

# Lung Examination

MEDICAL  
UNIVERSITY  
RM

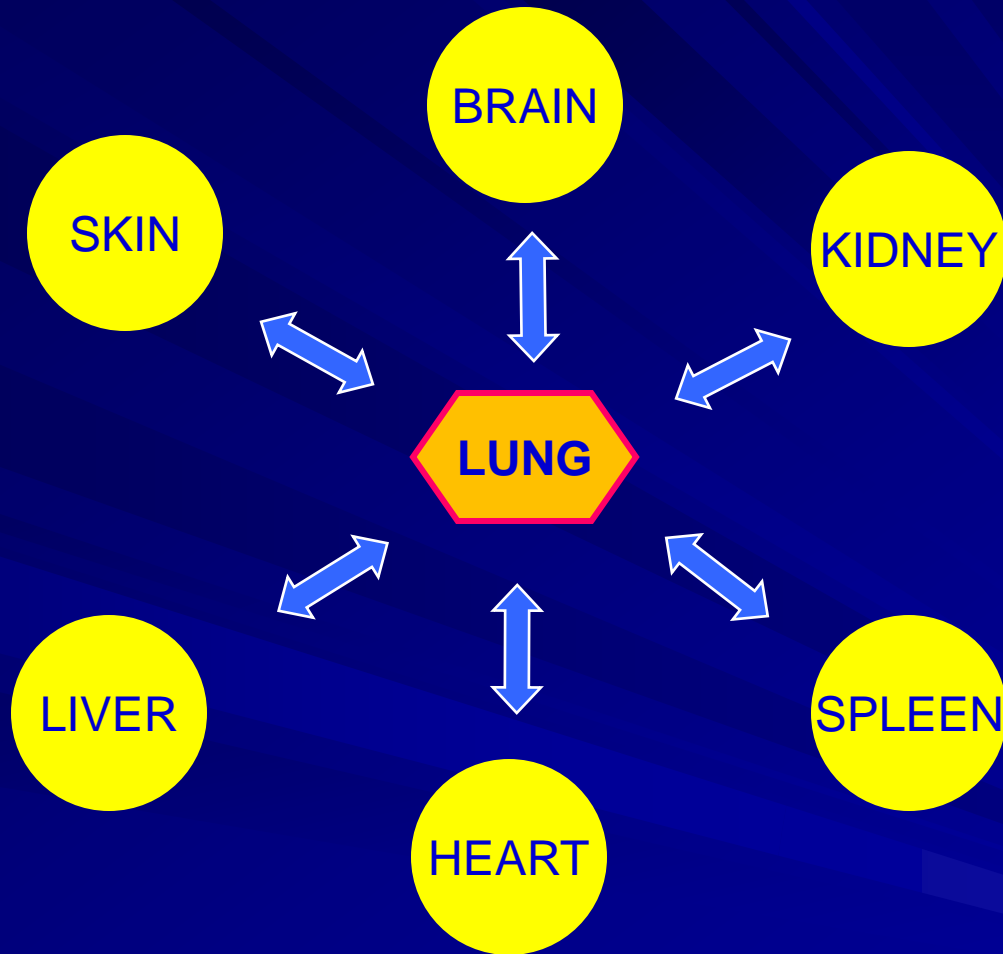
Chisinau

# Respiratory System

- Airways
- Lungs
- Pleura
- Mediastinum
- Chest Wall
- Respiratory Centers

# Pathological Correlation

- Localized Lung Disease
  - Consolidation
  - Cavitation
  - Mass
  - Atelectasis
- Diffuse Lung Disease
  - Emphysema
  - Diffuse airway disease
  - Diffuse alveolar disease
  - Diffuse interstitial disease
- Pleural Disease
  - Pleural effusion
  - Pneumothorax
- Mediastinal Disease
- Respiratory Centers Disease



# Physical Exam Steps

- Inquiry
- General examination
- Mediastinal position
- Chest expansion
- Chest palpation - Voice transmission
- Chest percussion - Lung resonance
- Auscultation - Breath sounds
- Auscultation - Adventitious sounds

# The environment

- Should be quiet (patient, family, clinic attendants, exam room, surrounding areas)
- Should be well lit

# Approaching a Patient

Have a name badge or ID card visible to the patient – you can see their name they should be able to see yours!

**ALWAYS STAND TO THE RIGHT OF THE PATIENT!!**

**Acknowledge:** Always knock on a door or make yourself known at the curtain.

**Introduce:** and shake the patients hand – introduce yourself to family members who maybe present too.

**Duration:** Give a timeline – be Specific and adhere to it.

**Explain:** what you are going to do

**Privacy:** Close curtains and maintain patient dignity

**Thanks:** Always!

Avoid using a patients bed, pillow or personal bedside tables

-Remember the floor is not Sterile. Do not put their stuff or hospital stuff on the floor.

# Inquiry

- Complaints
- Disease history
- Live history
- Unfavorable labor conditions, industrial hazards
- Harmful habits
- Past illnesses
- Allergies
- Family history



# Main Complaints *in RD*

- Dyspnea
- Cough
- Expectations
- Bloody expectorations (Hemoptysis)
- Pain (chest pain)
- Fever

**DYSPNEA**

# DYSPNEA

is understood the subjective difficult or labored breathing.

- is determined as changes of the respiration rate, depth and rhythm.

# DYSPNEA (patient)

- My chest feels tight
- I cannot take a deep breath
- I feel like I have a pillow over my mouth
- I am smothering

- *Physiological Dyspnea* can be caused by heavy exercise, emotions.
- Purely subjective Dyspnea can occur in hysteria, thoracic radiculitis.

# DYSPNEA (cont)

- ACUTE – (pulmonary embolism, asthma)
- CHRONIC – (COPD, CHF)
- TACHYPNEA – RR > 20 BR/MIN
- BRADYPNEA – RR < 8 BR/MIN (drugs, agonal)
- PND - PAROXYSMAL NOCTURNAL DYSPNEA  
sudden onset during night (CHF)

We can distinguish three types of *dyspnea* by the prevalence of breathing phase:

- Inspiratory
- Expiratory (typical for obstructive respiratory diseases)
- Mixed

# Etiologies of dyspnea

## Inspiratory Dyspnea

- Mechanical obstruction of the upper respiratory ducts

## Expiratory Dyspnea

- in case of narrowed lumen of the fine bronchi and bronchioles due to inflammatory edema or spasms - for example in *bronchial asthma* and COPD.



Main respiratory muscles involved in respiration are: intercostal, diaphragm, partly abdominal ones.

Accessory respiratory muscles:  
sternocleidomastoideus, trapezius,  
pectoralis major et minor.

# Mixed Dyspnea

1. In cardiovascular diseases

## Respiratory Diseases

2. Significant decrease in the respiratory surface of the lungs

- Lung compression by liquid or air, accumulated in the pleural cavity,
- Decreased pneumatization of the lung in pneumonia, atelectasis, infarction.

3. Embolism or thrombosis of the pulmonary artery

4. Acute edema of the lungs, bronchiolitis in children lead to heavy mixed Dyspnea, often followed by asphyxia (called suffocation).

5. Sharp contraction of the trachea and a large bronchus (stridulous respiration) .

So, inspiration is difficult in:

- obstruction of the upper respiratory ducts (trachea)

Expiration is difficult in:

- obstruction (narrowed lumen) of the fine bronchi and bronchioles

# And, mixed Dyspnea is met in:

- Sharp contraction of the trachea or a large bronchus
- Decreased pneumatization of the lung due to pneumonia, atelectasis, infarction, lung compression, edema of the lungs
- Cardiovascular diseases (because the congestion in lesser circulation or pulmonary artery thrombembolism)

# Orthopnea

The patient has dyspnea in supine position (lying position), gets some relief by sitting or standing up.

That's why he is sleeping in sitting position (or with 2-3 pillows).

Usually met in patients with **left ventricular failure, obstructive lung diseases.**

*Orthopnea is considered a patient's forced position.*

# Wheezing

- is a type of dyspnea, characterized by pronounced respiratory sounds that may be audible at a distance from the patient, specific in lower airways obstruction.

# WHEEZING

- ASTHMA
- BRONCHITIS
- VOCAL CORD DYSFUNCTION
- FOREIGN BODY ASPIRATION
- INFECTIONS – CROUP LARYNGITIS
- CONGESTIVE HEART FAILURE
- COPD
- CYSTIC FIBROSIS
- FORCED EXPIRATION IN NORMAL SUBJECTS

**NOT ALL THAT WHEEZES IS ASTHMA**



**COUGH**

# Cough

- is a complicated reflex act, a defense reaction aimed at clearing the larynx, trachea or bronchi from mucus or foreign material (by ciliated epithelium).
- Is produced after irritation of specific reflexogenic receptors

# *Reflexogenic zones (cough receptors):*

*tracheal bifurcation,*

*branching points of the bronchi,*

*pleura,*

*interarythenoid space of the larynx,*

*nose.*

# Stimuli of cough receptors

- **Physical** (dusts, foreign bodies and hot, cold air).
- **Chemical** (chemical substances)
- **Biological** (mucus). An inflamed bronchial mucosa produces a secretion which acts on the sensitive reflexogenic zones in the respiratory mucosa, which activates coughing reflex.

# DESCRIBE THE COUGH

- PRODUCTIVE – NONPRODUCTIVE (Dry)
- ACUTE – CHRONIC (> 3 month in 2 yrs)
- TIME OF DAY
- PRECIPITANTS – RELIEF
- BLOODY – NON BLOODY
- BARKING – HACKY (dry cough)
- Whooping

# Cough

- Nonproductive = unproductive
  - Not effective in bringing up sputum
  - “Dry cough”
- Productive
  - Effective in bringing up sputum
  - “Wet cough”

# Cough etiology

## SYMPTOM

## ETIOLOGY

MORNING

CHRONIC BRONCHITIS, LUNG  
ABSCESS, cavernous tb

NOCTURNAL

ASTHMA, CHF, TBC, LmGran

NON-PRODUCTIVE

IntLD, Tumor, pleurisy, laryngitis

RECUMBENT

SINUSITIS, CHF, REFLUX

BARKING

CROUP, LARYNGEAL

PRODUCTIVE

INFECTIOUS, TBC, CR, ABSCESS

BLOODY

TUMOR, CHF, TBC

WHOOPING

COMPRESSED TRACHEA

Evening

TB

# EXPECTORATIONS

- Materials from the air passageways leading to the lungs, brought with coughing
- Are called sputum



# Expectorations (sputum)

It is important to appreciate:

- **Amount** of sputum (during one fit or entire day)
- **Timing** - time of the day during which most sputum is expectorated (morning, evening)
- **Color, odor of the sputum.**
- **Character:** mucoid, purulent.
- Bacteriological and microscopic exams

# SPUTUM - WHAT ARE ITS CHARACTERISTICS ?

- Yellow-green (PNEUMONIA, BRONCHIECSTASIS)
- Rusty (PNEUMOCOCCAL PNEUMONIA)
- Anchovy paste (AMEBIASIS)
- Pink – blood tinged (EPISTAXIS, BRONCHITIS)
- Frothy (CHF)
- Bloody (MALIGNANCY, BRONCHIECSTASIS, PULMONARY RENAL SYNDROME)
- Smell – foul? (ANAEROBIC LUNG ABCESS)
- Sandlike (BRONCHOLITHIASIS)
- Black – COAL DUST INHALATION (carbune)

# HEMOPTYSIS

# Hemoptysis

- expectoration of bloody sputum, arising from the oral cavity, larynx, trachea, bronchi, or lungs

# HEMOPTYSIS - REQUIRES CAREFUL QUESTIONING

This symptom usually denotes a serious illness:

- TBC,
- TUMOR,
- BRONCHIECTASIS,
- Pulmonary Embolism,
- CARDIAC DISEASE

# THE PATIENT SHOULD BE QUESTIONED CAREFULLY REGARDING

- HOW MUCH blood (thin streaks or diffuse) ,
- FREQUENCY
- *The* character of blood (jelly-like, foamy, scarlet, rust) .
- Weight loss.

*Look for the* origin of bleeding (pulmonary, cardiovascular, cancer, thrombosis of the PA) – using paraclinical methods.

# CLUES TO DIFFERENTIATING HEMOPTYSIS FROM HEMATEMESIS

## HEMOPTYSIS

COUGH

FROTHY (spuma)

COLOR- BRIGHT RED

PUS

DYSPNEA

RESPIRATORY OR  
CARDIAC DISEASE

## HEMATEMESIS

NAUSEA – VOMITING

NOT FROTHY

COFFEE GROUNDS

FOOD

NAUSEA

GI DISEASE

# CHEST PAIN



# Chest pain

Origin of the chest pain could be :

## ■ Respiratory diseases :

1. In pleura irritation (pneumonia, tbc, pleurisy)
2. In tracheobronchitis – retrosternal, during cough
3. Bronchopulmonary cancer

## ■ Chest wall (myositis, intervertebral neuritis, broken ribs, osteochondritis, breast)

## ■ Cardiovascular diseases (angina, myocarditis, TPA, pericarditis, dissecting aortic aneurysm)

## ■ Digestive diseases (Hiatus hernia, cholelithiasis, reflux esophagitis)

# Chest pain - Causes

Cardiovascular	Respiratory	GI	Other
Angina MI Variant angina Syndrome X Aortic dissection Thoracic aneurysm Myo-pericarditis	PE Pneumonia Pneumothorax Acute asthma Pneumomediastinum Cancer	Oesophagitis Oesophageal spasm Hiatus hernia PUD Biliary colic Pancreatitis	Chest wall / musculoskeletal Psychogenic Costochondritis Cervical spondylosis

For establishing the etiology of pain is useful to determine its *characteristics* :

- location
- character (piercing, acute)
- intensity
- duration
- irradiation
- the precipitants and relief conditions (in pleura involvement pain is connected with the respiratory movements, cough, posture).

