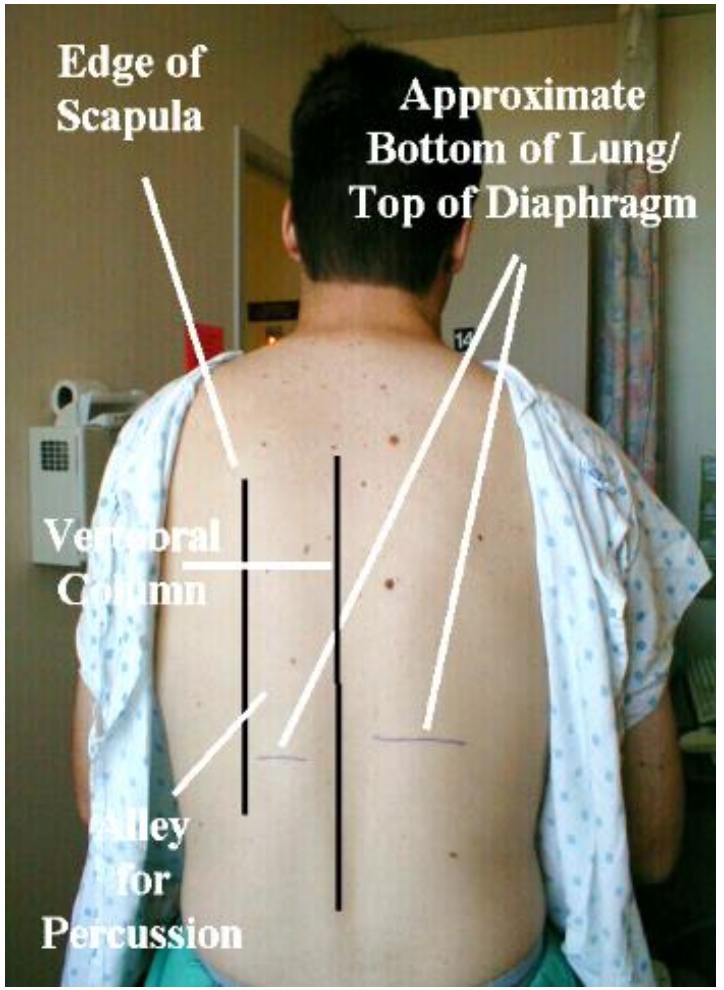
Abnormal Percussion

- Dull or flat percussion note
  - Increased density
  - Short, higher in pitch
  - Pneumonia, tumor, collapse

