



# RESPIRATORY SYSTEM ASSESSMENT

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# INTRODUCTION

▶ THE **RESPIRATORY SYSTEM** COMPRISES OF

1. UPPER RESPIRATORY TRACT
2. LOWER RESPIRATORY TRACT

**Nose**  
Passageway for air

**Mouth**  
Passageway for food and air

**Epiglottis**  
Covers larynx during swallowing

**Nasal cavity**  
Filters, warms, and moistens air

**Pharynx (Throat)**  
Common passageway for air, food, and liquid

**Larynx (Voice box)**  
Production of sound

**Pleural membranes**  
Cover the lungs and line the chest cavity

**Lung**  
Organ of gas exchange

**Intercostal muscle**  
Moves ribs during respiration

**Rib**

**Diaphragm**  
Skeletal muscle of respiration

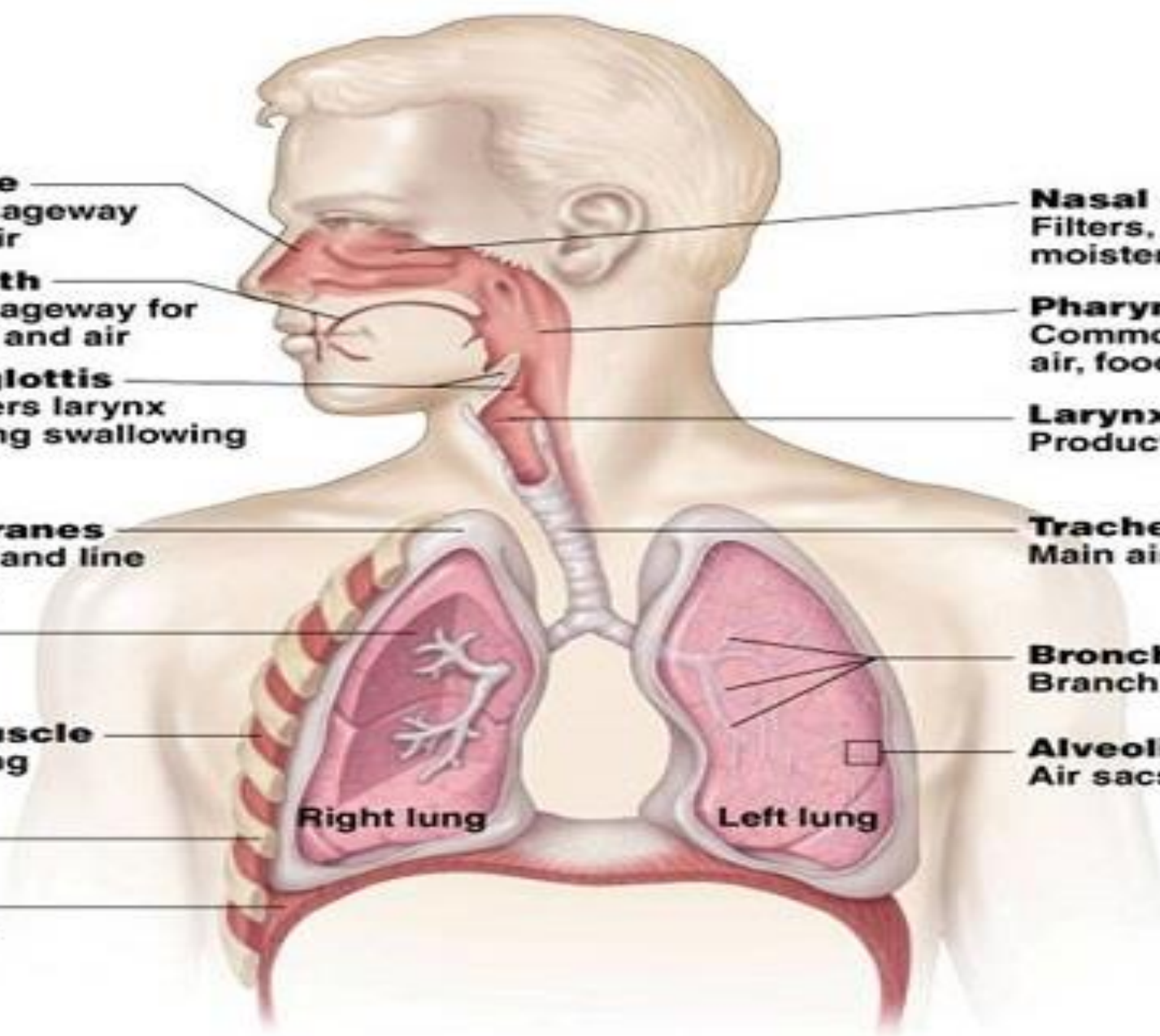
**Trachea (Windpipe)**  
Main airway

**Bronchi**  
Branching airways

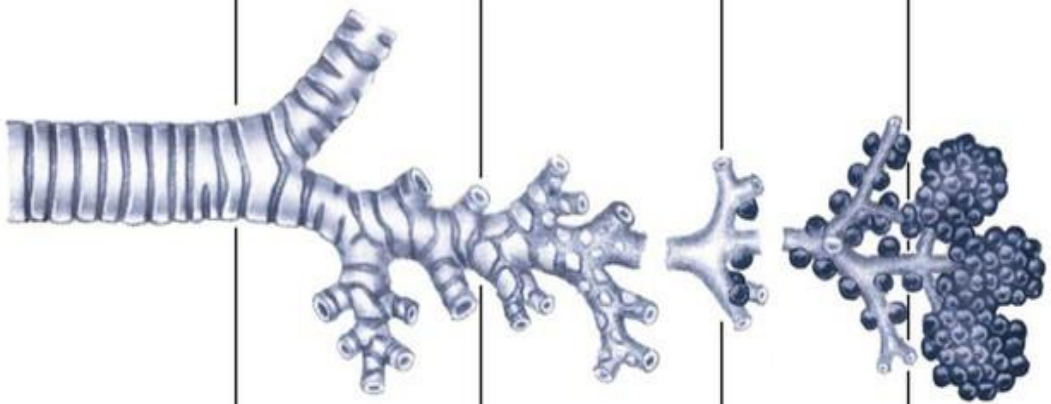
**Alveoli**  
Air sacs for gas exchange

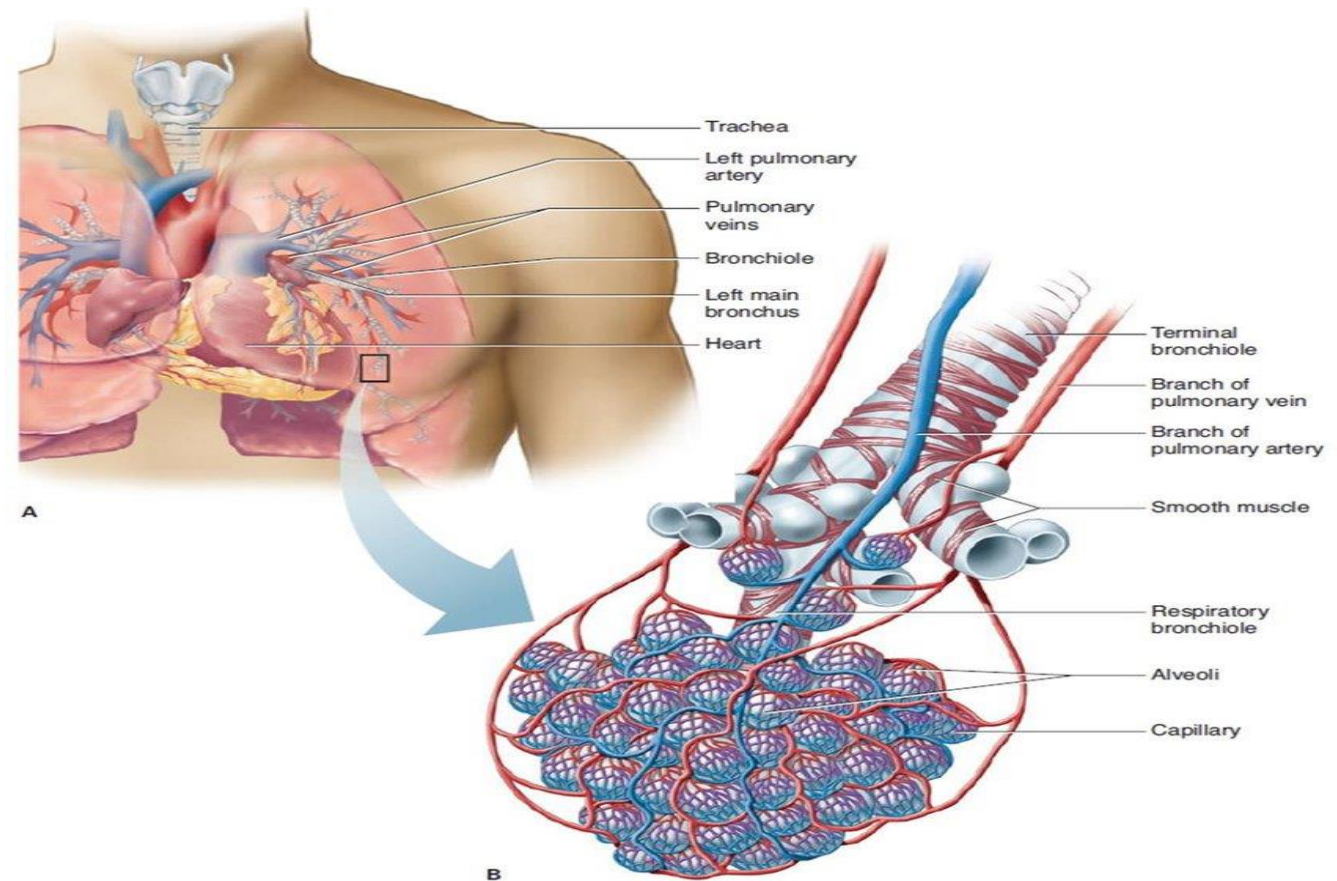
Right lung

Left lung



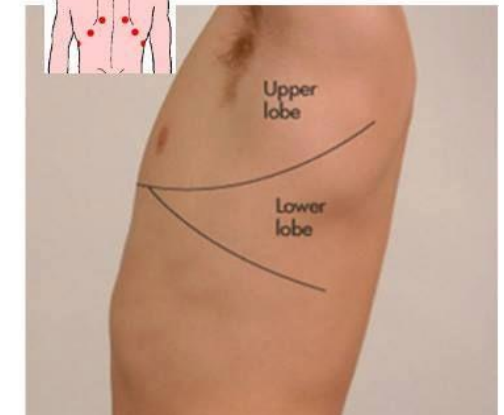
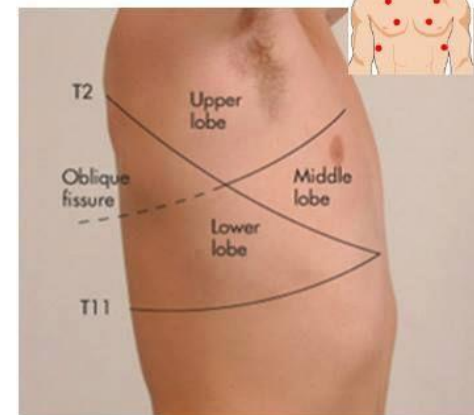
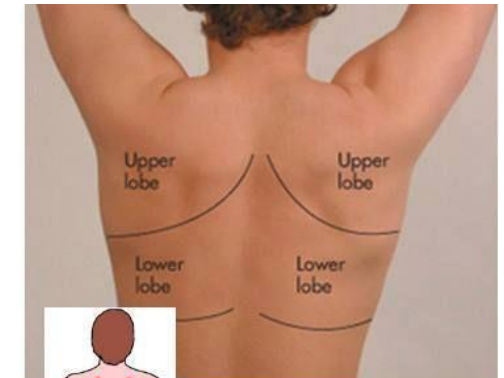
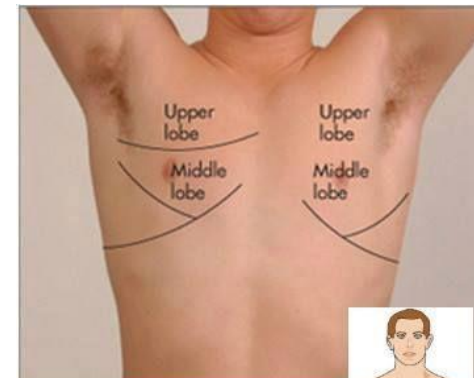
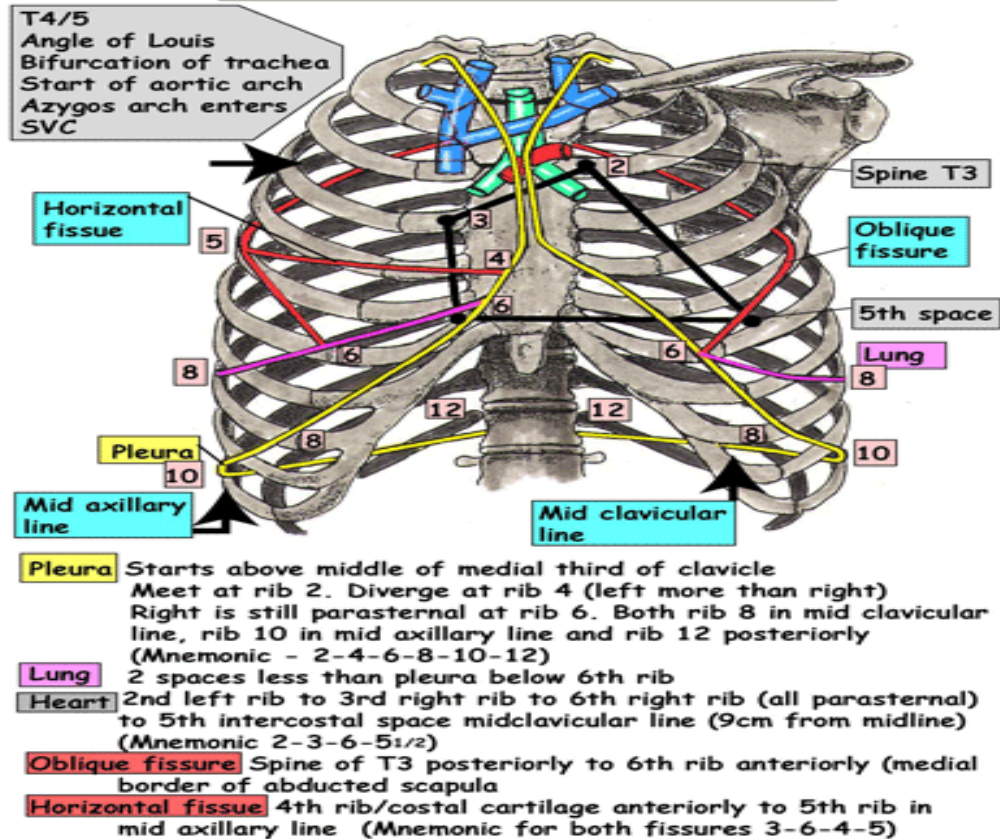
# THE AIRWAYS AND THE LUNGS