# Dysphonia:

Difficulty in speaking

Hoarseness

- may be a complaint in RD

# Past illnesses

(continue to inquire the patient)

Some items from the patient's history could be informative:

- Frequent chills
- Epidemiological conditions (influenza, tbc)

# Unfavorable labor conditions, industrial hazards

▣ **OCCUPATIONAL** - chronologic order

▣ **EXPOSURE :**

pipe fitters (ASBESTOS)

farming – (FARMERS LUNG)

military – (BERYLLIOSIS)

# Hazards, Harmful habits

**TRAVEL** - far east (PARAGONIMIASIS)  
south America (BRUCELOSIS)  
Africa (MALARY)

**DRUGS** – nitrofurantoin, amiodarone  
(interstitial lung disease)

**HABITS** – tobacco, nose drops, cocaine

# FAMILY HISTORY

- **EMPHYSEMA AT AN EARLY AGE** -  
CONSIDER ALPHA - 1 ANTITRYPSIN
- **RECURRENT RESPIRATORY INFECTIONS  
AND STERILITY IN A YOUNG ADULT  
MALE** - CONSIDER CYSTIC FIBROSIS,  
IMMOTILE CILIA OR YOUNG'S  
SYNDROME
- **PULMONARY NODULE AND HYPOXEMIA**  
- CONSIDER OSLER WEBER RENDU



# General and local examination

- Posture - effort of ventilation
- Cyanosis (skin color)
- Clubbing
- Weight
- Respiratory rate
- Pattern of breathing
- Respiration type
- Chest shape
- Hospital setting

# Effort of Ventilation.

## Pathological symptoms:

- Patient appears uncomfortable. Breathing seems voluntary.
- Accessory muscles are in use, expiratory muscles are active and expiration is not passive any more.
- The degree of negative pleural pressure is high.
- The respiratory rate is increased.

# Cyanosis

- Slightly bluish, grayish, slatelike, or dark purple discoloration of the skin due to presence of abnormal amounts of reduced hemoglobin in the blood

# CYANOSIS

- Peripheral – HANDS, FEET – warming decreases CYANOSIS – decreased cardiac output
- Central - LIPS, TONGUE, SUBLINGUAL – right to left shunts, respiratory insufficiency
- Pseudo cyanosis – blue pigments in skin - AMIODARONE

CRIT CARE NURS 13:66-72, 1993

# So, Central Cyanosis -

- may result from pulmonary dysfunction, the mucous membrane of conjunctiva and tongue are bluish (hypooxygenation due to respiratory insufficiency)

# Central Cyanosis - tongue is bluish

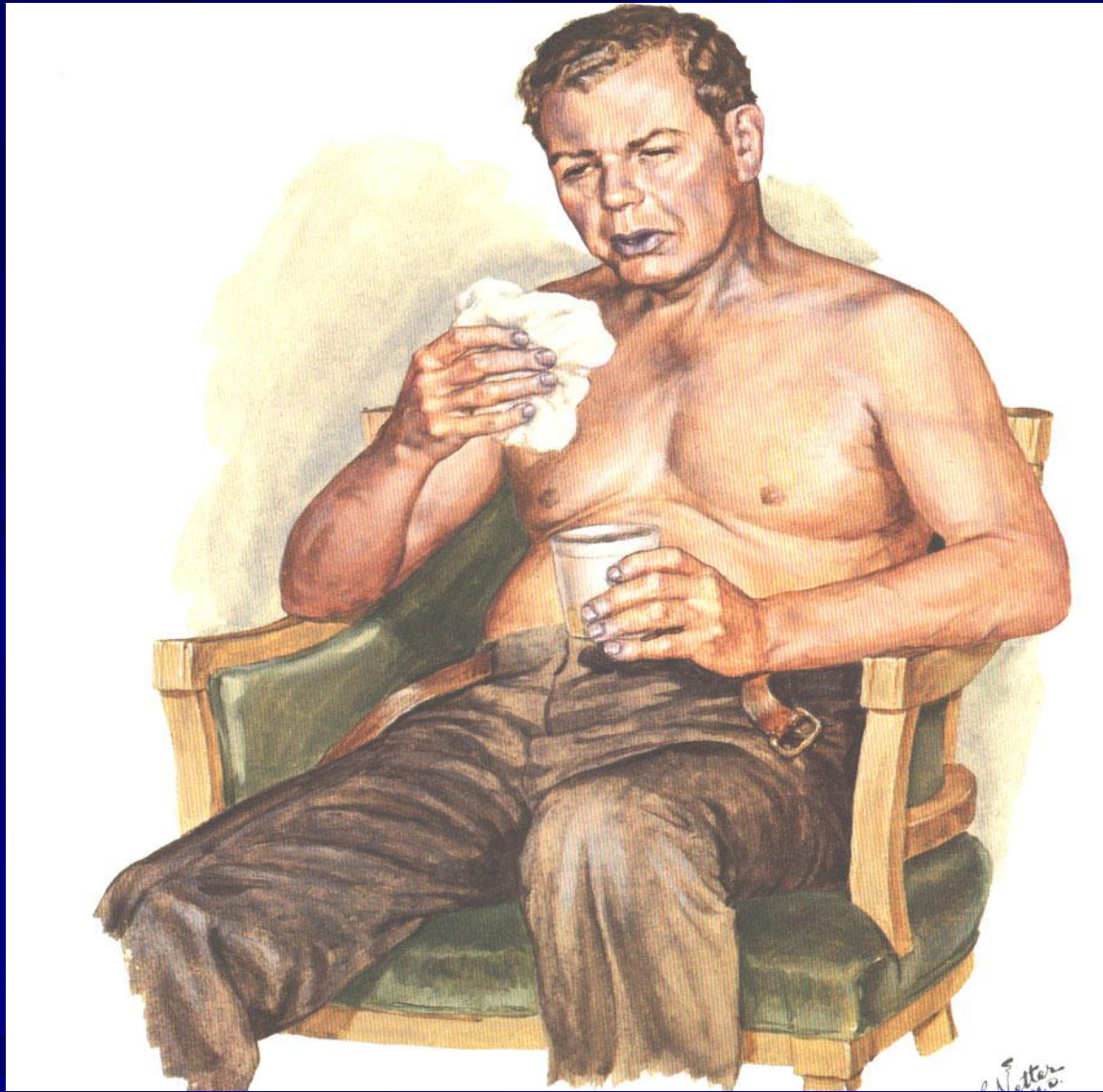


**Central Cyanosis**

# Peripheral cyanosis



**Cor pulmonale**



**BLUE BLOATER**



# Weight

- Emaciation cachectic
  - Malignancy
  - Tuberculosis
  - Obese: Sleep apnea syndrome




**Sleep apnea syndrome**

# Clubbing - shape of the fingernails

- In clubbing, there is widening of the antero-posterior and lateral diameter of terminal portion of fingers and toes giving the appearance of clubbing.



# CLUBBING

- Is due to enlargement of the connective tissue in the terminal phalanges of the fingers >toes due to peripheral hypooxygenation
- Painless
- The angle between the nail and skin is greater than 180°  .
- The perinail skin is stretched and shiny.
- There is fluctuation of the nail bed.
- Usually fingers are like “drum sticks”

# Clubbing



**Hereditary**

**Interstitial Fibrosis**

**Tumor**

**Bronchiecstasis**

**Heart Disease**

**Endocarditis**

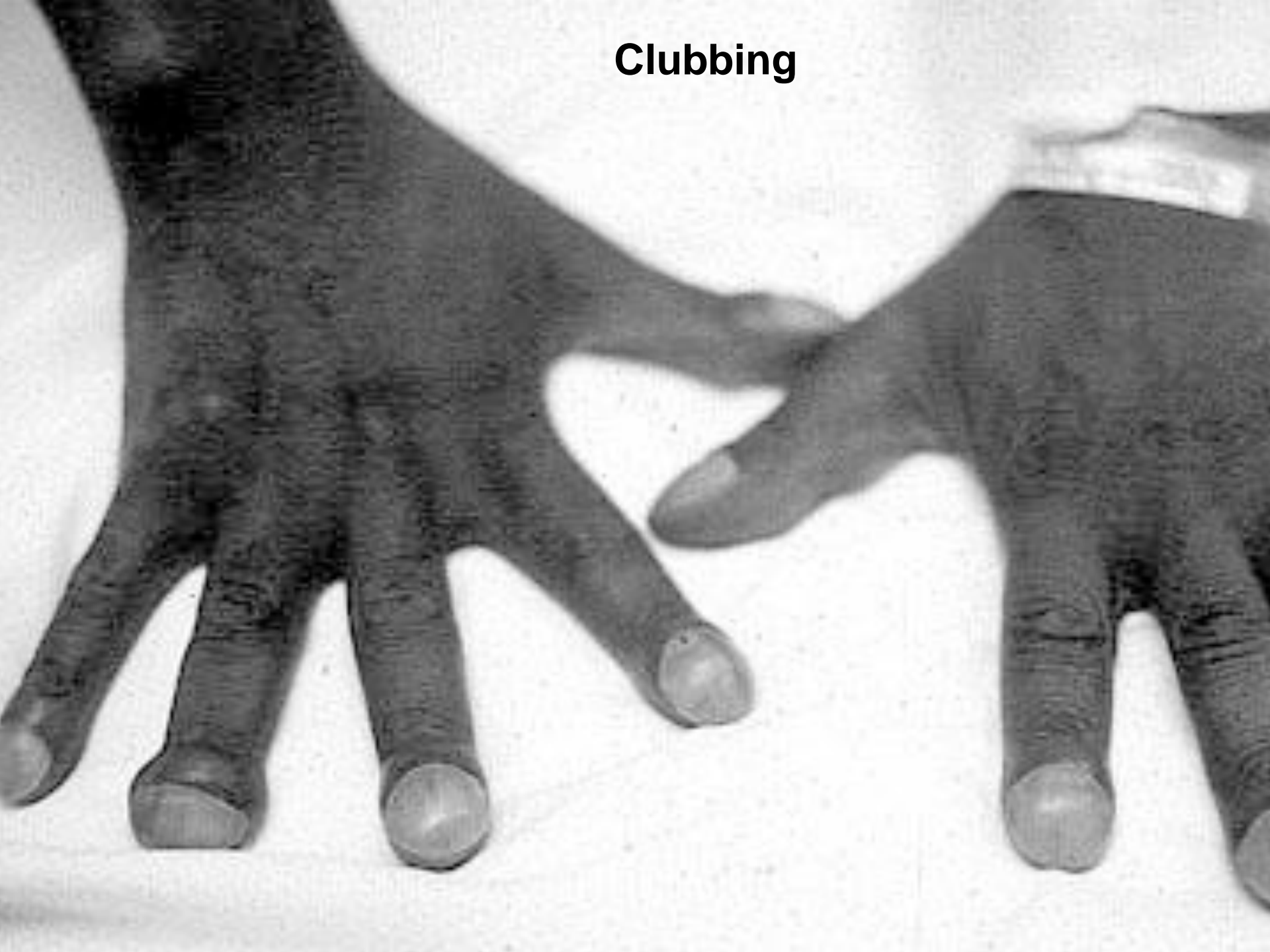
# CLUBBING



**SCHAMROTH'S SIGN – LOSS OF THE SUBUNGUAL  
ANGLE**

CLIN CHEST MED 8:287-298,1987

# Clubbing



# Significance: Clubbing Observed In:

- Intrathoracic malignancy: Primary or secondary (lung, pleural, mediastinal)
- Suppurative lung disease: (lung abscess, bronchiectasis, empyema)
- In chronic respiratory insufficiency, due to dystrophic changes in peripheral tissues
- Diffuse interstitial fibrosis: Alveolar capillary block syndrome
- In association with other systemic disorders



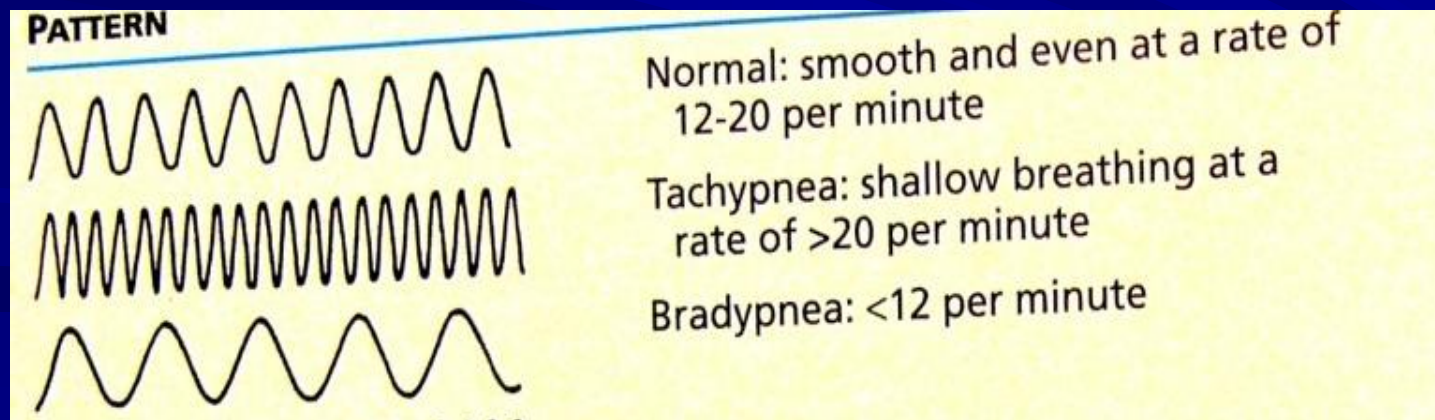
# Respiratory rate

Must be appreciated by counting the movements of the chest or the abdominal wall, with patient being unaware of this procedure.