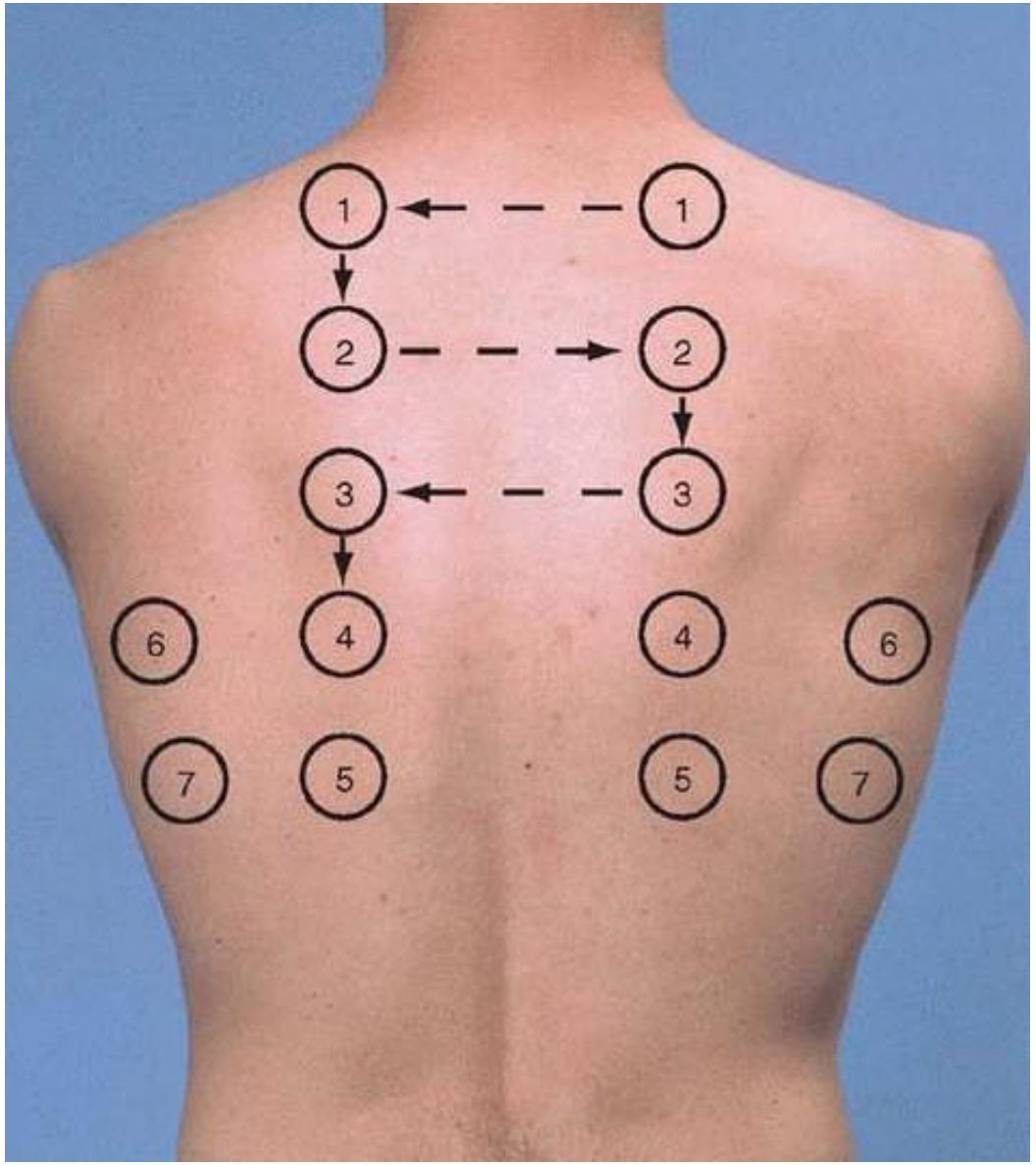
- Hyperresonant or tympanic
  - Decreased density
  - Long, lower in pitch
  - Pneumothorax, COPD

Percussion of Diaphragmatic Excursion

- **Patient inhales fully**, percuss to the point where resonant changes to dull
- **Patient exhales fully**, repeat
- Distance between these two points is the diaphragmatic excursion
- Normally ~5 cm
  - ➢ Little excursion from full inspiration denotes air trapping
  - ➢ Little change from expiration denotes nerve paralysis



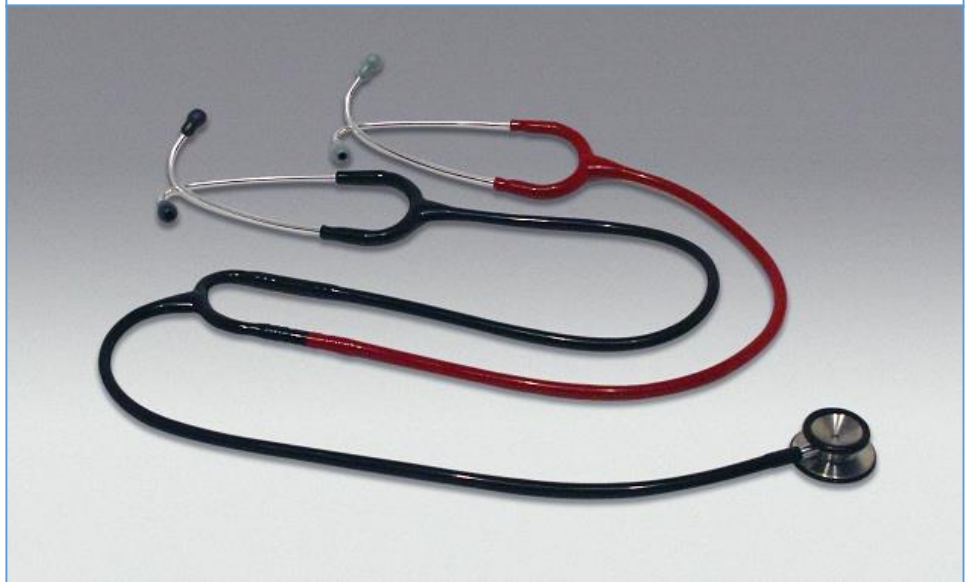
“Ladder” pattern for percussion and auscultation