| Conducting Airways                                                                 |                   |                                    | Respiratory Unit |                |
|------------------------------------------------------------------------------------|-------------------|------------------------------------|------------------|----------------|
| Trachea                                                                            | Segmental bronchi | Subsegmental bronchi (bronchioles) |                  | Alveolar ducts |
|                                                                                    |                   | Nonrespiratory                     | Respiratory      |                |
|  |                   |                                    |                  |                |
| Generations                                                                        | 8                 | 16                                 | 24               | 26             |



# SURFACE MARKING OF LUNGS

## THORAX - SURFACE MARKINGS



# MUSCLES OF RESPIRATION

## Muscles of inspiration

### Accessory

Sternocleidomastoid  
(elevates sternum)

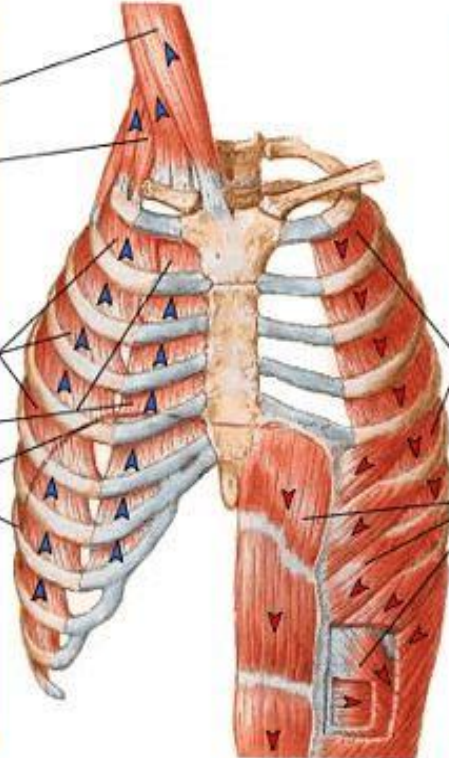
Scalenes Group  
(elevate upper ribs)

Not shown:  
Pectoralis minor

### Principal

External intercostals  
Interchondral part of  
internal intercostals  
(also elevates ribs)

Diaphragm  
(dome descends, thus  
increasing vertical  
dimension of thoracic  
cavity; also elevates  
lower ribs)



## Muscles of expiration

### Quiet breathing

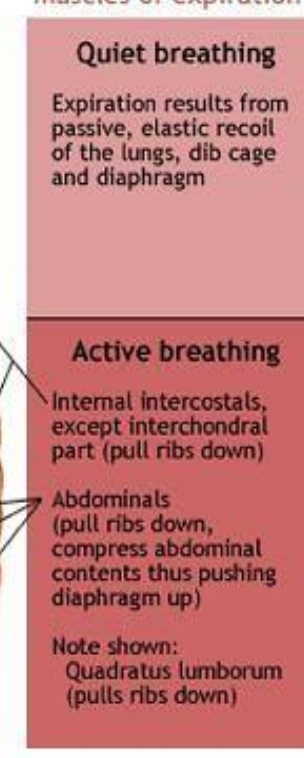
Expiration results from  
passive, elastic recoil  
of the lungs, rib cage  
and diaphragm