- Count the breaths while you “check the pulse”
- Normal number of respiratory movements  
- 12 to 20 per minute at rest, in newborn  
40-45; during sleep- 11-14.

# Respiratory Rate

- Bradypnea: rate less than 8 per minute
- Tachypnea: rate greater than 20-25 per minute



# Rapid shallow breathing is due to :

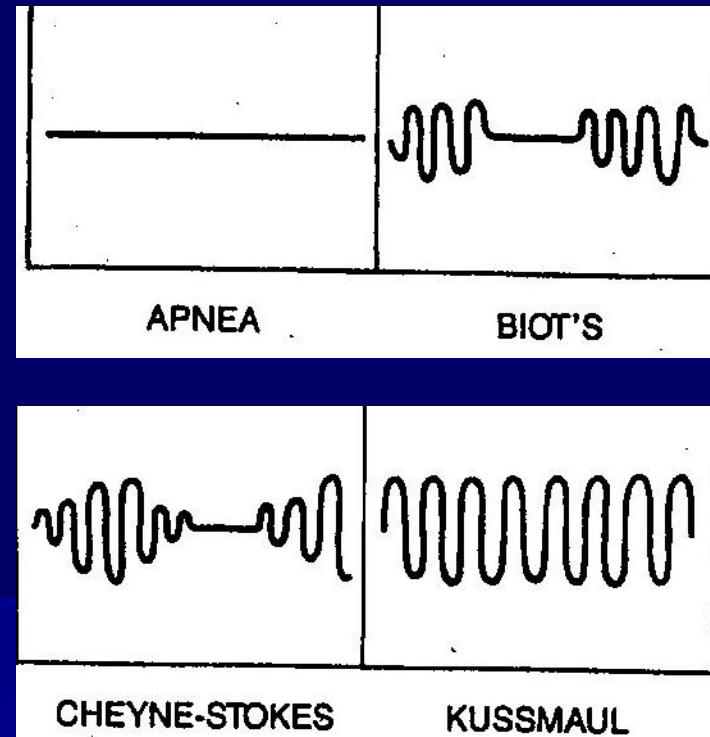
- narrowing of the lumen of small bronchi,
- decreased in the respiratory surface of the lungs, pleuritic pain;
- insufficient depth of breathing.
- rapid deep breathing it mostly occurs after exercise, or due to acidosis (Kussmaul)

# Slow respiration could be met in:

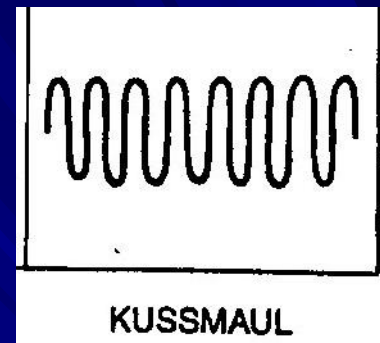
- inhibition of the respiratory centre (intracranial pressure, meningitis, edema of the brain),
- toxic effects on the brain ~ coma.

# Abnormal Pattern of Breathing

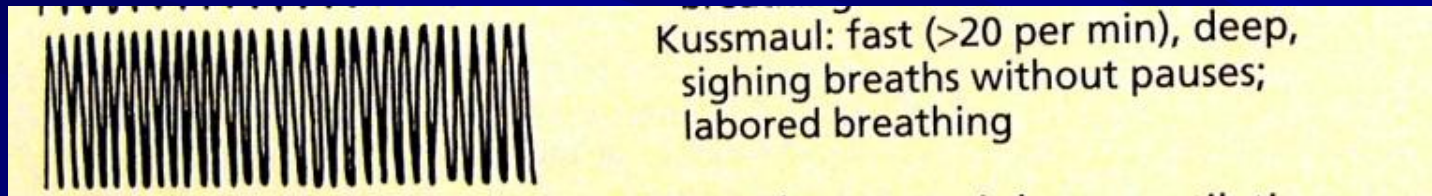
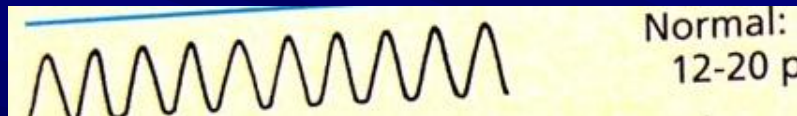
- Kussmaul's
- Cheyne Stokes
- Biot's
- Grocco's
- Sleep apnea



# Kussmaul's:

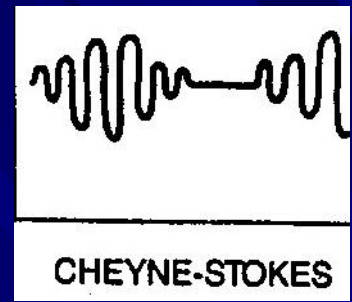


- Deep and slow respiration with marked noisy respiratory movements.

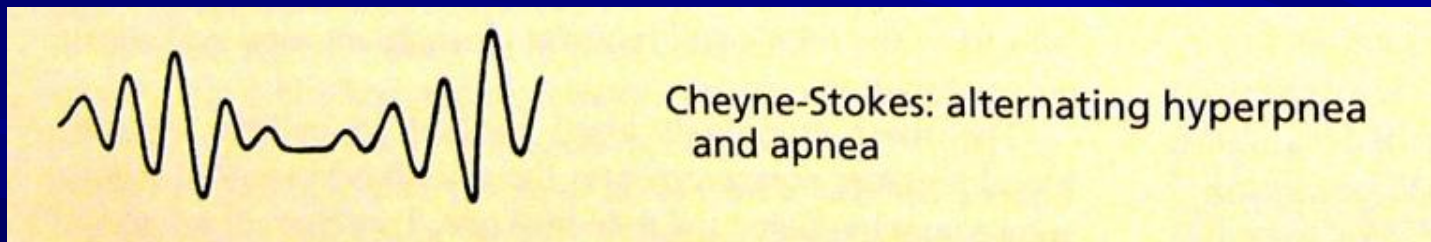


- METABOLIC ACIDOSIS

# Cheyne-Stokes' s

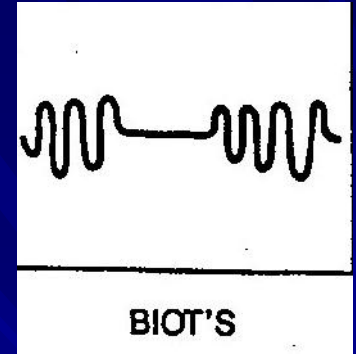


- - periods of apnea (no breathing), followed by noiseless shallow respiration, which quickly deepens, becomes noisy to attain its maximum at the 5-7 inspiration, then gradually slows down to end with a new short respiratory pause.

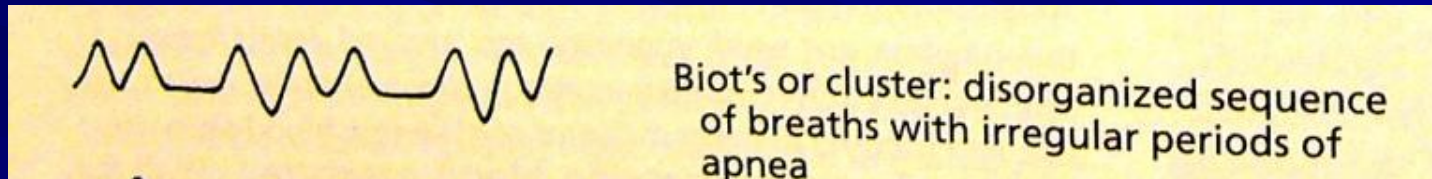


- CONGESTIVE HEART FAILURE – DRUGS – CEREBRAL

# Biot's respiration



- - rhythmic but deep respiratory movements which alternate with long respiratory pauses.

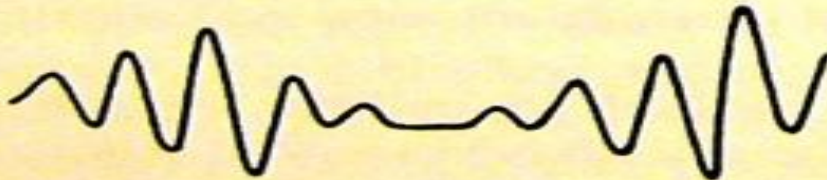


- INCREASED INTRACRANIAL PRESSURE –  
DRUGS- MEDULLA

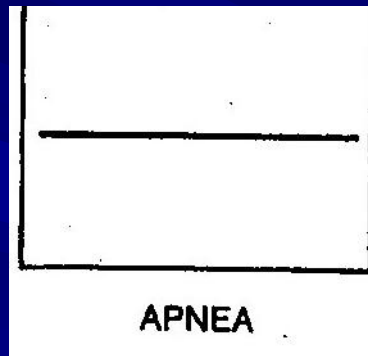
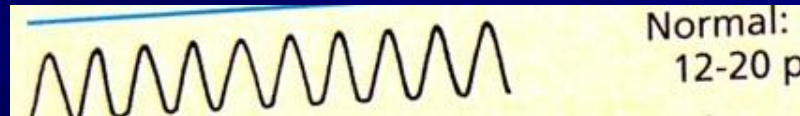


# Grocco's

- - it is like the Cheyne-Stokes's one, but instead of respiratory pause we have a weak shallow respiration.



# APNEA - CARDIAC ARREST



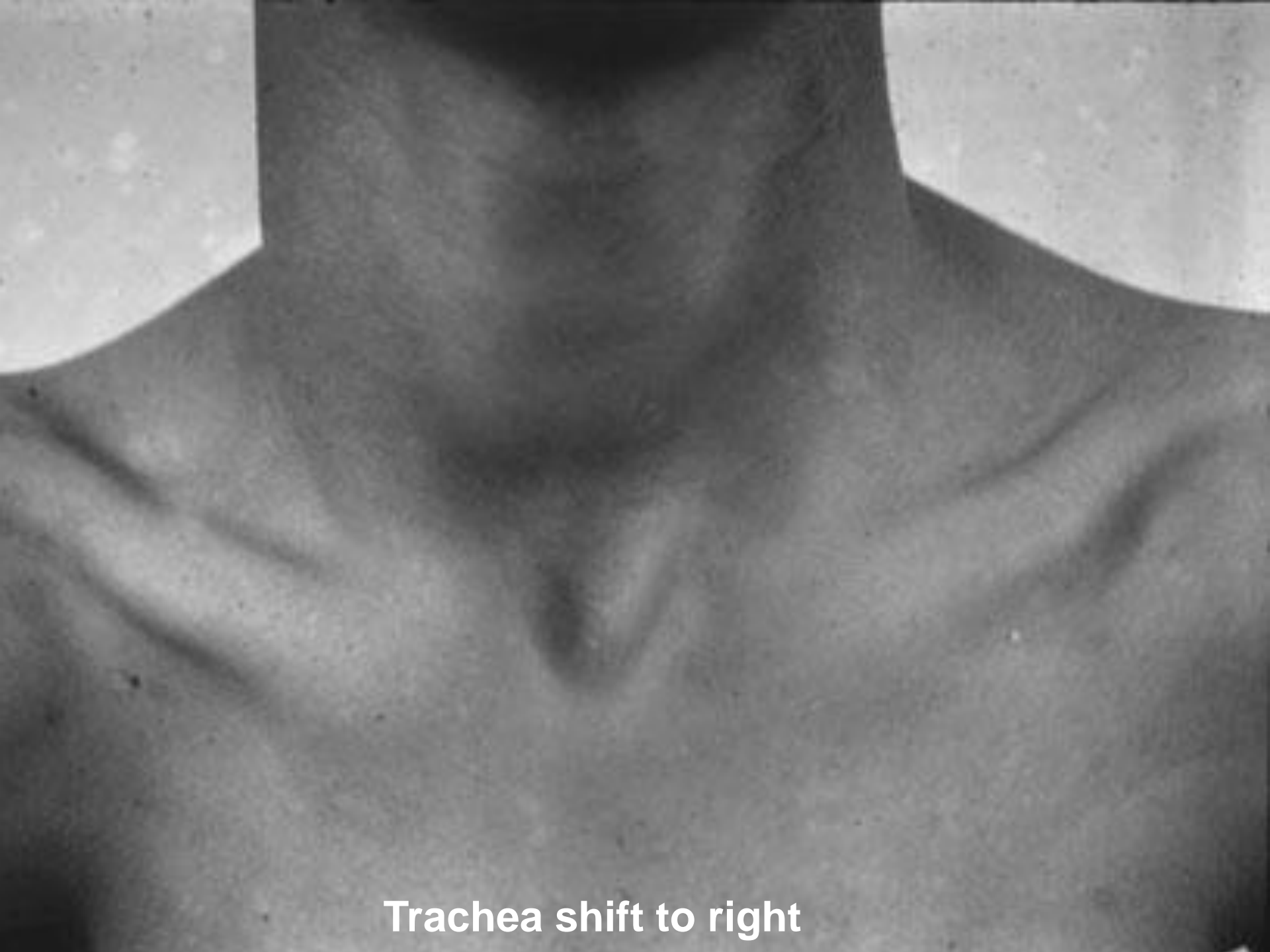
# Respiratory types:

- *Thoracic (costal)* - respiratory movements are carried out mainly by the contraction of the intercostal muscles. Chest broadens, then narrows. It is mostly characteristic for women.
- *Abdominal* - respiratory movements are carried out mainly by the diaphragmal muscles. In Inspiration – the diaphragm contracts and lowers, the abdominal wall displaces anterior. In expiration - diaphragm muscles are relaxed, abdominal wall returns back (usually met in men).
- *Mixed* - aged persons, in some pathological conditions.