Auscultation

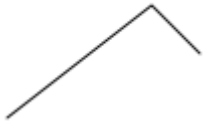
1. Sounds generated by breathing
2. Any adventitious (added) sounds
3. If abnormalities are suspected, listening to the sounds of the patient's spoken or whispered voice as they are transmitted through the chest wall

Stethoscope



Normal breath sounds

1. **Vesicular**:
   - Low pitch, soft intensity
   - Peripheral lung areas.



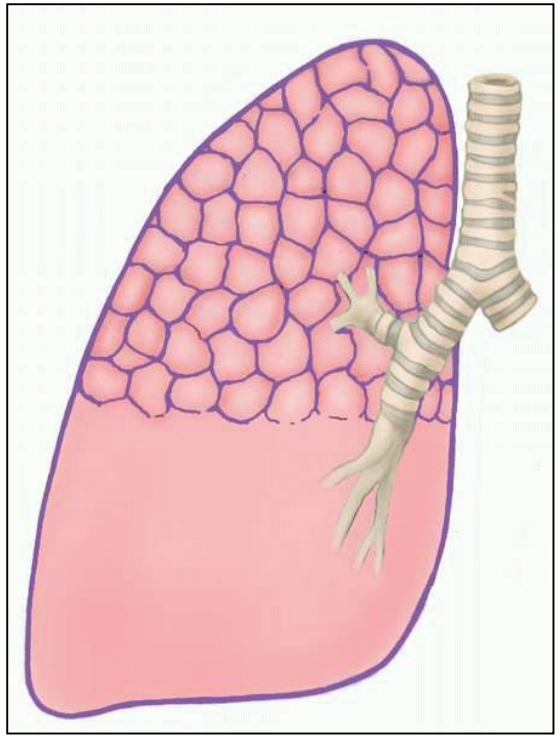
2. **Bronchovesicular:**
   - Moderate pitch, moderate intensity
   - Medial chest

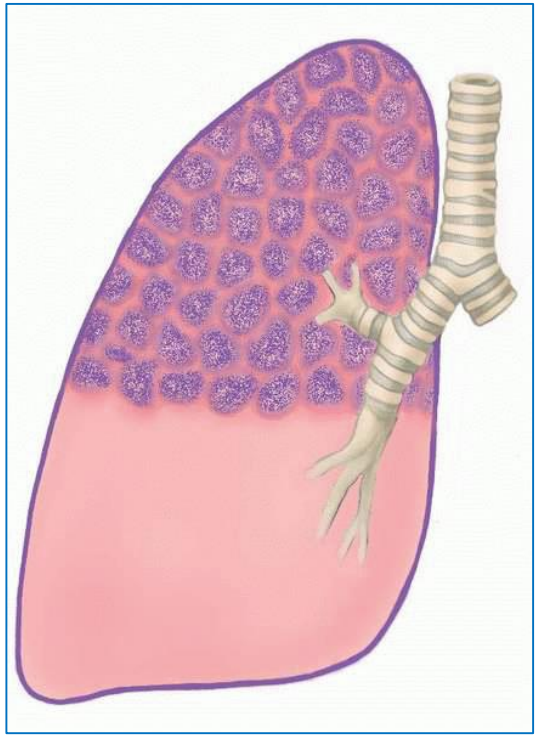
3. **Bronchial:**
   - High Pitch, Loud Intensity
   - Trachea

4. **Tracheal**

Characteristics of Breath Sounds

	Duration of Sounds	Intensity of Expiratory Sound	Pitch of Expiratory Sound	Locations Where Heard Normally
Vesicular 	I > E	Soft	Relatively low	Over most of both lungs
Broncho-vesicular 	I = E	Intermediate	Intermediate	Infraclavical, interscapule
Bronchial 	I < E	Loud	Relatively high	Trachea
Tracheal 	I = E	Very loud	Relatively high	Over the trachea in the neck