### Active breathing

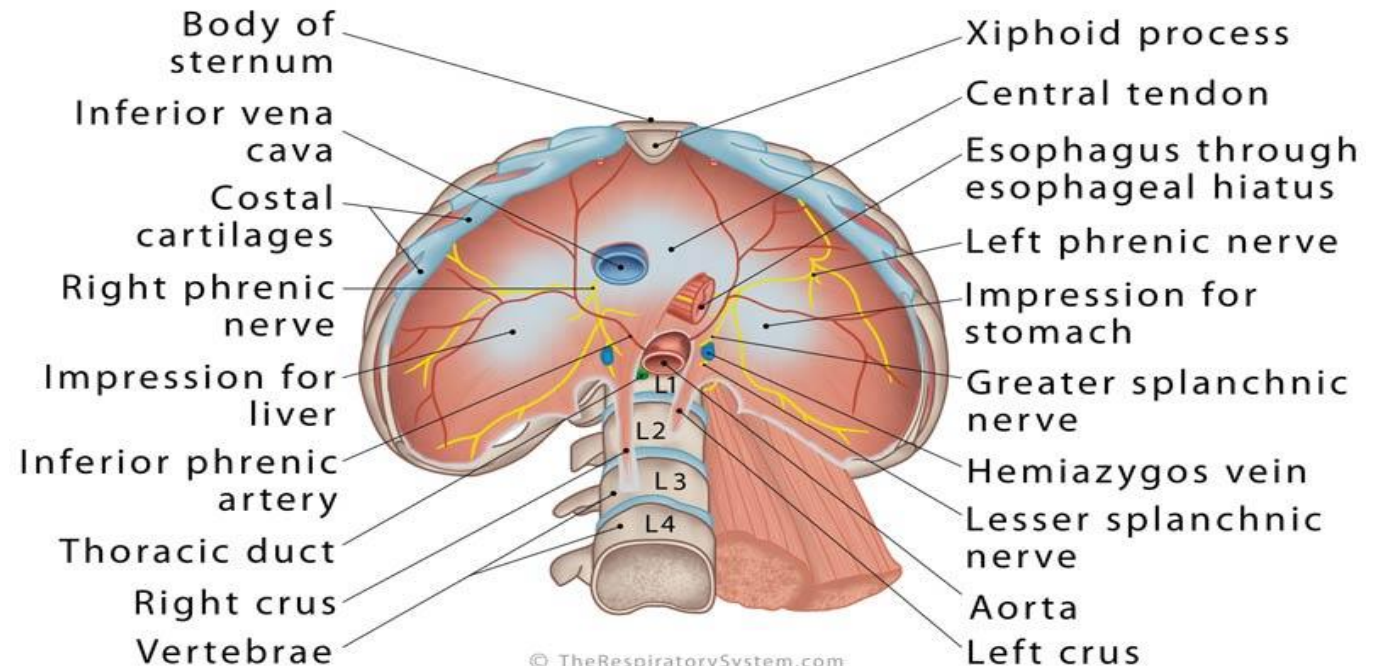
Internal intercostals,  
except interchondral  
part (pull ribs down)

Abdominals  
(pull ribs down,  
compress abdominal  
contents thus pushing  
diaphragm up)

Note shown:  
Quadratus lumborum  
(pulls ribs down)



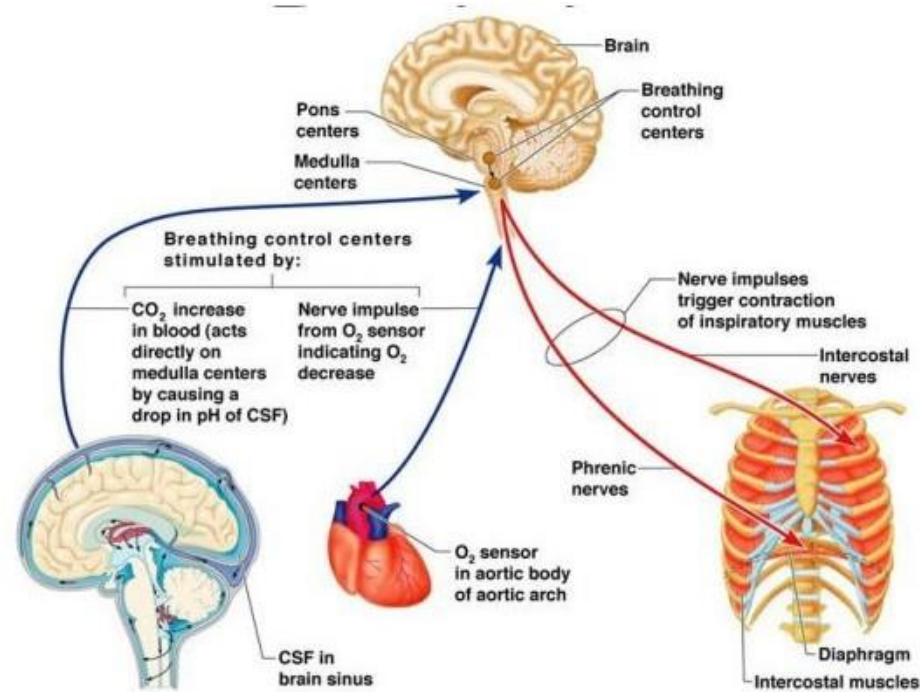
## Diaphragm



# FUNCTIONS OF THE RESPIRATORY SYSTEM

- ▶ GAS EXCHANGE
- ▶ REGULATION OF BLOOD pH
- ▶ SOUND PRODUCTION
- ▶ OLFACTION
- ▶ THERMOREGULATION
- ▶ PROTECTION FROM MICROORGANISMS
- ▶ METABOLIC FUNCTIONS
  1. Surfactant production
  2. Conversion of angiotension I to II
  3. Formation of bradykinin, histamine, serotonin, heparin and prostaglandins

# NEURAL CONTROL OF RESPIRATION



# COMMON RESPIRATORY CONDITIONS IN CRITICAL CARE

## ► OBSTRUCTIVE DISEASES

1. *COPD*
2. *ASTHMA*
3. BRONCHIECTASIS

## ► RESTRICTIVE DISEASES

1. *INTERSTITIAL LUNG DISEASES*
2. *ARDS*
3. KYPHOSCOLIOSIS

## ► INFECTIONS

1. *PNEUMONIAS*
2. LUNG ABSCESS
3. EMPYEMA

## OTHER ACUTE CONDITIONS

*MASSIVE PLEURAL EFFUSION*

*HEMOTHORAX*

*PNEUMOTHORAX*

*LUNG MASS COMPROSING AIRWAYS*

*VOCAL CORD EDEMA / STRIDOR*

# ASSESSMENT

# TOOLS TO HELP IN ASSESSMENT

- ▶ PULSE OXIMETER
- ▶ MEASURING TAPE
- ▶ TONGUE DEPRESSOR AND TORCH
- ▶ RULERS
- ▶ STETHOSCOPE

# GENERAL ASSESSMENT

- ▶ HOW IS THE PATIENT'S GENERAL BEING?
- ▶ IS HE HYPERVENTILATING?
- ▶ IS HE CYANOSED?
- ▶ IS HE USING ACCESSORY MUSCLES OF RESPIRATION
- ▶ IS HE ABLE TO RESPOND TO SIMPLE QUESTIONS AND TALK BACK IN FULL SENTENCES?