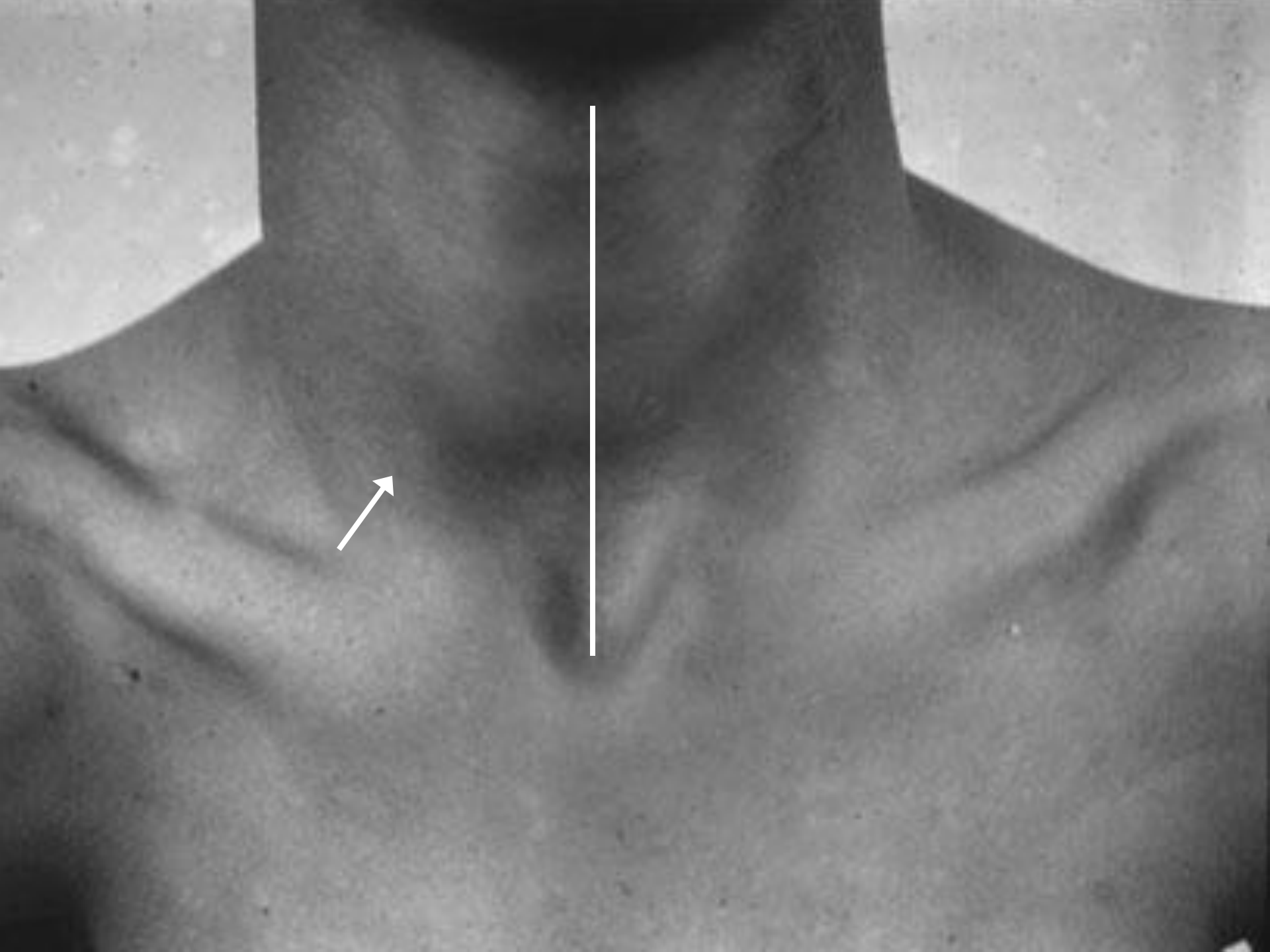
# DO NOT FORGET THE TRACHEA

## TRACHEAL DEVIATION

- TRACHEAL TUG (OLIVERS SIGN) – DOWNWARD DISPLACEMENT OF THE CRICOID CARTILAGE WITH VENTRICULAR CONTRACTION – OBSERVED IN PATIENTS WITH AN AORTIC ARCH ANEURYSM
- TRACHEAL TUG (CAMPBELL'S SIGN) – DOWNWARD DISPLACEMENT OF THE THYROID CARTILAGE DURING INSPIRATION – SEEN IN PATIENTS WITH COPD
- May be displaced, usually by pleural effusion



**Trachea shift to right**



# Tracheal Position: Mediastinum

- Lateral shift: The mediastinum can be either pulled or pushed away from the lesion
  - Pull: Loss of lung volume (Atelectasis, fibrosis, agenesis, surgical resection, pleural fibrosis)
  - Push: Space occupying lesions (pleural effusion, pneumothorax, large mass lesions)
- Any deviation of the mediastinum is abnormal

# Resting Size and Shape of Thorax

- Normal configuration
- Barrel chest
- Paralytic chest
- Rachitic chest
- Foveated chest
- Pectus excavatum
- Gibbus
- Deformations of the spine
  1. Cyphosis
  2. Lordosis
  3. Scoliosis



# Normal configuration

- Appreciate AP and TR diameters, position of the clavicles, supra- and subclavicular fosses, ribs, shoulders, blades

## Normal Chest has:

- Symmetrical right and left sides
- Clavicles and blades are at one level
- Supraclavicular fosses equally pronounced.

To appreciate the type of the chest we must press the thumbs against the costal arch.

There are 3 normal  
chest forms:

# 1. Normosthenic chest -

in persons with normosthenic constitution; a cone whose bottom is directed upward. Anterior-posterior diameter of the chest is smaller than the lateral (transverse) one.

Epigastric angle nears  $90^\circ$ .

The ribs are moderately inclined.

Chest is about the same height as the abdominal part of the trunk.

## 2. Hypersthenic chest -

in persons with hypersthenic constitution; it has a shape of cylinder. The anterior-posterior diameter of the chest is about the same as the lateral (transverse) one.

Supraclavicular fosses are absent.

Epigastric angle exceeds  $90^\circ$ .

The ribs in the lateral parts are nearly horizontal.

The thoracic part of the trunk is smaller than the abdominal one.

### 3. Asthenic chest

in persons with asthenic constitution. It is elongated, narrow.

Both anterior-posterior and transverse diameters are smaller than normal; supra- and subclavicular fosses are pronounced.

Epigastric angle is less  $90^\circ$ .

The ribs are more vertical at the sides.

The chest is longer than the abdominal part of the trunk.

**PATHOLOGICAL**  
types of the chest:



**Gibbus**

# Emphysematous (barrel) chest

it is more like the hypersthenic one in its shape,  
but differs from it by  
its **barrel-like configuration**.

- Intercostal spaces are enlarged;
- ribs are almost horizontal,
- supra- and subclavicular fosses are prominent.

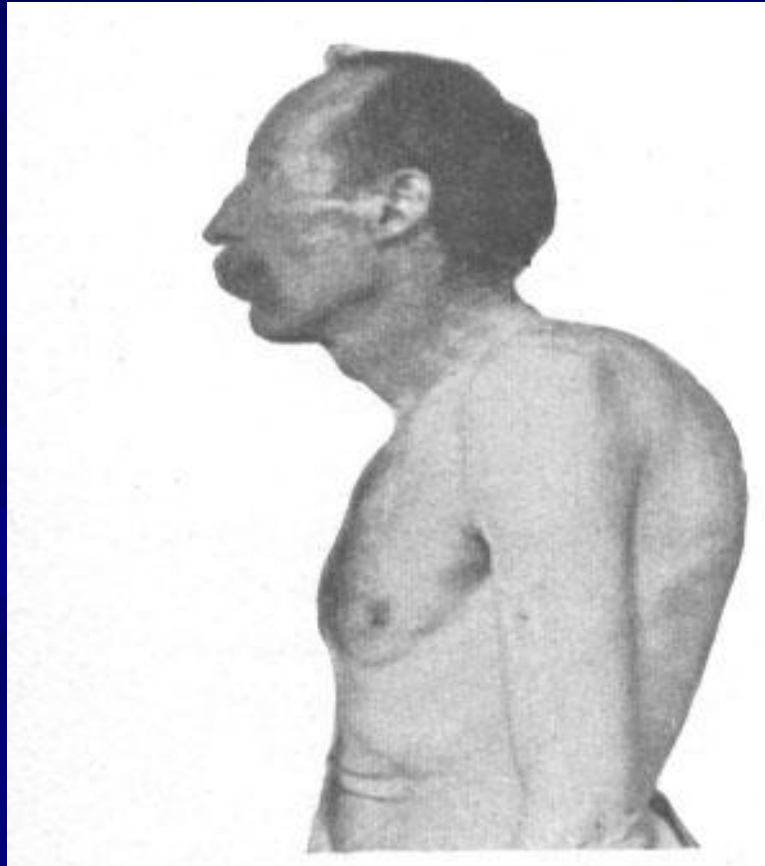
*It is characteristic* in chronic lung's emphysema,  
when volume of the lungs increases.



# So, WHAT IS A BARRELL CHEST?

- Thoracic index – ratio of the antero-posterior to lateral diameter normal 0.70 – 0.75 in adults
- $>0.9$  is considered abnormal
- NORMALS - ILLUSION
- COPD

# BARREL CHEST



# Barrel Chest



**AP Diameter =  
Transverse Diameter**

# Rachitic chest-pectus carnatum (pigeon chest).

- It has a marked greater anterior-posterior diameter compared with the transverse one, due to the prominence of the sternum (like a keel of a boat).
- The lateral surfaces as if pressed on both sides, the ribs meet at an acute angle at the sternal bone.
- The costal cartilages thicken like beads at point of their transition to bones (“Rachitic beads”).



# Funnel chest – pectus excavatum

- It has a funnel-shaped depression in the lower part of the sternum.
- It can be regarded as a result of abnormal development of the sternum or its prolonged compression in the childhood.



Fig. 108. *Funnel chest*

# Paralytic chest

usual for general asthenia, pulmonary tbc, pneumosclerosis.

During examination can be observed:

Atrophy of the chest, asymmetry of the clavicles and dissimilar depression of the supraclavicular fosses along with typical signs of an asthenic chest.

Shoulder blades are not at the same level.

# Foveated chest

- Is almost the same as the funnel chest, only the depression is found in the upper and the middle parts of the anterior surface of the chest (occurs in syringomyelia).

# Types of Deformation of the spine:

- Scoliosis - lateral curvature of the spine;
- Cyphosis - backward curvature of the spine;
- Lordosis - forward curvature of the spine.









# Chest Expansion

- Asymmetrical chest expansion is abnormal
  - The abnormal side expands less and lags behind the normal side
  - Any form of unilateral lung or pleural disease can cause asymmetry of chest expansion
- Global expansion decrease

# **PALPATION OF THE CHEST**

# CHEST PALPATION

has the goal to identify:

- Thoracic elasticity.
- Tender, pain areas. Carefully palpate any area with lesions.
- Thoracic expansion – how hemithoraxes are participating in respiratory act (symmetrically or unilateral lagging of one of them).
- Tactile fremitus (vocal fremitus).

# Thoracic elasticity

- Is evaluated by pushing the hands, placed on opposite sides of the thorax, towards each other (antero-posterior; right lateral side-left lateral side)
- Thoracic elasticity is decreased in lung's emphysema.

# Tender, pain areas

- – their presence suggested a disease located in the chest wall – muscles inflammation, nevritis, broken ribs etc.
- You should check for them anteriorly, on lateral sides, posteriorly



# THORACIC EXPANSION

- Asymmetry in expansion of the chest can be detected during inspection and palpation of the thorax
- During prompted inhalation observe the movement of both hemi thoraxes
- Asymmetry may suggest ***Pleural effusion, pneumothorax, pneumonia ,hydrothorax, pleural thickening, atelectasis***



# Thoracic expansion



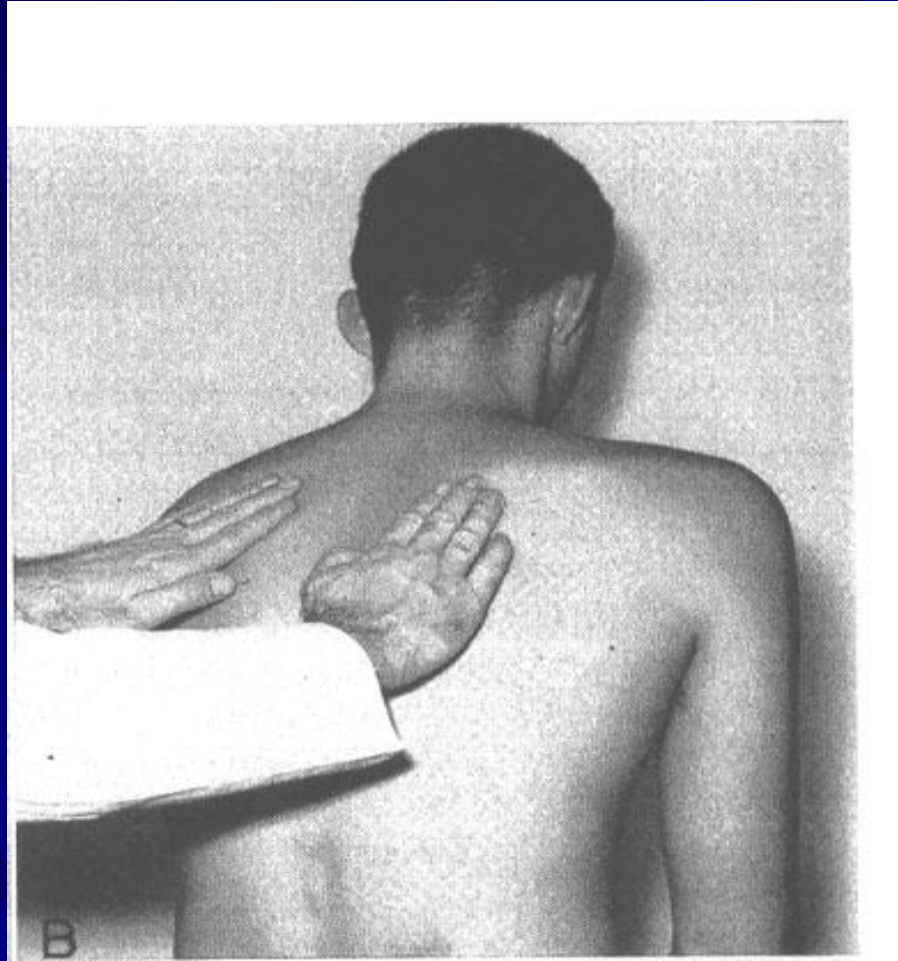
# Tactile fremitus (vocal fremitus)