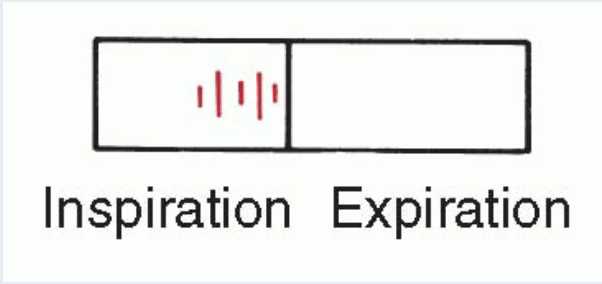
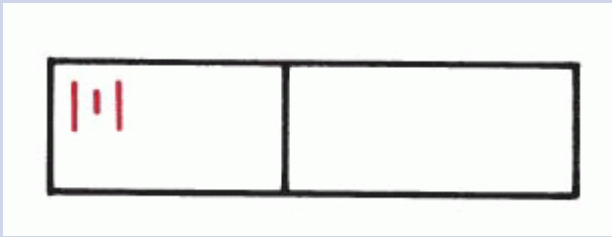
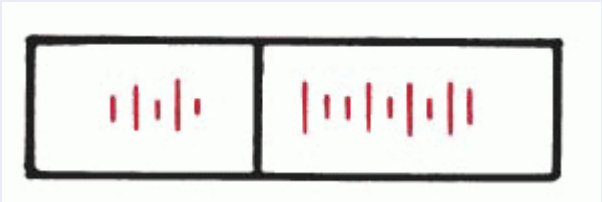


	Normal Air-Filled Lung	Airless Lung, as in Lobar Pneumonia
Breath Sounds	Predominantly vesicular	Bronchial or bronchovesicular over the involved area
Transmitted Voice Sounds	Spoken words muffled and indistinct	Spoken words louder, clearer (bronchophony)
	Spoken "ee" heard as "ee" Whispered words faint and indistinct, if heard at all	Spoken "ee" heard as "ay" (egophony) Whispered words louder, clearer (whispered pectoriloquy)
Tactile Fremitus	Normal	Increased

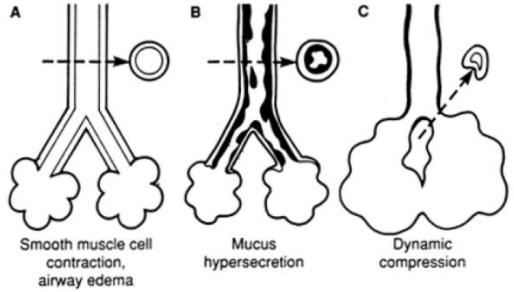
Adventitious Sounds

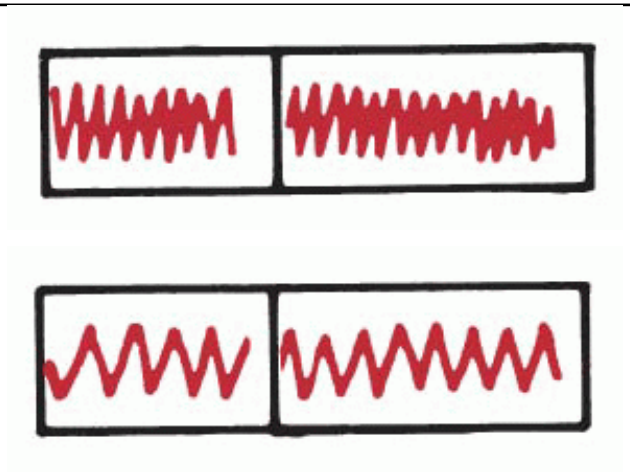
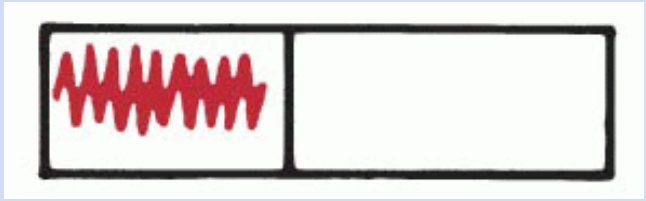
Crackles (or Rales)	Wheezes and Rhonchi
Discontinuous	Continuous
Intermittent, nonmusical, and brief	≥250 msec, musical, prolonged (but not necessarily persisting throughout the respiratory cycle)
Like dots in time	Like dashes in time
Fine crackles: soft, high-pitched, very brief (5-10 msec)	Wheezes: relatively high-pitched (≥400 Hz) with hissing or shrill quality
Coarse crackles: somewhat louder, lower in pitch, brief (20-30 msec)	Rhonchi: relatively low-pitched (≤200 Hz) with snoring quality