# VITALS

- ▶ **PULSE RATE-** RATE, RHYTHM, REGULARITY, SYNCHRONICITY, VESSEL WALL, PERIPHERAL PULSES
- ▶ **BLOOD PRESSURE-**TAKEN IN RIGHT OR LEFT ARM IN SITTING OR LYING DOWN POSITION
- ▶ **RESPIRATORY RATE-** NUMBER, ABDOMINO THORACIC OR THORACIC
- ▶ **TEMPERATURE-** IN CELSIUS OR FAHRENHEIT TAKEN IN ORAL/AXILLA
- ▶ **SPO2**

# SATURATION OF PARTIAL PRESSURE OF O<sub>2</sub>

- ▶ LESS THAN 95% ON PULSE OXIMETER DENOTES HYPOXEMIA
- ▶ CONFIRMATION OF HYPOXEMIA IS DONE BY ARTERIAL BLOOD GAS ANALYSIS IN WHICH P<sub>o2</sub> IS SEEN



# GENERAL PHYSICAL EXAMINATION

- ▶ PALLOR
- ▶ ICTERUS
- ▶ LYMPHADENOPATHY
- ▶ JVP
- ▶ CLUBBING
- ▶ CYANOSIS
- ▶ PEDAL/SACRAL EDEMA

# PALLOR & ICTERUS



# CYANOSIS



# LYMPHADENOPATHY

**Preauricular nodes:**  
Drain scalp, skin

**Differential DX:**  
Scalp infections,  
mycobacterial infections

**Malignancies:**  
Skin neoplasm, lymphomas,  
head and neck squamous  
cell carcinomas

**Posterior cervical nodes:**  
Drain scalp, neck,  
upper thoracic skin

**Differential DX:**  
Same as preauricular nodes

**Supraclavicular nodes:**  
Drain gastrointestinal tract,  
genitourinary tract, pulmonary

**Differential diagnosis:**  
Abdominal/thoracic neoplasms,  
thyroid/laryngeal disease,  
mycobacterial/fungal infections

**Submandibular nodes:**  
Drain oral cavity

**Differential diagnosis:**  
Mononucleosis, upper  
respiratory viral/bacterial infection,  
mycobacterial infection,  
toxoplasma, cytomegalovirus,  
dental disease, rubella

**Malignancies:**  
Squamous cell carcinoma of the  
head and neck, lymphomas,  
leukemias

**Anterior cervical nodes:**  
Drain larynx, tongue,  
oropharynx, anterior neck

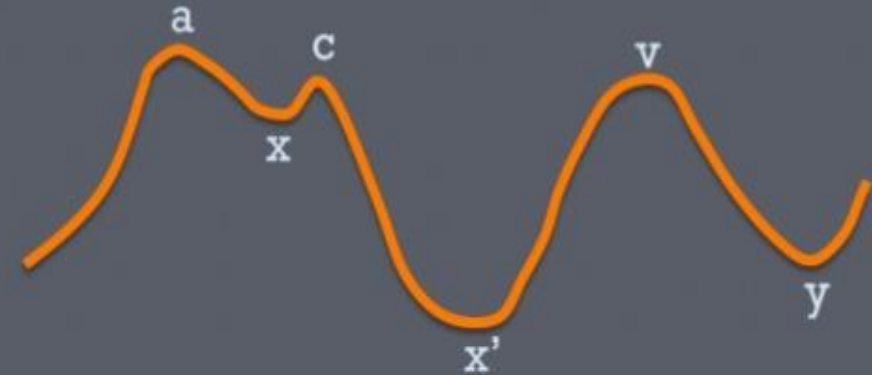
**Differential diagnosis:**  
same as submandibular nodes

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**JVP**

The Normal Waveform



a – atrial contraction

x – atrial relaxation

c – bulging of tricuspid valve with ventricular contraction

x' – downward movement of tricuspid valve with ventricular contraction

v – passive atrial filling

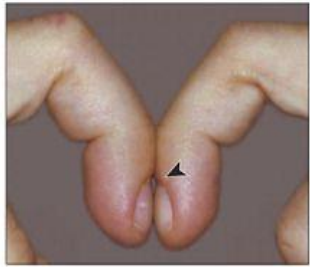
y - atrial emptying with opening of the tricuspid valve

a-c-v waves  
x-y descents

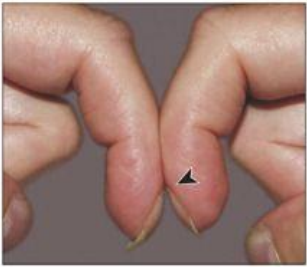
# CLUBBING

A Schamroth sign

Normal

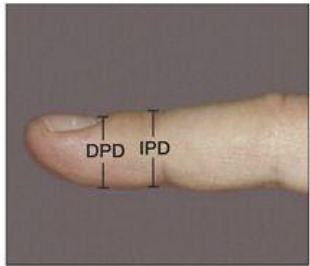


Clubbed

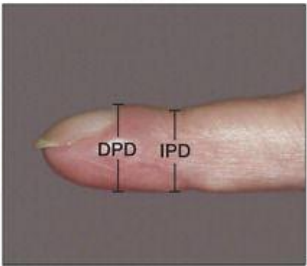


B Phalangeal depth ratio

Normal



Clubbed



# IMPORTANCE OF THE GPE

- ▶ ANAEMIA IS ASSOCIATED WITH COMMON CHRONIC RESPIRATORY CONDITIONS LIKE TB, BRONCHIECTASIS ETC.
- ▶ ANAEMIA ALSO MAY LEAD TO PULMONARY EDEMA
- ▶ ICTERUS MAY BE SEEN IN ATT INDUCED HEPATITIS, HEPATO-PULMONARY SYNDROME
- ▶ CLUBBING IS SEEN IN VARIOUS CHRONIC PULMONARY DISEASES LIKE CA, IPF, EMPYEMA
- ▶ CENTRAL CYANOSIS IS SUGGESTIVE OF HYPOXEMIA
- ▶ LYMPHADENOPATHY CAN DENOTE TB, SARCOIDOSIS OR LYMPHOMA
- ▶ RAISED JVP MAY BE SEEN IN COR PULMONALE
- ▶ PERIPHERAL EDEMA MAY BEEN SEEN IN ADVANCED COPD OR COR PULMONALE

# EXAMINATION OF UPPER RESPIRATORY TRACT

- ▶ ANY EXTERNAL DEFORMITY- DNS, FLARING OF ALAE NASAE( SIGNIFIES ACCESSORY MUSCLE OF RESPIRATION INVOLVEMENT)
- ▶ ANY POLYPS, CRUSTATIONS, DISCHARGE IN THE NASAL ORIFICE
- ▶ PALPATE AREAS FOR SINUS TENDERNESS
- ▶ INSPECT ORAL CAVITY, LOOK FOR MISSING TEETH, DENTAL ABSCESS, TONGUE, TONSILS , POSTERIOR PHARYNGEAL WALL AND CROWDING OF THE AIRWAYS