- refers to the palpable *vibrations* transmitted through the broncho-pulmonary system to the chest wall when the patient speaks.
- A thrill or vibration which is felt on the clinicians hand while resting on the patients chest wall at the same time the patient speaks 99 – 1-2-3
- Symmetry may be seen in normals
- Asymmetry – is abnormal

# Method

of tactile fremitus identifying:

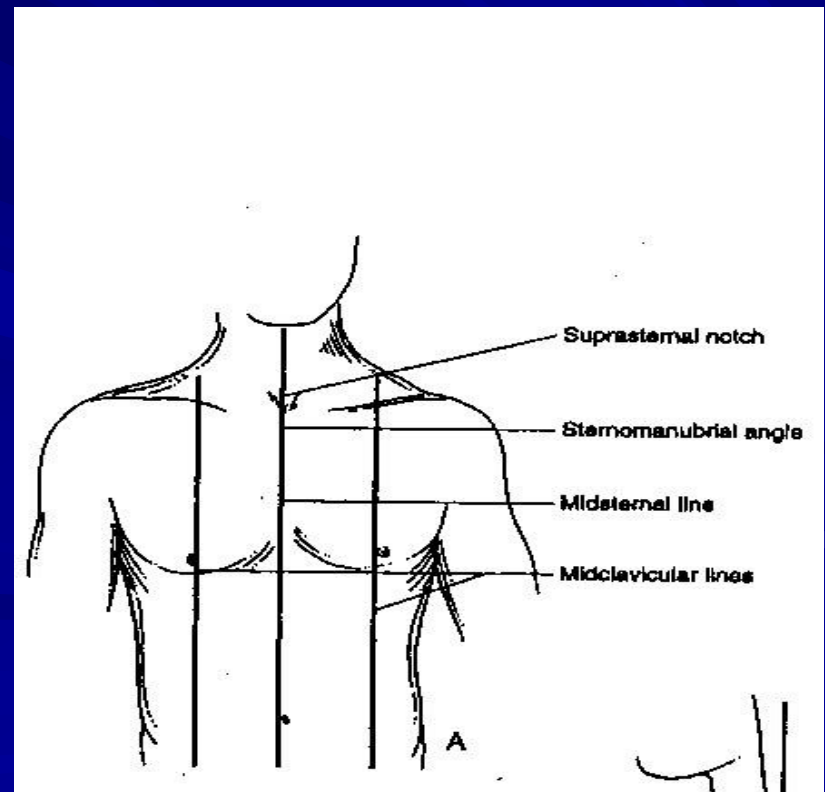
- Ask the patient to repeat the words ninety-nine, one-one-one; put your palms on the symmetrical areas of the chest wall, using surface of the hand, and appreciate the vibrations produced by the sound waves.



# Points for identifying **Tactile fremitus**

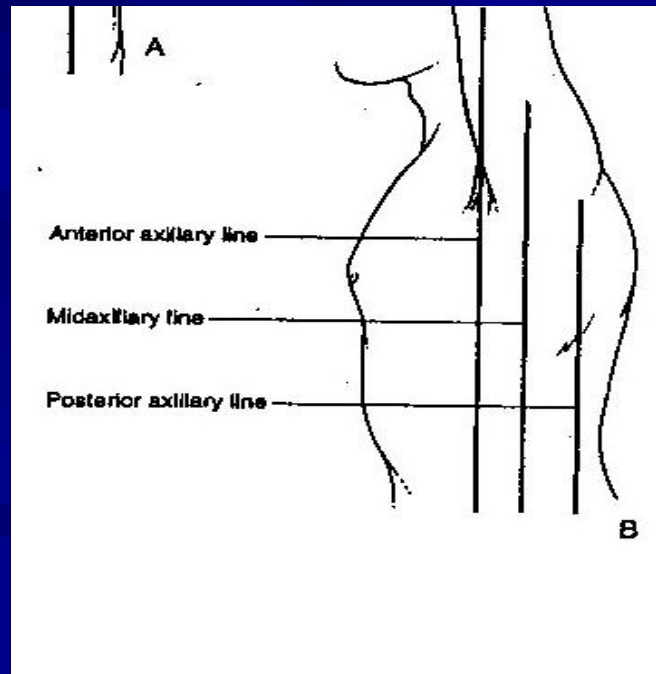
■ Anteriorly:

Under the clavicles (position of the hands – like butterfly)



- Lateral sides

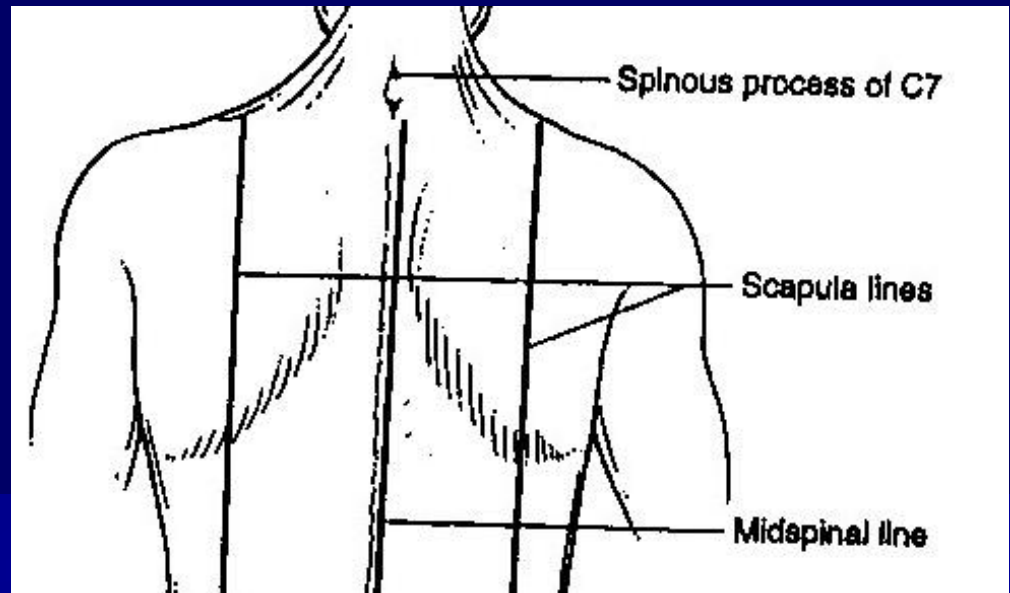
- Hands are placed strictly vertical with distal falanga in the axillary fossa





- Posterior side

- Over the scapulae, fingertips should achieve the clavicles
- Between the scapulae, hands are vertical,
- Under the scapulae – hands are placed horizontally



- Asymmetrical voice transmission points to disease on one side

- Palpation should be done by placing the palms on the symmetrical parts of the chest.

- *Vocal fremitus* is more prominent in the interscapular area than in the lower lung fields, and on the right side.

Fremitus is decreased or absent

- Soft patient's voice
- Very thick chest wall

# Tactile fremitus .

## Pathological *decreased* or absent

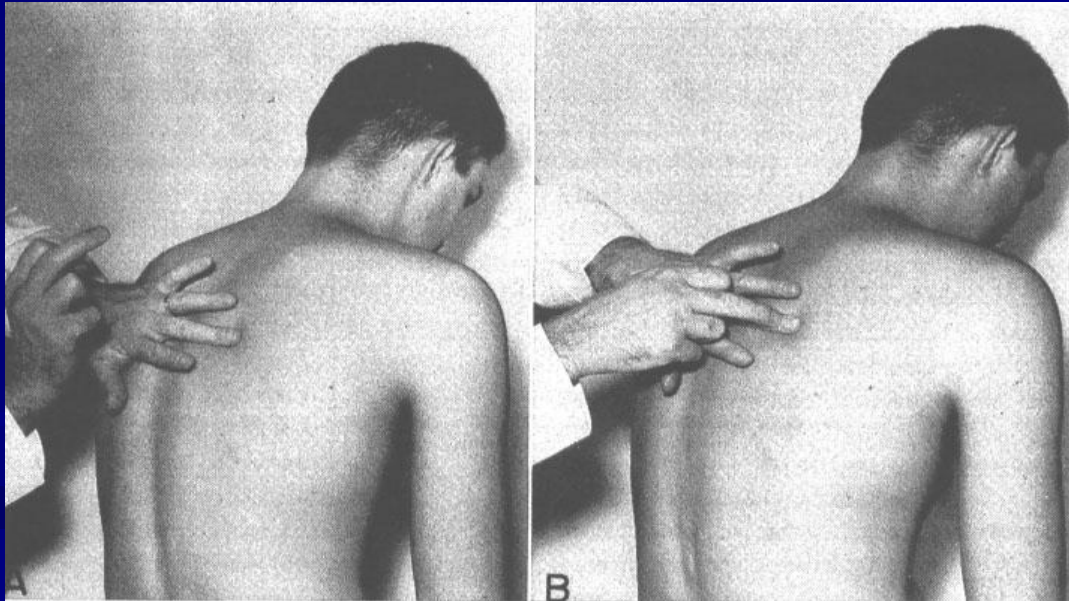
- Emphysema (in emphysema we have distension of the air spaces and excessive accumulation of air in them; and we know that *air is a worse medium for sound waves conduction*).
- Accumulation of the fluid in pleural cavity (pleural effusion) – over the fluid vocal fremitus is decreased;

- Gas, air accumulated in the pleural cavity (pneumothorax) – over the air vocal fremitus is decreased;
- Obstructed bronchus (obstructed atelectasis) - sound waves are blocked by the obstruction and are not conducted to the chest wall.

# Tactile Fremitus is increased in:

- Thin patient's chest wall
- Consolidation of the lung tissue - an infiltration, a dense process (tumor, pneumonia, tbc); *a solid medium is a better conductor for sound waves.*
- Air cavity in the lung, communicated with a large bronchus; in this case the cavity is playing the role of a resonant box, amplifying the sounds.

# PERCUSSION



# PERCUSSION

- Percussion is a method of examination using short strikes over the body.
- Percussion sets the chest wall and underlying tissues into motion, producing audible sounds.
- It helps to determine if the underlying tissues are air-filled, fluid-filled, or solid.
- It is produced on the symmetric parts of the chest over the lungs.



# PERCUSSION

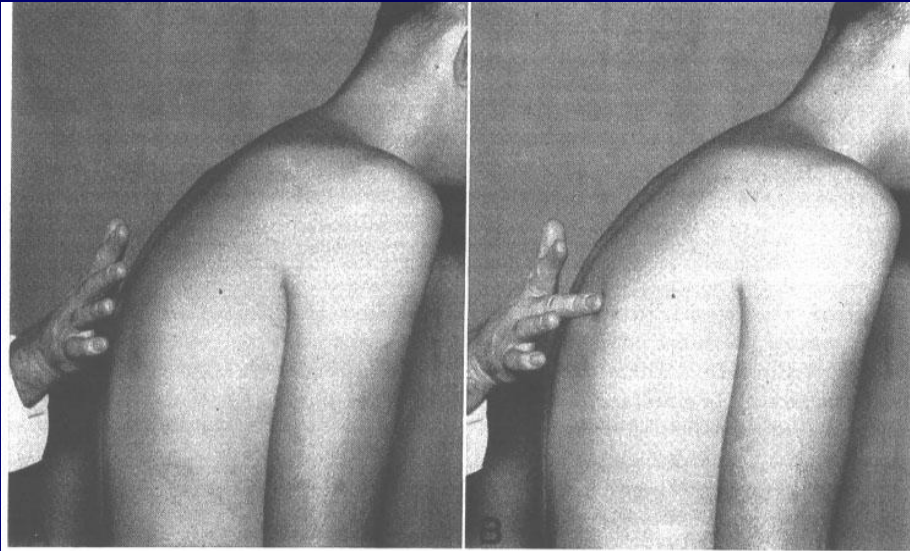
## TWO TECHNIQUES

- DIRECT – BLOW LANDS DIRECTLY ON THE CHEST
- INDIRECT – PLESSIMETER - USUALLY THE MIDDLE FINGER

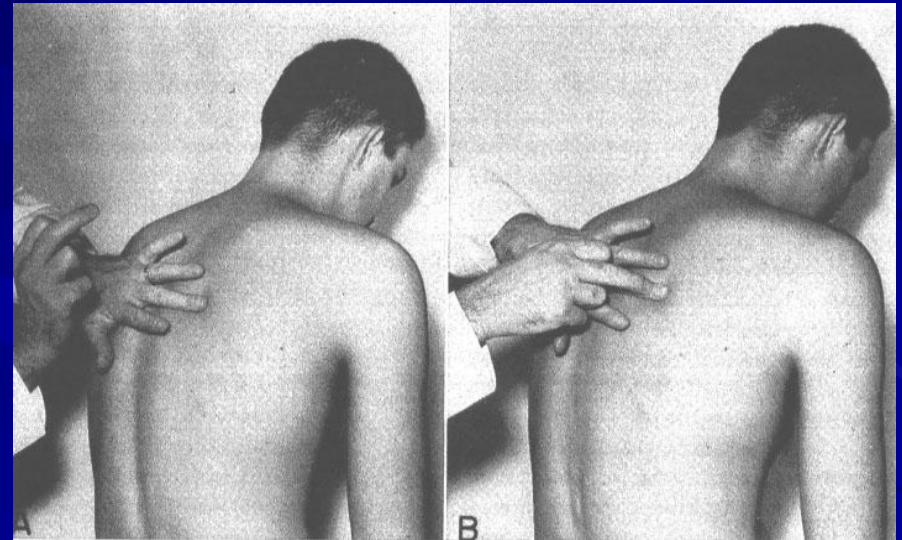
## THREE TYPES

- COMPARATIVE
- TOPOGRAPHIC
- AUSCULTATORY

# METHODS OF PERCUSSION



DIRECT



INDIRECT

## *Indirect Technique (main one):*

- The doctor should hyperextend the middle finger of the left hand (the pleximeter finger).
- Press the left hand ***firmly*** on the surface.
- Position of your right hand should be quite close to the surface with the hand cocked upward.
- The right middle finger should be flexed (plexor), it will strike quick the pleximeter with the tip, no pad.
- Strike twice, than move on.