Crackles

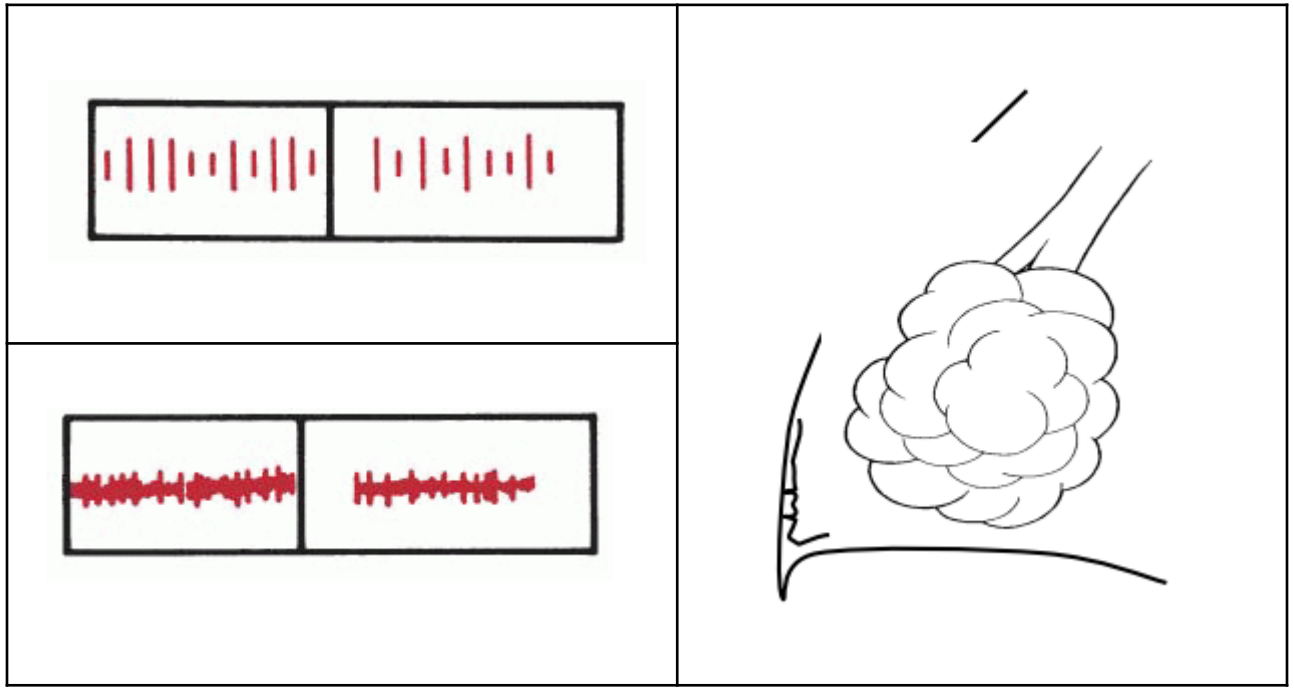
	Late inspiratory crackles
	Early inspiratory crackles
	Midinspiratory and expiratory crackles

Wheezes and Rhonchi, Stridor



	Wheezes and Rhonchi
	Stridor

Pleural Friction Rub

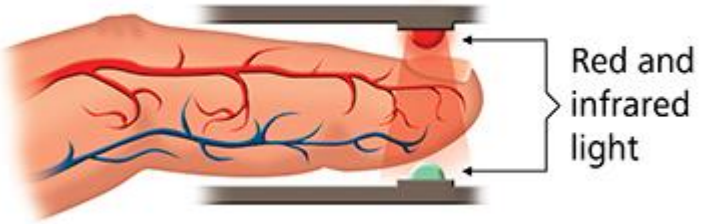


If the pleura is roughened due to any reason, a scratching, grating sound, related to respiration is heard