# EXAMINATION OF LOWER RESPIRATORY TRACT

- ▶ INSPECTION
- ▶ PALPATION
- ▶ PERCUSSION
- ▶ AUSCULTATION

# INSPECTION

- ▶ **SUPERFICIAL EXAMINATION**- SKIN OVERLYING THE CHEST, AXILLA AND THE BACK- ANY LOCAL SWELLINGS OR PULSATIONS NOTED
- ▶ **CHEST SYMMETRY (FORM OF CHEST)** - SIZE, SHAPE AND TYPE OF CHEST, ANY BULGING, RETRACTION, INTERCOSTAL RECESSIONS, POSTERIORLY PROMINENCE OF MEDIAL BORDER, SPINE OF SCAPULA, SPINO SCAPULAR DISTANCE
- ▶ **POSITION OF THE MEDIASTINUM**- TRAIL'S SIGN, APICAL IMPULSE AND POSTERIORLY THE SPINE-CONCAVITY OR CONVEXITY FROM MIDLINE
- ▶ **MOVEMENTS**- ANY ABNORMALITIES ON EITHER SIDE, ANY ABNORMALITIES IN THE TYPE OF BREATHING

# TRAIL'S SIGN



PROMINENCE OF THE CLAVICULAR HEAD OF THE STERNOCLEIDOMASTOID TENDON DUE TO RELAXATION OF THE PRETRACHEAL FASCIA ON THE SIDE OF PULL OF THE TRACHEA

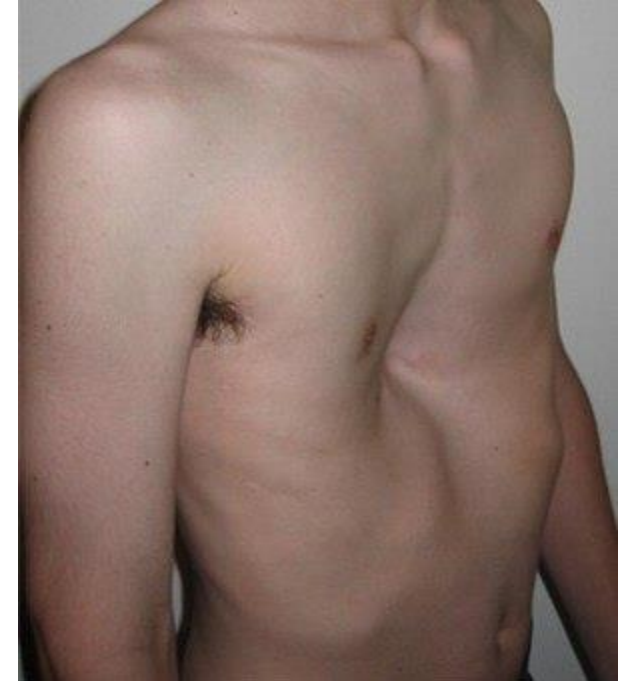
# COPD- BARREL SHAPED CHEST

- ▶ INCREASE IN THE AP DIAMETER AND AT/TRANSVERSE RATIO  $>0.7$  DUE TO HYPERINFLATION AND INCREASED RESIDUAL VOLUME IN THE LUNGS



# PECTUS EXCAVATUM

- ▶ CAVING IN OF THE STERNUM IN THE LOWER PORTION
- ▶ SEEN IN CHILDHOOD RICKETS AND CONGENITAL MALFORMATIONS
- ▶ MAY BE SEEN IN MARFAN'S SYNDROME
- ▶ CLINICALLY NOT SIGNIFICANT UNLESS SEVERE ENOUGH TO DISPLACE THE HEART



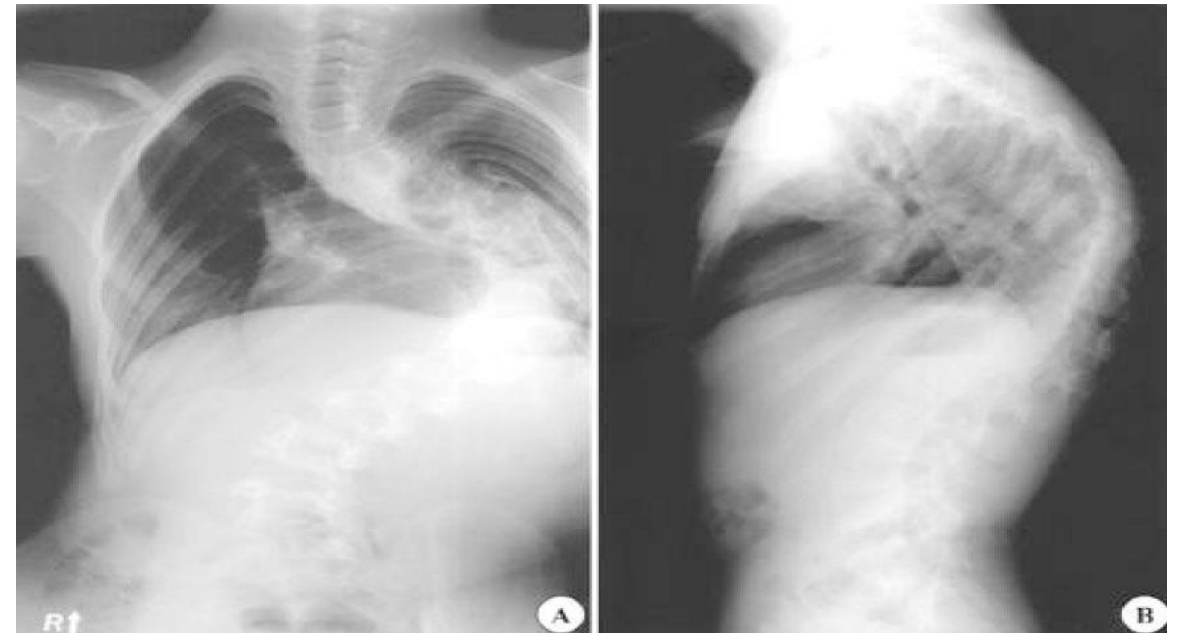
# PECTUS CARINATUM

- ▶ “PIGEON CHEST”- MARKED PROTUSION OF THE STERNUM AND THE ADJACENT COSTAL CARTILAGES
- ▶ SECONDARY TO RICKETS IN CHILDHOOD OR CHRONIC RESPIRATORY CONDITIONS



# KYPHOSCOLIOSIS

- ▶ LEADS TO ASYMMETRY OF THE THORAX AND CAN LEAD TO RESTRICTIVE LUNG DISEASE AND COR PULMONALE IN THE LONG RUN



# PALPATION

## CONFIRM FINDINGS OF INSPECTION

- ▶ **POSITION OF THE MEDIASTINUM-** TRACHEA AND APEX BEAT
- ▶ FEEL ANY **SWELLING, PULSATIONS, SUPERFICIAL CREPITUS**, SUPERFICIAL TENDERNESS OVER ANY PART OF THE CHEST OR BACK
- ▶ **MOVEMENTS** AND ANY INTERCOSTAL RETRACTIONS PALPATED- MOVEMENTS TO BE CHECKED OVER APEX, ANTERIORLY, POSTERIORLY AND THEN INSINUATE YOUR FINGERS INTO RIB SPACES TO LOOK FOR RIB CROWDING OR WIDENED RIB SPACES IN AREAS OF REDUCED MOVEMENT
- ▶ **TACTILE VOCAL FREMITUS-** TO BE COMPARED BILATERALLY
- ▶ **MEASUREMENTS**  
AP, TRANSVERSE, CHEST CIRCUMFERENCE, SPINO SCAPULAR DISTANCE