# There are 2 types of percussion:

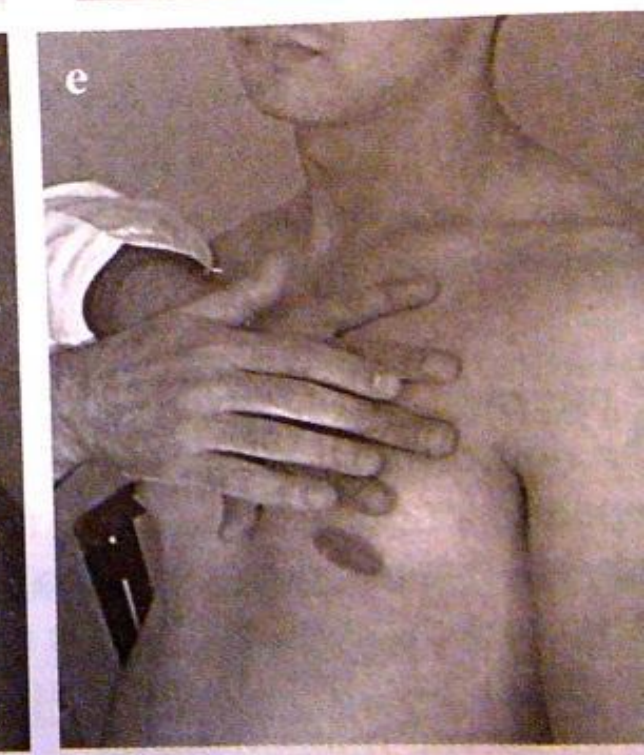
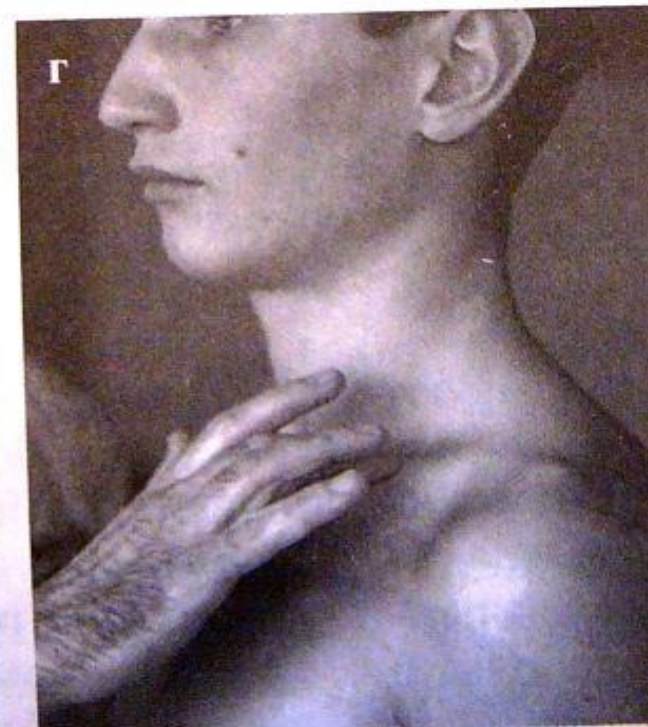
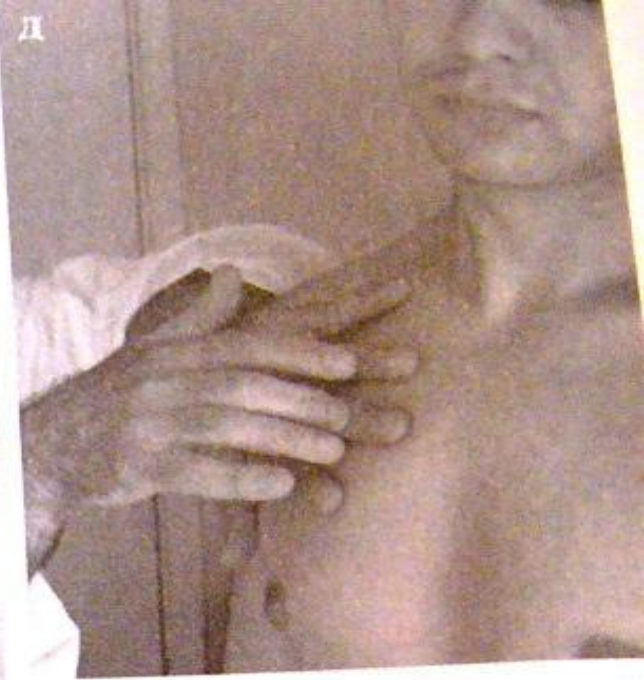
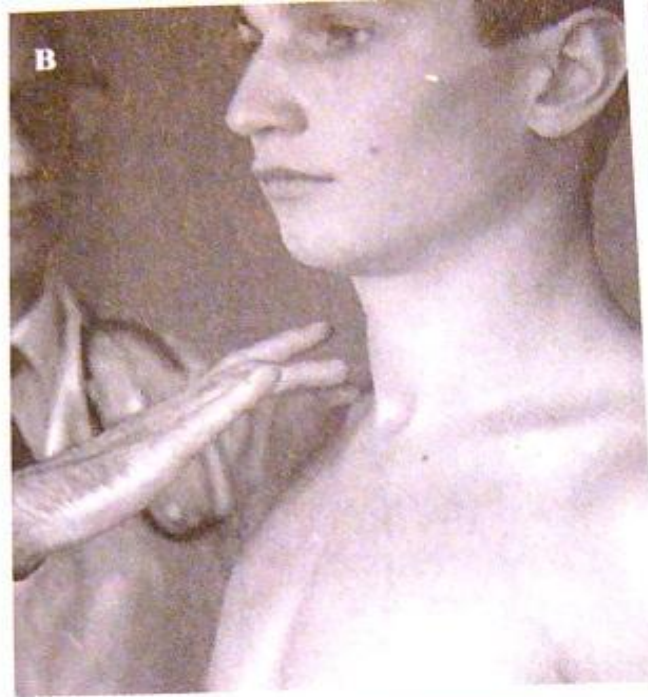
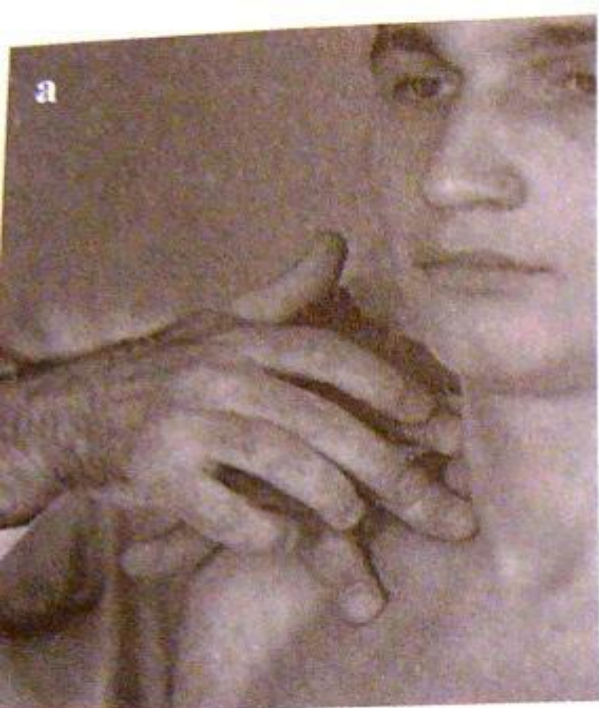
- **Comparative percussion** - is used to determine the type of percussion note over the lungs comparatively, in symmetrical regions.
- **Topographic percussion** – is used to determine the topography of the lungs.

# Comparative percussion

- Over the lungs Must be identified resonant sound

# Points for comparative percussion

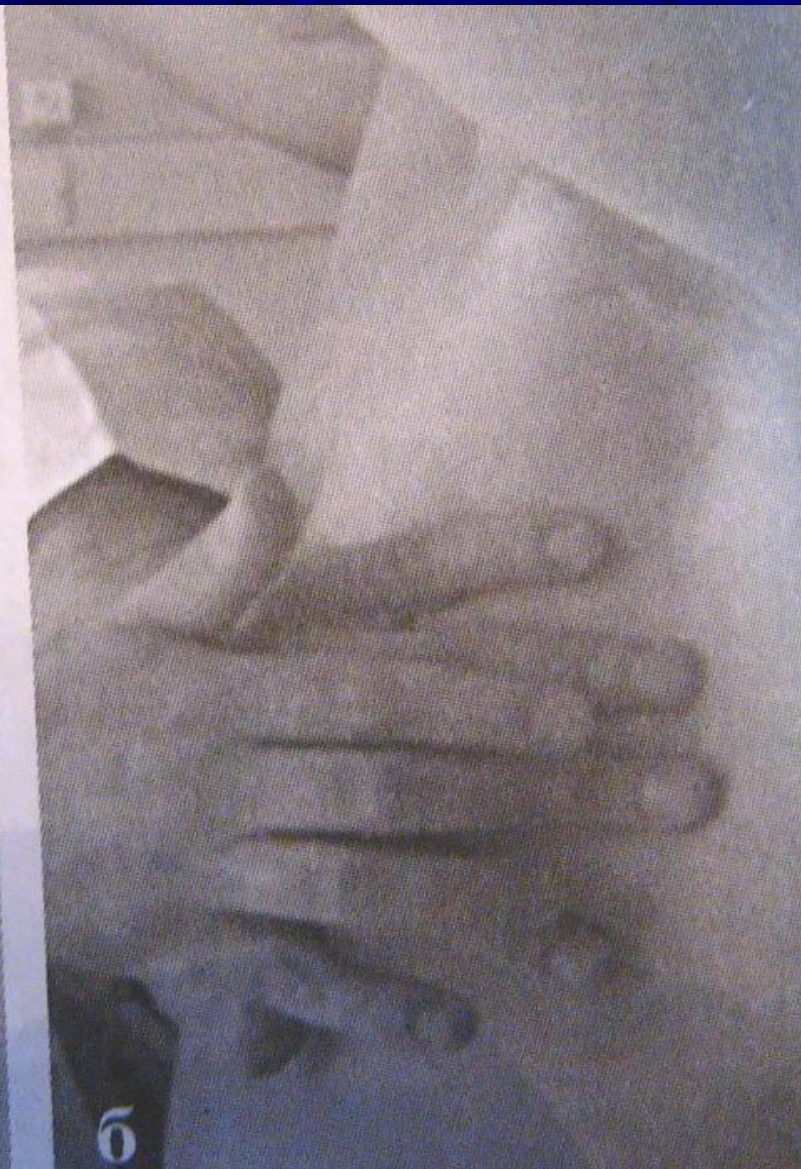
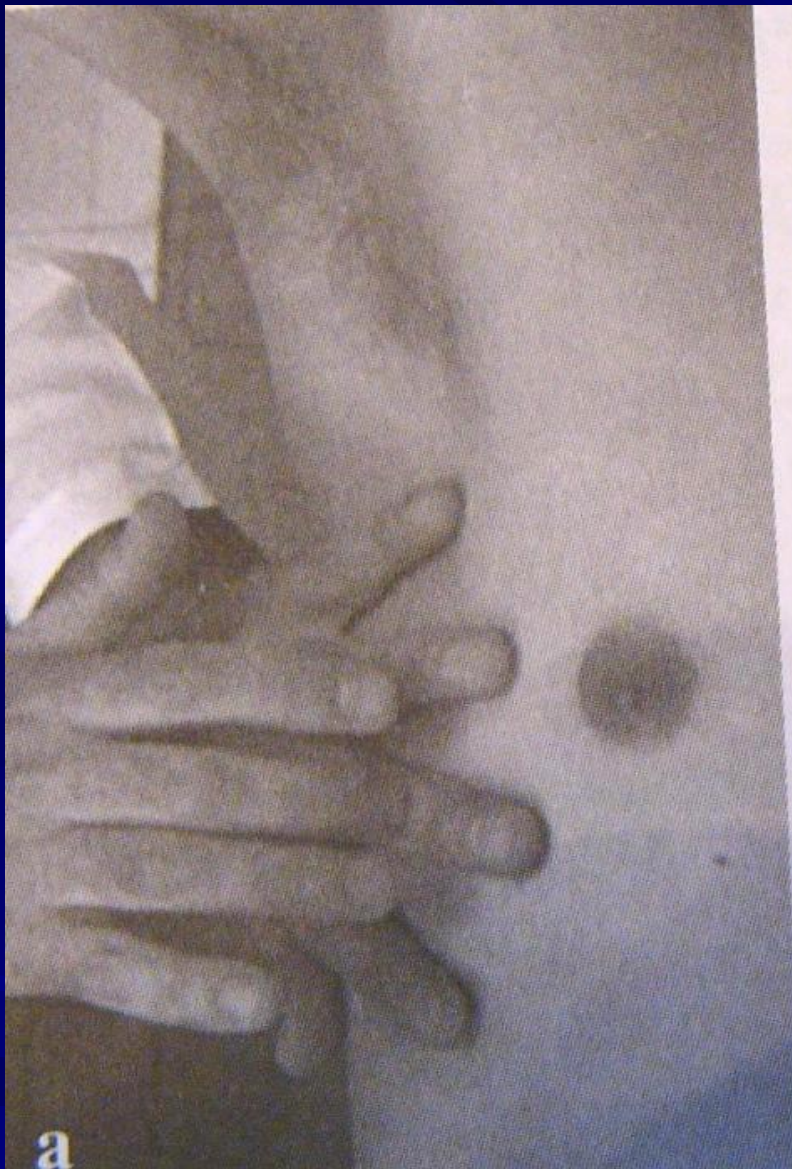
- Anteriorly:
  1. Over the clavicles
  2. The clavicles
  3. 1<sup>st</sup> intercostal space
  4. 2<sup>nd</sup> intercostal space



