GOALS: 1) Brief review of chest/lung examination.
2) Describe common abnormalities found during **Inspection, Palpation, Percussion, and Auscultation**
3) Be able to describe physical findings commonly seen in patients with conditions involving pleural effusion, consolidation, pneumothorax
4) Most important concepts are in **BOLD CAPS**

EVIDENCE-BASED LESSON: Clinically Relevant Standards for Tachypnea in Febrile Children Younger Than 2 Years (Arch Ped Adol Med 1995; 149:283-7)
(see also JAMA 1998; 279:308-313)
The best individual finding to rule out pneumonia is absence of tachypnea:
- Age < 6 months Respiratory rate ≤ 59
- Age 6-11 months ≤ 52
- Age 1-2 years ≤ 42

Anatomy

**Lung boundaries:** best reviewed by pictures rather than words!

Superior:
- Anteriorly: Apex extends 4cm above first rib
- Posteriorly: Apex at level of first thoracic vertebra (T1)

Inferior:
- T12 with deep inspiration, T9 with forced expiration

Lobes:
- Most of posterior lung surface is made up of lower lobes (RLL, LLL)
- Right middle lobe (RML) found anteriorly below fourth rib

Other concepts:

“Accessory muscles of respiration”
- Sternocleidomastoid (SCM), scalenes, serratus
- Help out the diaphragm and intercostals during heavy exertion or respiratory distress
Examination of Chest and Lungs: Inspection

Information from patient’s history of breathing problems:
Symptoms (described by patient):
Dyspnea (DISP-nee-ah)- difficult breathing
Orthopnea (ohr-THOPP-nee-ah)- shortness of breath (SOB), worse when supine. “How many pillows do you use to sleep?”
Paroxysmal Nocturnal Dyspnea (PND) – sudden SOB after a period of sleep, relieved by sitting up

Signs (observed by you)
Cyanosis- bluish discoloration of lips or nails
Clubbing- nail base angle of 180° or more
Nasal flaring, use of accessory muscles, retractions- air hunger
… all of these suggest pulmonary or cardiac problem

Patterns of Respiration:

• Abnormal respiratory rate- normal for adults is 12-20

  **Definition**  **Common Causes**
  Tachypnea (tah-KIPP-nee-ah)- rate > 20 anxiety, infection, pain
  Hyperpnea -rate > 20, deep breathing exercise, anxiety, metabolic

• Other patterns:
  Sighing anxiety

  Cheyne (“chain”)-Stokes
crescendo-decrescendo-apnea drugs, CNS damage

  Kussmaul (KOOS-mall)
  Rapid, deep, labored metabolic acidosis

  Stridor (STRIDE-or)
  Harsh, high-pitched inspiration airway obstruction
  *Dangerous sign of laryngeal obstruction!*
  Example: epiglottitis in a child
  - fever, cough, very sore throat, drooling, scared
  - do NOT attempt to see oropharynx except under anesthesia
Palpation

Crepitus- a crackling sensation, can be both felt and heard
Caused by air in the subcutaneous space
Pleural friction rub- coarse vibration, can be both felt and heard
Caused by pleural inflammation
Thoracic expansion- thumbs at 10th ribs posteriorly will diverge symmetrically with inspiration. Loss of symmetry is abnormal.

TACTILE FREMITUS (FREMM-it-us)- chest wall vibrations from speech
Palpate chest with ulnar surfaces of hands while patient says “99”
Varies with chest wall thickness & type of voice, but should be symmetric

**DECREASED FREMITUS:** harder for sound to reach chest wall
Examples:
1) Blockage in airway prevents sound transmission-
   For example, a tumor in a mainstem bronchus
2) Something is between lung and outer chest wall-
   Pleural effusion (fluid in pleural space)
   Pneumothorax (air in pleural space)
   Pleural thickening or obesity

**INCREASED FREMITUS:**
Sound transmission $\uparrow$ through solid or fluid passageways
Example:
Consolidation of lung tissue from pneumonia
   (air passages become fluid passages)

Percussion

Technique: remember to relax your “hammer” finger and use your wrist
Patient position: arms folded, to move scapulae out of the way
Sequence: Consistently use a pattern that is comfortable for you
   Percuss every 4-5 cm over intercostal spaces
   Compare right and left sides

**FINDINGS:**

Hyperresonance: (more air than normal)
Pneumothorax
Hyperinflation from Chronic Obstructive Pulmonary Disease (COPD)
Dullness: (less air, more liquid or solid than normal)
Pleural effusion
Consolidation from pneumonia