# PALPATION TECHNIQUES



# PERCUSSION



# PERCUSSION

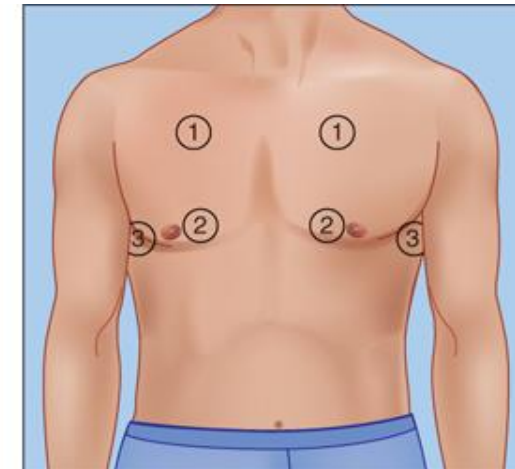
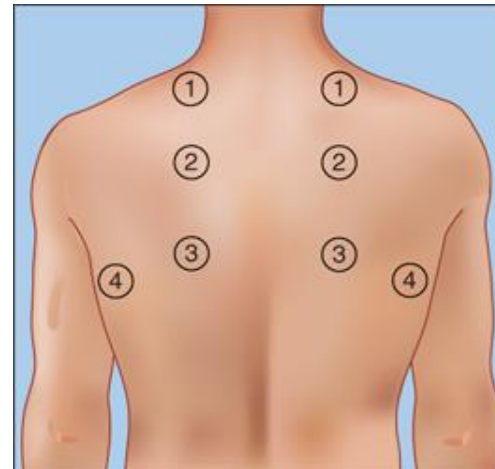
- ▶ KRONIG'S ISTHMUS, CLAVICULAR PERCUSSION AND STERNAL PERCUSSION
- ▶ **PERCUSSION OF LUNG –INTERCOSTAL SPACES- COMPARING TWO SIDES**
- ▶ PERCUSSION OF **LOWER BORDER OF LUNG RESONANCE** AND UPPER BORDER OF LIVER DULLNESS AND MARKING IT IN THREE LINES- THE MIDCLAVICULAR, MID AXILLARY AND THE POSTERIOR SCAPULAR LINE
- ▶ PERCUSSION OF THE **CARDIAC BORDERS**- RIGHT AND LEFT USING THE APEX BEAT AS THE OUTERMOST BORDER
- ▶ **TIDAL PERCUSSION**- RIGHT AND LEFT
- ▶ TRAUBE'S AREA OF TYMPANITIC RESONANCE
- ▶ **IF DULLNESS IS PERCUSSED SHIFTING DULLNESS IF TO BE LOOKED FOR AND SUCUSSION SPLASH TO BE ELICITED IF HYDRO PNEUMOTHORAX IS SUSPECTED- TO BE DONE IN AUSCULTATION**

# PERCUSSION

| TYPE OF NOTE     | CONDITIONS                                                                            |
|------------------|---------------------------------------------------------------------------------------|
| RESONANT         | NORMAL LUNG                                                                           |
| DULL OR IMPAIRED | PLEURAL EFFUSION, LUNG COLLAPSE,<br>LOBAR PNEUMONIA, LUNG MASS,<br>POST PNEUMONECTOMY |
| HYPERRESONANT    | EMPHYSEMA, PNEUMOTHORAX                                                               |

# AUSCULTATION

- ▶ WITH DIAPHRAGM OF STETHOSCOPE FOR 2 BREATH CYCLES
- ▶ PT BREATHES WITH HIS MOUTH OPEN
- ▶ AUSCULTATE ATLEAST TWO AREAS IN FRONT OF CHEST, TWO POSTERIORLY AND TWO AREAS IN AXILLA
- ▶ ALWAYS COMPARE ONE SIDE OF CHEST TO OTHER



# AUSCULTATION

- ▶ **AREAS-** SUPRA CLAVICULAR, INFRACLAVICULAR, MAMMARY, AXILLARY AND INFRAAXILLARY, SUPRASCAPULAR, INTERSCAPULAR AND INFRASCAPULAR
- ▶ **CHARACTER OF SOUND-** VESICULAR, BRONCHIAL ,ETC.
- ▶ **INTENSITY OF BREATH SOUNDS-** WHETHER EXPIRATION IS PROLONGED IN ANY AREAS
- ▶ **ANY ADDED SOUNDS-** CREPTS, CRACKLES, RHONCHI, PLEURAL RUB ETC.- DESCRIBE IT
- ▶ VOCAL RESONANCE
- ▶ FORCED EXPIRATORY TIME- NOT MANDATORY
- ▶ **IF BRONCHIAL BREATH SOUNDS + CHECK FOR WHISPERING PECTORILOQUY/EGOPHONY**

# BREATH SOUNDS

| VESICULAR BREATH SOUNDS              | BRONCHIAL BREATH SOUNDS       |
|--------------------------------------|-------------------------------|
| NORMAL                               | ABNORMAL EXCEPT OVER TRACHEA  |
| LOW PITCH                            | HIGH PITCH                    |
| SOFT INTENSITY “ RUSTLING OF LEAVES” | HARSHER AND LOUDER “ BLOWING” |
| NO GAP BETWEEN I AND E               | PERCIEVED GAP BETWEEN I AND E |

# INTENSITY OF BREATH SOUNDS

## Changes in the intensity of breath sounds.

| Increased                                                                                                 | Decreased                                                                                                                                            |
|-----------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Increases in airway fluid</b><br>Pneumonia<br>Pulmonary hemorrhage<br>ARDS<br>Congestive heart failure | <b>Increased lung volume</b><br>Hyperinflation<br>Asthma<br>Emphysema/bullous disease<br>Chronic bronchitis                                          |
| <b>Increased air entry/turbulence</b><br>Hyperventilation<br>Mouth breathing                              | <b>Decreased air entry</b><br>Hypoventilation<br>Airway obstruction<br>Phrenic nerve injury<br>Muscle weakness<br>Lung collapse                      |
|                                                                                                           | <b>Increased distance of lung from chest wall</b><br>Obesity<br>Pleural thickening<br>Pneumothorax<br>Empyema<br>Hemothorax<br>Transudative effusion |

ARDS, acute respiratory distress syndrome.