- Lateral sides

- In the axillary fossa (the plesimeter is placed strictly vertical with distal falanga in the fossa; should strike the distal falanga)
- Lower the previous point with 1 intercostal space
- Lower the previous point with 1 intercostal space more



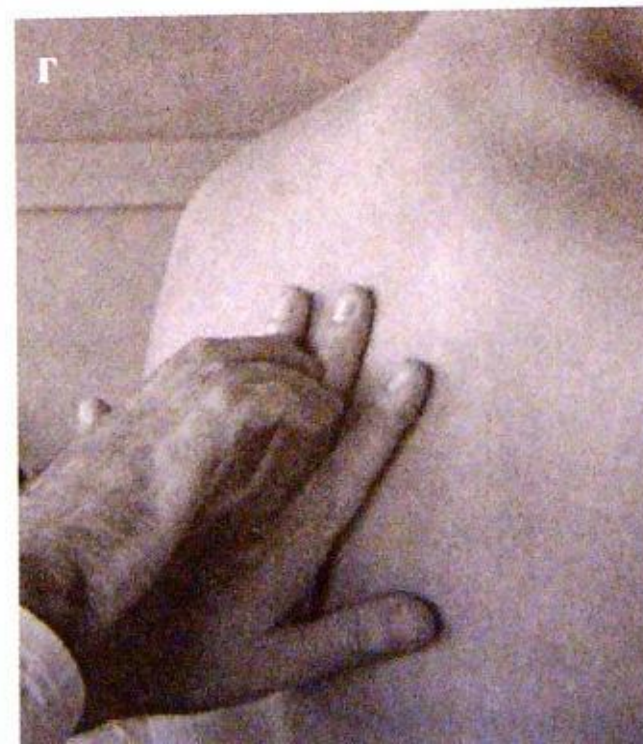
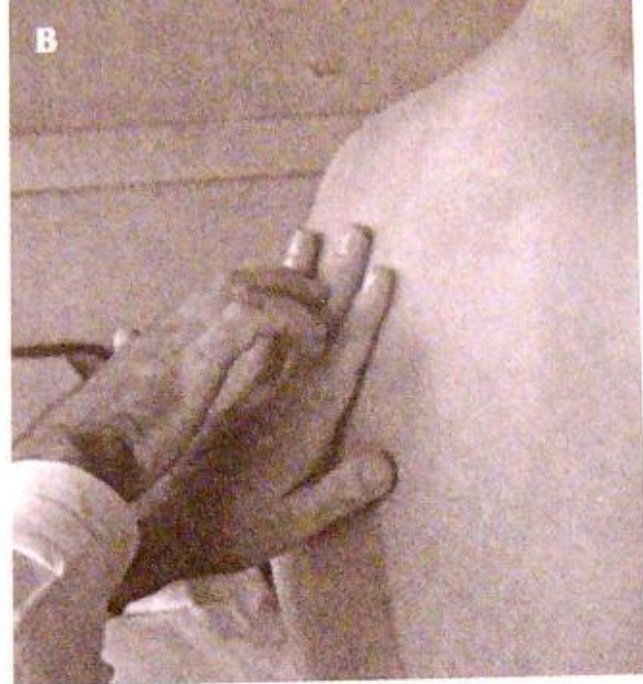
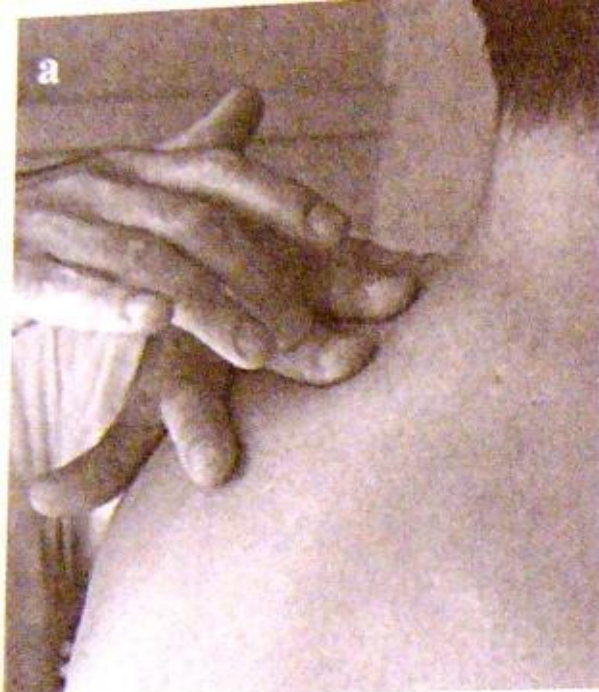


a

b

- Posterior side

- Over the scapulae, plesimeter is placed horizonrally
- Between the scapulae, plesimeter is placed parallel to the spine – 2 points,
- Under the scapulae – plesimeter is placed horizontally



# Percussion notes (sounds)

# Classification

- Resonance
  - Normal
- Hyperresonance
  - Emphysema
- Tympany
  - Cavity , pneumothorax
- Dullness
  - Hydrothorax, atelectasis
- Flatness
  - Massive Hydrothorax, massive atelectasis

# **1. Resonance** (pulmonary sound)

- loud, low pitched;

**Lung's sound in percussion in healthy subjects:**

- **Resonance**
- **Slight dullness in some areas (upper, right, back) due to thickness of muscles and skeletons**

## 2. Slight dullness

It is a sound between resonance and dullness.

Is heard over the heart covered by lungs

**Pathology:** more profound lung consolidations – tbc, cancer, pneumonia, or in the III stage of lobar pneumonia.

# 3. Dullness

- soft, medium short sound; is normally appreciated over the liver.



■ **Dullness** replaces resonance when fluid or solid tissue replaces air-containing lung or occupies the pleural space beneath your percussion fingers:

- Lobar pneumonia
- Big tumor
- Fibrous tissue
- Large pleural effusion (including empyema)
- Hemothorax

# 4. Hyperresonance

– very loud, low pitched, long sound; as if striking a box.

■ In emphysema (because of increased amount of air in lung),

■ Traube's space

*General Hyperresonance* may be heard over the hyperinflated lungs asthma fit.

Unilateral *Hyperresonance* suggests a **small pneumothorax**.

## 4. Tympany

loud, high pitched, long sound; is normally appreciated over gastric air or intestine (a cavity with air).

- Is identified over large pneumothorax.

## 5. Flat sound-

- soft, high short; is normally appreciated over thigh.
- The sound is flat or dull in pleural effusion

## 6. Tympany with metallic sound

-- is appreciated over a superficial big cavity, more than 8 cm in diameter, with thick walls.

## 7. Dullness with tympanic sound

- is appreciated in lobar pneumonia, I and III stage.

# Topographic lung percussion

- Is used rarely,
- Its aim is to establish the lung borders:

1.) Upper borders of the lungs

2.) Lower borders of the lungs

*and*

3.) Shifting range of bottom of lung (3-10 cm)

4.) Krönig fields

# Topographic percussion -normal data

## 1.) Upper borders of the lungs:

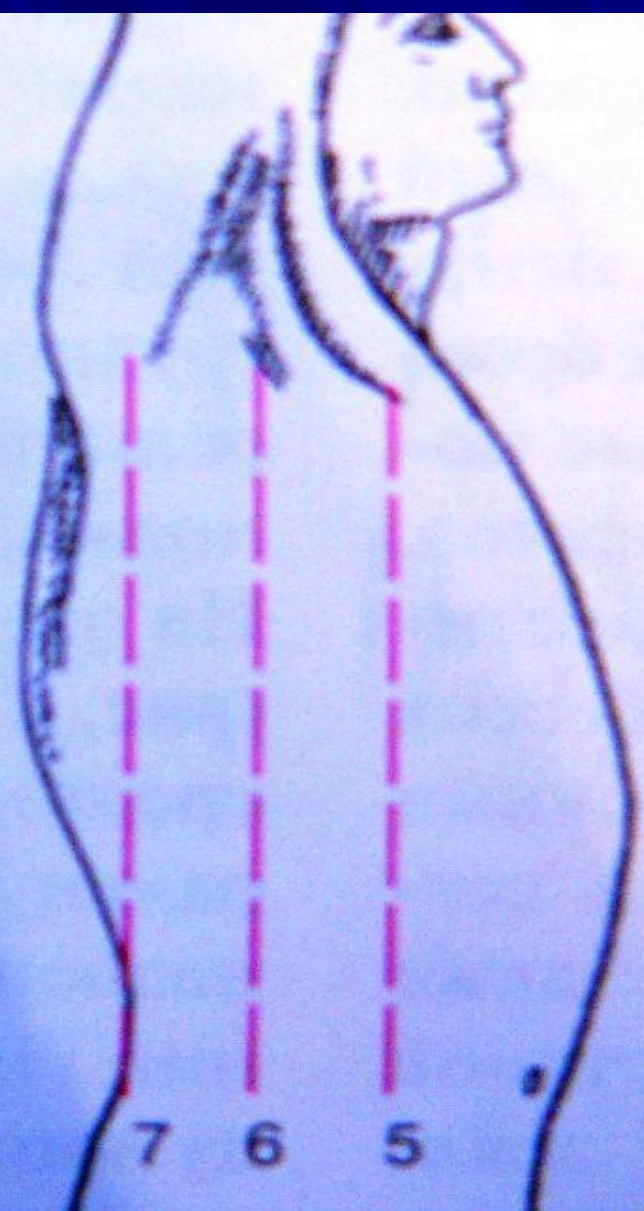
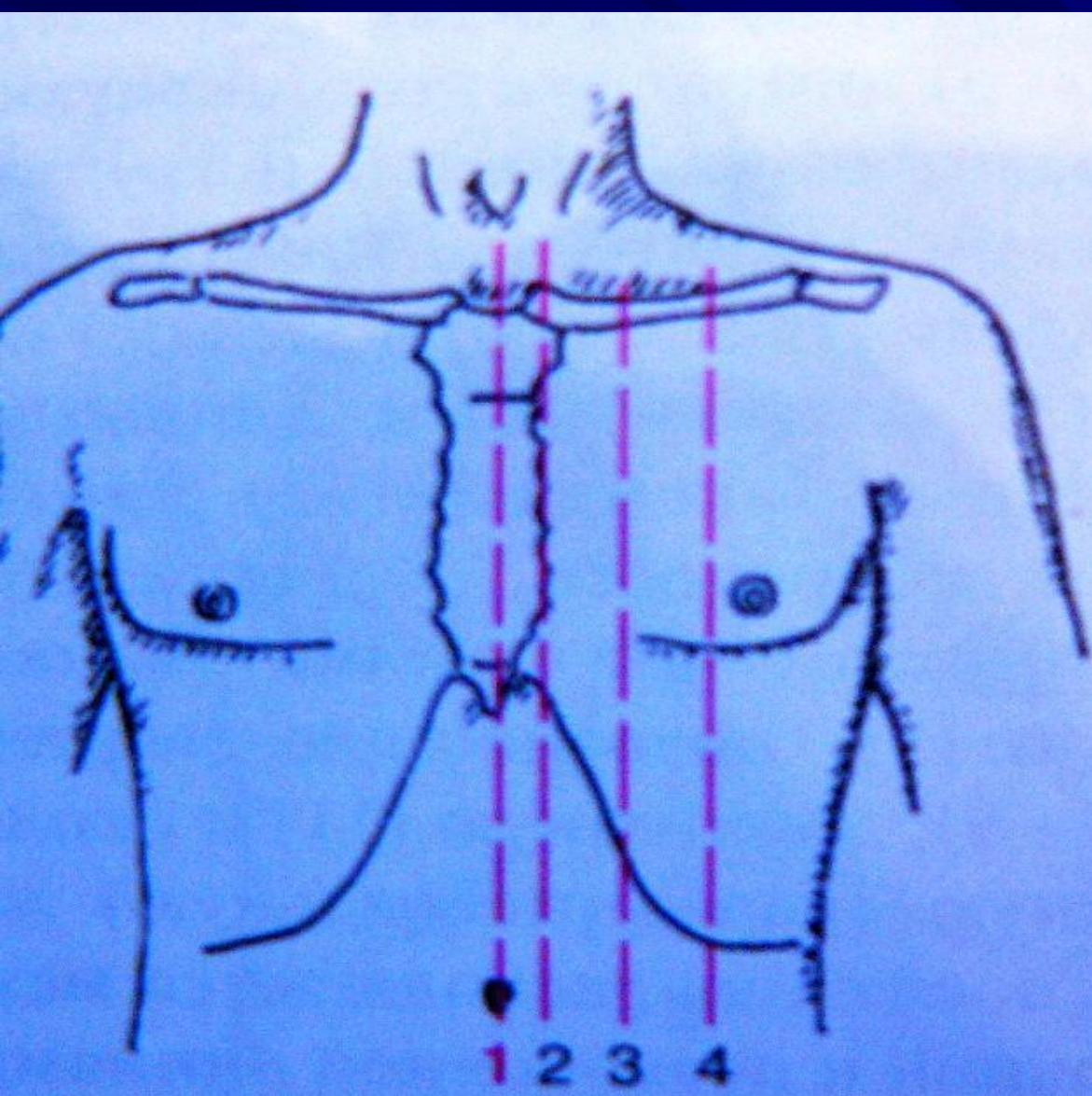
- superior anterior apices borders ( normal level - over the clavicles 3-4 cm )
- superior posterior apices bord. (normal level - at the level of the VII th cervical vertebra)
- Kroenig's area (perpendicular to m.trapezius: normal dimension – 6-8 cm)