Diaphragmatic Excursion: detects position and motion of diaphragm
Locate diaphragm at transition from dullness (kidneys, liver) to resonance (lung tissue) at scapular line
Compare deep inspiration with forced expiration
Normal excursion: 3-5 cm
Auscultation

**Technique:**
- Demonstrate deep breathing for patient
- Caution patient against hyperventilation
- Use diaphragm of stethoscope (most sounds high pitched)
- Use same patient position and sequence as for percussion
  (consider starting at bases for elderly or ill- you’ll have more chance of findings before the patient fatigues)
- Watch out for extra sounds from skin, hair, or clothing

**Findings (important to compare patient’s left and right):**

Normal breath sounds (listen for these on yourself or your lab partner)
- **Vesicular** - heard over most of lung
  - low pitch, soft
- **Bronchovesicular** - heard over main bronchus
  - medium pitch
- **Bronchial** - heard over trachea
  - high pitch, loud

**ALL SOUNDS DECREASE IF IT’S HARDER FOR SOUND TO REACH CHEST WALL (JUST LIKE FREMITUS)**

1) Blockage in airway prevents sound transmission-
   - For example, a tumor in a mainstem bronchus

2) Something is between lung and outer chest wall-
   - Pleural effusion (fluid in pleural space)
   - Pneumothorax (air in pleural space)
   - Pleural thickening or obesity

**ALL SOUNDS INCREASE WITH CONSOLIDATION-**
(AGAIN, JUST LIKE FREMITUS)
Auscultation findings, continued

ADVENTITIOUS BREATH SOUNDS: (unexpected or extra sounds)

(We will listen to recordings of each of these)

Crackles: (the finding formerly known as rales)
May signal pneumonia or congestive heart failure (CHF)
Fine: high-pitched, discrete, inspiratory
(sounds like hair rubbing together or distant fireworks)
Coarse: similar, but with lower pitch

Wheeze:
May signal asthma, COPD, or bronchitis/bronchiolitis
High pitched, continuous musical whistle
Originate in small airways
Focal wheezes suggest local obstruction-
tumor, foreign body, mucus plug

Rhonchi:
May signal bronchitis
Low pitched, continuous, coarse, like a snore
Originate in larger airways, often clear with cough

Friction rub:
Signals pleural or pericardial inflammation
Dry, grating, low pitched during inspiration or expiration

VOCAL RESONANCE: transmission of spoken voice-

The auditory equivalent of tactile fremitus, affected by the same
factors (for example, increased in pneumonia)

Bronchophony (brohn-KOFF-uh-nee)- greater clarity and loudness
of spoken words
Whispered pectoriloquy (pek-torr-ILL-o-quee)- when even a
whisper is transmitted clearly to your stethoscope-
A form of extreme bronchophony
Egophony (ee-GOFF-uh-nee) or “E to A changes”-
Bronchophony causes “E” sound to become an “A” during
transmission
Putting it all together:

Case 1
60 year-old patient with cough and fever
You see the X-ray on your way to the emergency room
You might expect to find:
- History: Type of cough:
- Other symptoms:
- Inspection: Respiratory rate:
- Other findings:
- Palpation: Tactile fremitus:
- Percussion:
- Auscultation: Type of breath sounds:
- Adventitious sounds:
- Vocal resonance:

Case 2
73 year-old smoker with gradually increasing shortness of breath
Your intern tells you that he has decreased breath sounds on the right
What processes are in your differential diagnosis?
You might expect to find:
- History: Other symptoms:
- Inspection: Respiratory rate:
- Other findings:
- Palpation: Tactile fremitus: }
  } How do these help?
- Percussion: }
- Auscultation: Type of breath sounds:
- Adventitious sounds:
- Vocal resonance:

Case 3
23 year-old student with fairly sudden onset of mild shortness of breath
Again, your intern tells you that he has decreased breath sounds on one side
What processes are in your differential diagnosis?
You might expect to find:
- History: Other symptoms:
- Inspection: Respiratory rate:
- Other findings:
- Palpation: Tactile fremitus: }
  } How do these help?
- Percussion: }
- Auscultation: Type of breath sounds:
- Adventitious sounds:
- Vocal resonance:
Examination of Infants and Children:

Variations in exam:

Inspection- chest circumference < head circumference in infants

Signs of respiratory distress:

  Retractions- intercostal, subcostal, supraclavicular
  Nasal flaring
  Grunting
  Asynchrony of motion
    (diaphragmatic hernia, pneumothorax)

Percussion- less reliable in infants
  chest is more resonant

Auscultation- thinner chest wall makes
  -normal breath sounds more bronchial in character
  -adventitious sounds louder, harder to localize

Sobbing can be a good time to examine- can hear heart and lungs