# BRONCHIAL BREATH SOUNDS

## ▶ **TUBULAR- HIGH PITCHED WITH TUBULAR QUALITY**

1. CONSOLIDATION
2. COLLAPSE
3. PULMONARY INFARCTION

## ▶ **CAVERNOUS- LOW PITCHED AND HOLLOW**

1. UNDERLYING CAVITY IN THE LUNG
2. PULLED TRACHEA SYNDROME
3. OPEN PNEUMOTHORAX

## ▶ **AMPHORIC- HIGH PITCHED WITH METALLIC/ ECHO LIKE QUALITY**

1. HYDROPNEUMOTHORAX

# ADDED SOUNDS

- ▶ **WHEEZE-** high pitched continuous sounds produced due to airway narrowing
  1. MONOPHONIC- STRIDOR- laryngeal obstruction
  2. POLYPHONIC- B. asthma, COPD, Emphysema, pulmonary edema
- ▶ **CRACKLES-** short interrupted sounds due to sudden opening of partially collapsed airways
  1. FINE- soft , high pitched discontinuous sounds- heart failure or pulmonary fibrosis-ILD
  2. COARSE- louder, longer, low pitched- due to secretions- pneumonias, bronchiectasis
- ▶ **RHONCHI-** low pitched continuous sounds heard during expiration caused by turbulence over airways due to retained secretions or abnormal airway collapsibility – e.g. bronchitis
- ▶ **PLEURAL FRICTION RUB-** biphasic crepitus like sounds heard over localised areas where pleuritic pain may be present- often palpable
- ▶ **SQAWKS-** mixed sounds- short musical component accompanied by crackles- conditions affecting distal airways like ILDs and pneumonias

# TRANSMITTED SOUNDS

- ▶ **WHISPERING PECTORILOQUAY**
- ▶ **BRONCHOPHONY**
- ▶ **EGOPHONY**
  
- ▶ ALL THESE SOUNDS ARE USUALLY ASSOCIATED WITH TUBULAR OR CAVERNOUS TYPE OF BRONCHIA BREATH SOUNDS AND ARE SPECIFICALLY HEARD OVER AREAS OF CONSOLIDATION, COLLAPSE OR INFARCTION

# BREATH SOUNDS-SUMMING UP!

## VESICULAR SOUNDS



Normal - heard over periphery  
Gentle rustling sound  
Fades on expiration

## BRONCHIAL SOUNDS



Normal - heard over substernal notch  
**LOUDER** - Expiratory lasts longer  
Silent internal

## BRONCHOVESICULAR



Normal - heard 1st & 2nd inter costal space anteriorly and between scapulae posteriorly  
Intermediate intensity

## FINE CRACKLES



Abnormal - discontinuous  
High pitched  
Popping quality

## COARSE CRACKLES



Abnormal - discontinuous  
Low pitched  
Louder & Longer

## WHEEZE



Abnormal - continuous  
High pitched  
Musical quality

## RHONCHI



Abnormal - continuous  
Low pitched  
Gurgling quality

INSPIRATION      EXPIRATION

| Pathological process                        | Chest wall movement (reduced) | Mediastinal displacement               | Percussion note         | Breath sounds                     | Vocal resonance   | Added sounds                                     |
|---------------------------------------------|-------------------------------|----------------------------------------|-------------------------|-----------------------------------|-------------------|--------------------------------------------------|
| Consolidation (i.e. lobar pneumonia)        | Affected side                 | None                                   | Dull                    | Bronchial                         | Increased         | Fine crackles                                    |
| Collapse                                    |                               |                                        |                         |                                   |                   |                                                  |
| Major bronchus                              | Affected side                 | Towards lesion                         | Dull                    | Diminished or absent              | Reduced or absent | None                                             |
| Peripheral bronchus                         | Affected side                 | Towards lesion                         | Dull                    | Bronchial                         | Increased         | Fine crackles                                    |
| Fibrosis                                    |                               |                                        |                         |                                   |                   |                                                  |
| Localized                                   | Affected side                 | Towards lesion                         | Dull                    | Bronchial                         | Increased         | Coarse crackles                                  |
| Generalized (e.g. idiopathic lung fibrosis) | Both sides                    | None                                   | Normal                  | Vesicular                         | Increased         | Fine crackles                                    |
| Pleural effusion (>500 mL)                  | Affected side                 | Away from lesion (in massive effusion) | Stony dull              | Vesicular reduced or absent       | Reduced or absent | None                                             |
| Large pneumothorax                          | Affected side                 | Away from lesion                       | Normal or hyperresonant | Reduced or absent                 | Reduced or absent | None                                             |
| Asthma                                      | Both sides                    | None                                   | Normal                  | Vesicular<br>Prolonged expiration | Normal            | Expiratory polyphonic wheeze                     |
| Chronic obstructive pulmonary disease       | Both sides                    | None                                   | Normal                  | Vesicular<br>Prolonged expiration | Normal            | Expiratory polyphonic wheeze and coarse crackles |

# CARDIAC EXAMINATION

- ▶ VERY IMPORTANT ADJUVANT TO RESPIRATORY EXAMINATION
- ▶ CONDITIONS SUCH AS PULMONARY HYPERTENSION, COR PULMONALE, HEART FAILURE CO EXIST WITH LUNG DISEASES OR MAY MIMIC THEM
- ▶ FEELING FOR PALPABLE HEAVE OR MURMURS MAY HELP DETECT COR PULMONALE
- ▶ ACCENTUATED 2<sup>ND</sup> HEART SOUNDS ESPECIALLY IN PULMONIC SPACE ALSO IS SUGGESTIVE OF PULMONARY HYPERTENSION
- ▶ THE APEX BEAT MAY BE MASKED IN CASES OF HYPERINFLATION OR PNEUMOTHORAX
- ▶ APEX BEAT MAY BE DISPLACED IN CASES OF SHIFT IN MEDIASTINUM

# PRIMARY INVESTIGATIONS

- ▶ CHEST XRAY
- ▶ ECG
- ▶ ABG
- ▶ CBC

# CONCLUSION

- ▶ PATIENTS IN CRITICAL CARE WILL NOT GIVE TIME!
- ▶ ASSESSMENT MUST BE QUICK AND CONCISE
- ▶ VITAL PARAMETERS, GPE AND INSPECTION ARE PARAMOUNT IN FAST ASSESSMENT
- ▶ SIDE BY SIDE INVESTIGATIONS SUCH AS CHEST XRAY AND ECG WILL ADD TO CLINICAL DIAGNOSIS IN A PROMPT MANNER
- ▶ YOUR EYES SPOT WHAT YOUR MIND KNOWS!
- ▶ KEEP READING!

THANK YOU FOR YOUR ATTENTION!