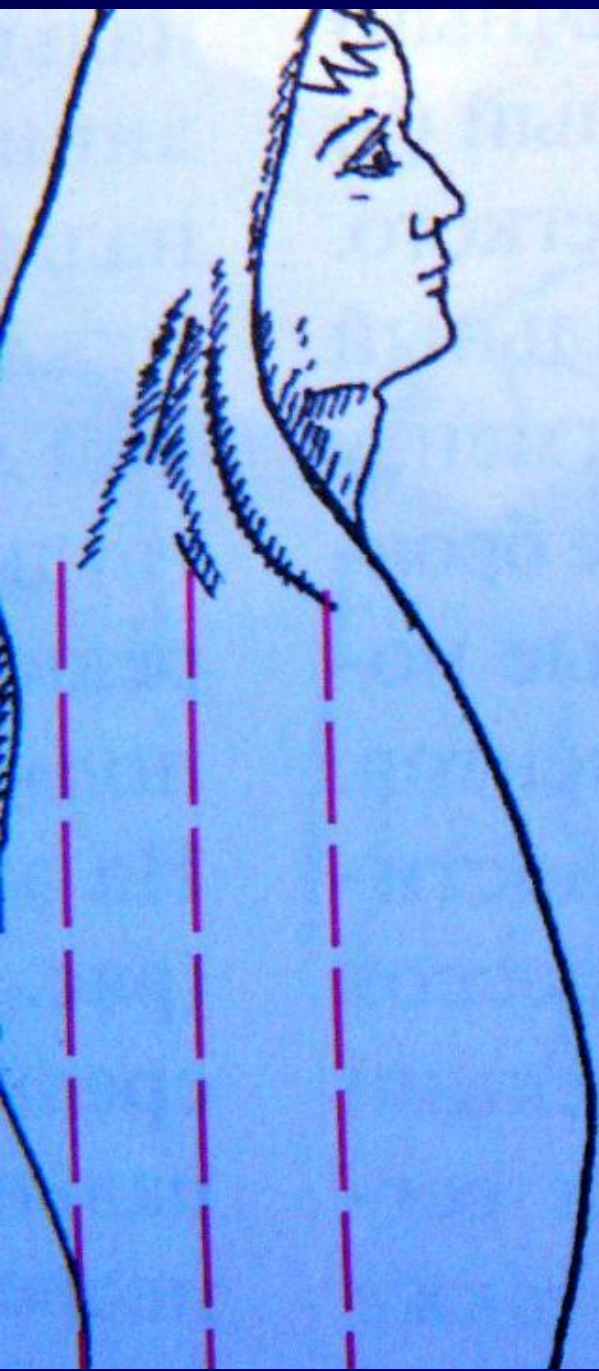


## 2.) Lower borders of the lungs:

### Topographical lines for lungs percussion

- Parasternal
- Midclavicular
- Anterior axillary line
- Midaxillary line
- Posterior axillary line
- Scapular line
- Paravertebral line





Hand-drawn anatomical diagram of the larynx and trachea, showing the cartilages and the vocal folds.

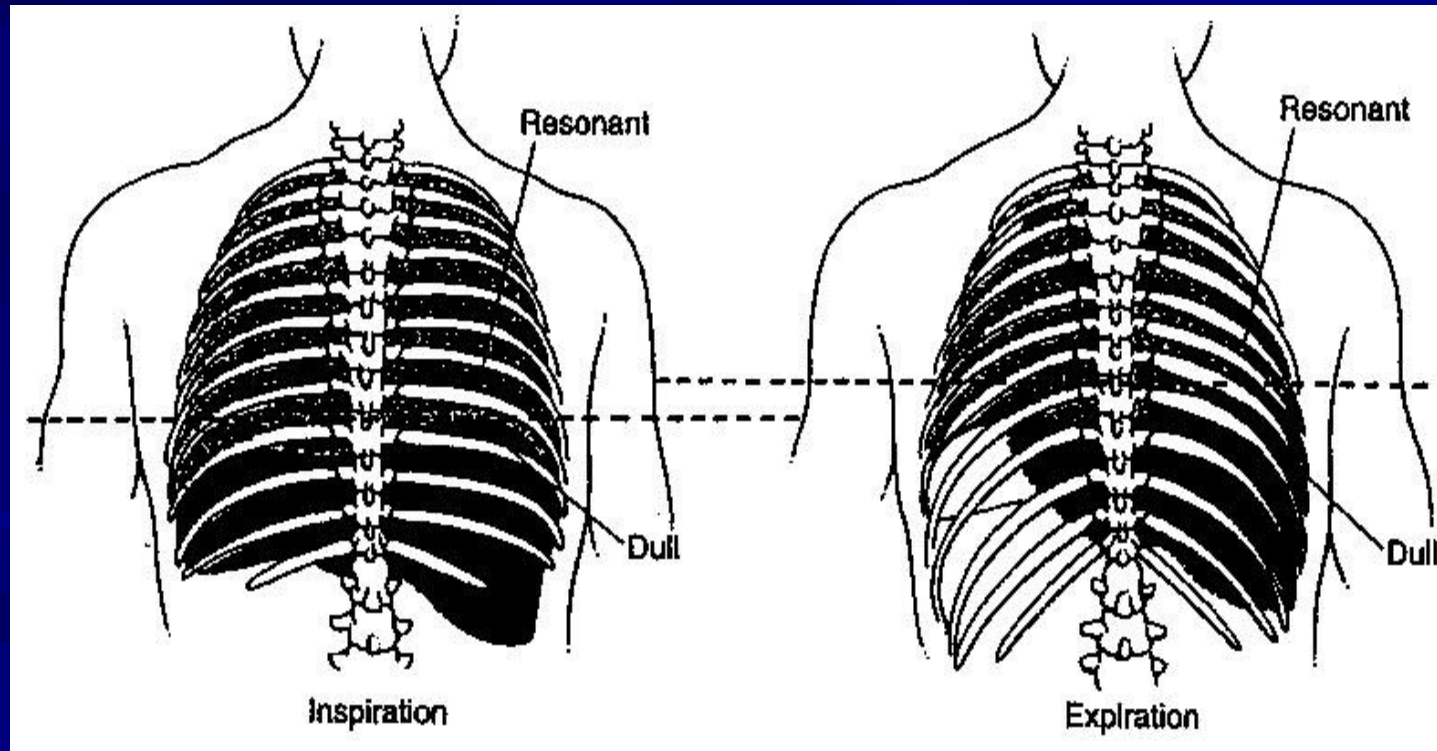


# Normal position of the lower borders of the lungs :

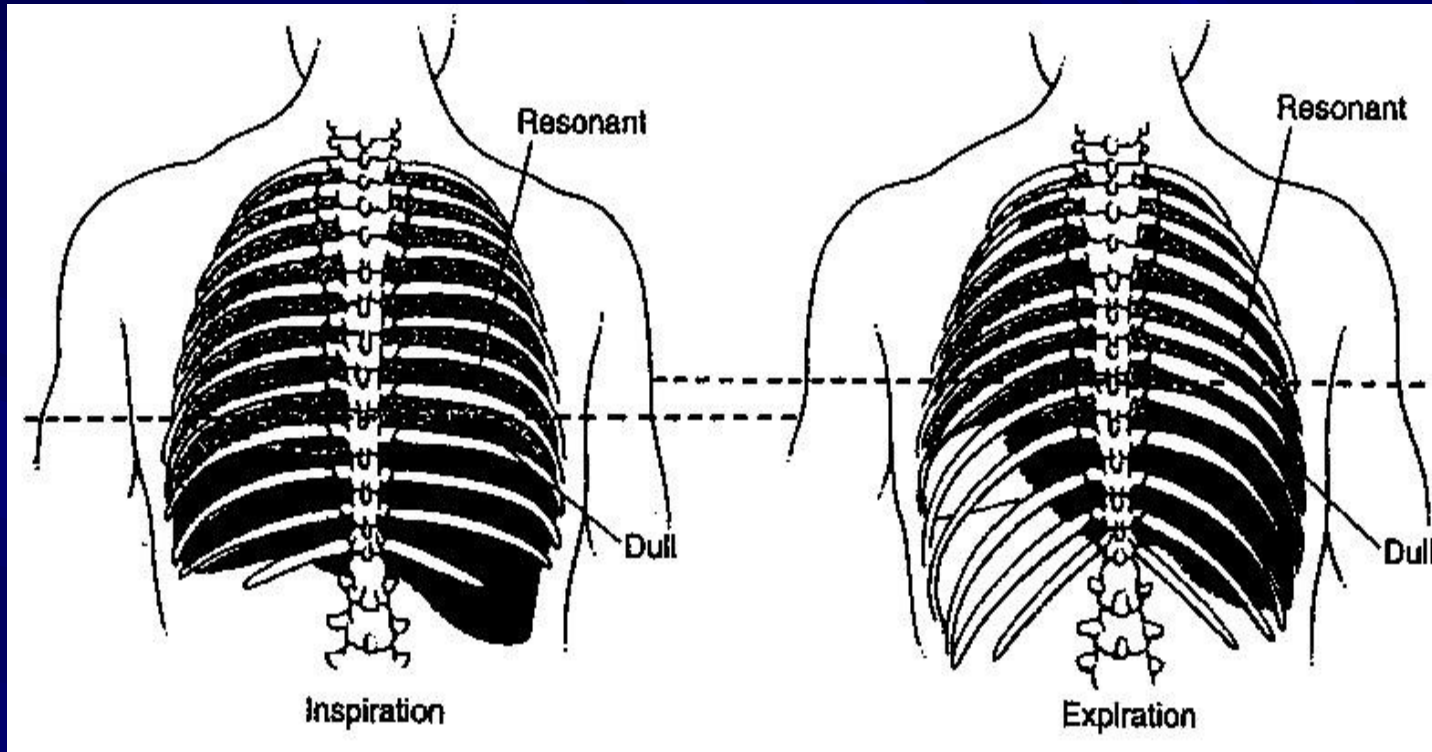
	<u>Right</u>	<u>Left</u>
■ Parasternal line	5 <sup>th</sup> i/c sp	-
■ Midclavicular line	6 <sup>th</sup> i/c sp	-
■ Anterior axillary line	7 <sup>th</sup> i/c sp	7 <sup>th</sup> i/c sp
■ Midaxillary line	8 <sup>th</sup> i/c sp	8 <sup>th</sup> i/c sp
■ Posterior axillary line	9 <sup>th</sup> i/c sp	9 <sup>th</sup> i/c sp
■ Scapular line	10 <sup>th</sup> i/c sp	10 <sup>th</sup> i/c sp
■ Paravertebral line	11 <sup>th</sup> th.vert.	11 <sup>th</sup> th.vert

### 3.) Shifting range of bottom of lung (DIAPHRAGMATIC EXCURSION)

Normal excursion – 3 till 10 cm (on midaxillary line)



# DIAPHRAGMATIC EXCURSION



Transition point between dullness and resonance at full inspiration and expiration

Diaphragmatic excursion (Shifting range of bottom of lung) is the distance between these two points; **NORMAL 3 – 6 - 10 CM** (depends on the line where it is appreciated)

# Shifting range of bottom of lung

## Method

Along the scapular line

To percuss bottom of lung, marking

To ask the pat. to inspire deeply and hold

To percuss bottom of lung, marking

To ask the pat. to expire deeply and hold

To percuss bottom of lung, marking

To measure the dist. between upper and lower lines



- **Decreased:** emphysema, atelectasis, fibrosis, pulmo. edema, pneumonia

**Detected impossibly:** pleura adhesion, massive hydro- and pneumothorax, diaphragmatic paralysis

Pathological Changes of the  
upper borders of the lungs:



# Elevation of the apices and widening of the Kroenig's area

- in emphysema,

# Lowering of the apices and decreasing of the Kroenig's area < 6 cm

- Presence of an airless area in the upper border of the lung (tbc, pneumonia, connective tissue)
- Pulmonectomy
- Lung atelectasis caused by airways obstruction

# Pathological Changes of the lower lungs borders:

1. Bilateral Lowering - emphysema, bronchial asthma, splachnoptosis;
2. Unilateral Lowering - compensatory (vicarious) emphysema;

# 3. Elevation:

Unilateral elevation: -

- shriveling of the lung (pneumosclerosis)
- collapse of the lung (atelectasis)
- accumulation of the fluid or air in the pleural cavity which displace the lung upwards
- enlargement of the liver or of the spleen

Bilateral elevation: in accumulation of the fluid in the abdomen