Other Abnormal Sounds

- **Bronchophony:** increase intensity of voice sound; 99, 66
- **Egophony:** E to A change
- **Whispered pectoriloquy:** increased intensity of whispered sounds
- All indicate an increase in density

Pulse Oximeter



Peak Flow Meter
尖峰呼氣流量計

- Peak Expiratory Flow Rate, PEFR


60
100
150
200
250
300
350
400
450
500
L/Min
ISO
23741


700
650
600
550
500
450
400
350
300
250
200
150
100
60
L/Min
ISO
23741


CE
800
700
650
600
550
500
450
400
350
300
250
200
150
100
60
L/Min
ISO
23741

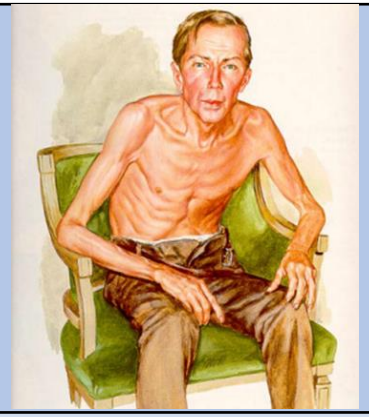
氣喘嚴重度評估

指標項目	氣喘症狀發作頻率氣喘症狀： 咳嗽、胸悶、呼吸急促、喘鳴(呼吸有)		尖峰呼氣流速值 (PEFR)	
	白天	夜晚	預測值%	變異度%
間歇性	＜1次/週	≦2次/月	≧80	＜20
輕度持續性	≧1次/週 ＜1次/天	＞2次/月	≧80	20-30
中度持續性	≧1次/天	≧1次/週	60-80	＞30
重度持續性	連續	常常	≦60	＞30

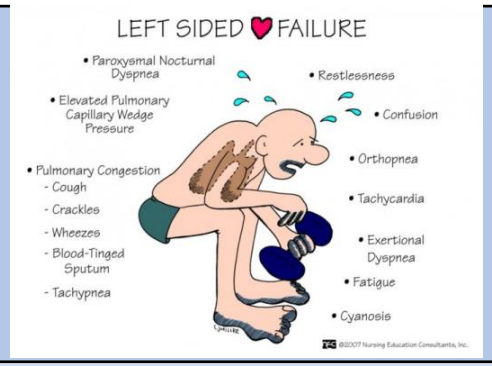
病人自我監測

體重控制	⟷	體重機
發燒	⟷	溫度計
高血壓	⟷	血壓計
糖尿病	⟷	血糖機
氣喘	⟷	尖峰呼氣流量計

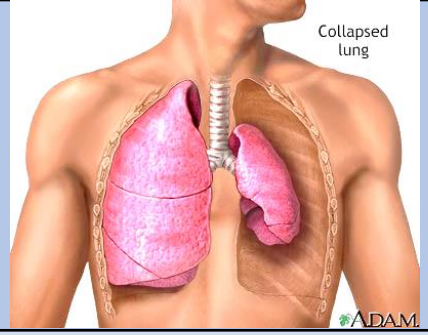
Physical Findings in Selected Chest Disorders

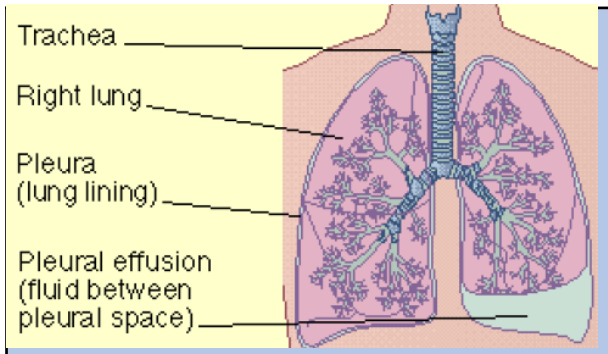
	**Chronic Obstructive Pulmonary Disease (Emphysema)**
Condition	Slowly progressive disorder in which the distal air spaces enlarge and lungs become hyperinflated
Percussion Note	Diffusely hyperresonant
Trachea	Midline
Breath Sounds	Decreased to absent
Adventitious Sounds	None, or the crackles, wheezes, and rhonchi of associated chronic bronchitis
Tactile Fremitus and Transmitted Voice Sounds	Decreased

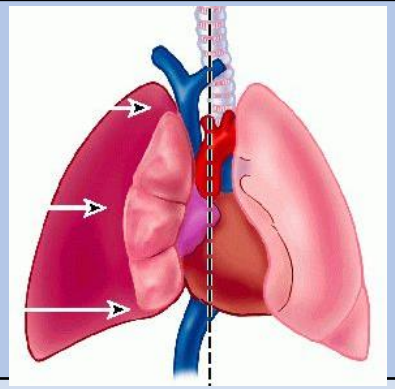
	**Chronic Obstructive Pulmonary Disease (Chronic Bronchitis)**
Condition	The bronchi are chronically inflamed and a productive cough is present. Airway obstruction may develop
Percussion Note	Resonant
Trachea	Midline
Breath Sounds	Vesicular (normal)
Adventitious Sounds	None; or scattered coarse crackles in early inspiration and perhaps expiration; or wheezes or rhonchi
Tactile Fremitus and Transmitted Voice Sounds	Normal or decreased

	**Left-Sided Heart Failure (Early)**
Condition	Increased pressure in the pulmonary veins causes congestion and interstitial edema (around the alveoli); bronchial mucosa may become edematous
Percussion Note	Resonant
Trachea	Midline
Breath Sounds	Vesicular
Adventitious Sounds	Late inspiratory crackles in the dependent portions of the lungs; possibly wheezes
Tactile Fremitus and Transmitted Voice Sounds	Normal

	**Consolidation (Pneumonia)**
Condition	Alveoli fill with fluid or blood cells, as in pneumonia, pulmonary edema, or pulmonary hemorrhage
Percussion Note	Dull over the airless area
Trachea	Midline
Breath Sounds	Bronchial over the involved area
Adventitious Sounds	Late inspiratory crackles over the involved area
Tactile Fremitus and Transmitted Voice Sounds	Increased over the involved area, with bronchophony, egophony, and whispered pectoriloque

	**Atelectasis (Lobar Obstruction)**
Condition	When a plug in a mainstem bronchus (as from mucus or a foreign object) obstructs air flow, affected lung tissue collapses into an airless state
Percussion Note	Dull over the airless area
Trachea	May be shifted toward involved side
Breath Sounds	Usually absent when bronchial plug persists. Exceptions include right upper lobe atelectasis, where adjacent tracheal sounds may be transmitted.
Adventitious Sounds	None
Tactile Fremitus and Transmitted Voice Sounds	Usually absent when the bronchial plug persists. In exceptions (e.g., right upper lobe atelectasis) may be increased

	**Pleural Effusion**
Condition	Fluid accumulates in the pleural space, separates air-filled lung from the chest wall, blocking the transmission of sound
Percussion Note	Dull to flat over the fluid
Trachea	Shifted toward opposite side in a large effusion
Breath Sounds	Decreased to absent, but bronchial breath sounds may be heard near top of large effusion.
Adventitious Sounds	None, except a possible pleural rub
Tactile Fremitus and Transmitted Voice Sounds	Decreased to absent, but may be increased toward the top of a large effusion

	**Pneumothorax**
Condition	When air leaks into the pleural space, usually unilaterally, the lung recoils from the chest wall. Pleural air blocks transmission of sound
Percussion Note	Hyperresonant or tympanitic over the pleural air
Trachea	Shifted toward opposite side if much air
Breath Sounds	Decreased to absent over the pleural air
Adventitious Sounds	None, except a possible pleural rub
Tactile Fremitus and Transmitted Voice Sounds	Decreased to absent over the pleural air

	**Asthma**
Condition	Widespread narrowing of the tracheobronchial tree diminishes air flow to a fluctuating degree. During attacks, air flow decreases further, and lungs hyperinflate.
Percussion Note	Resonant to diffusely hyperresonant
Trachea	Midline
Breath Sounds	Often obscured by wheezes
Adventitious Sounds	Wheezes, possibly crackles
Tactile Fremitus and Transmitted Voice Sounds	Decreased