Respiratory System Overview for RN CM/DNs

Debra Ward Goldberg, RN, MSN
DDA SMRO
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• A comprehensive nursing assessment includes an assessment of each system. The purpose of this training is to review the components of a respiratory assessment.
Ventilation

- Ventilation occurs as a result of a mechanical process causing air to move into and out of the lungs.
- The muscles of respiration must overcome any resistance to chest wall movement and lung expansion.
Thoracic Cavity
Anatomic Landmarks

- Sternal notch
- Angle of Louis
- 2nd Costal cartilage
- Upper lobes
- Middle lobe
- Lower lobes

Midsternal line
Midclavicular line
Anterior axillary line
Thoracic Cavity

- Thoracic Cavity:
  - Divided into right and left pleural cavities separated by the mediastinum.
  - Mediastinum contains heart, aorta, lower trachea, large bronchi, esophagus and hilum (where mainstem bronchi and pulmonary vessels enter the lungs)
  - Each pleural cavity lined by pleura (a 2 layer membrane) containing serous lubricating film to facilitate movement without friction.
Upper & Lower Airway

- Upper airway includes the nasal cavity, pharynx and larynx
- Lower airway is comprised of trachea, mainstem bronchi, segmental bronchi, bronchioles, and alveoli.
- Smaller airways obstruct due to mucus/foreign particles.
- Constriction of bronchioles occurs with asthma.
- Aspiration into right lung is more common due to right mainstem bronchus being shorter, wider and more vertical than left.

[Image of upper and lower respiratory tracts]

Mechanism of Respiration

• Inspiration:
  – the diaphragm descends and flattens creating a negative intrathoracic pressure that causes air to be “sucked” into the lungs. (Tidal volume)
  – Inspiration is opposed by the elastic properties of the respiratory system.

• Expiration:
  – Passive.
  – The diaphragm relaxes and the elastic recoil properties of the lungs expel air and pull the diaphragm to its resting position.
Thoracic Cavity Abnormalities

- Increased pressure within the thoracic cavity (due to pleural effusion, hemo/pneumothorax, empyema, pulmonary edema, tumor) may interfere with expansion.
What do you see? Aspiration Pneumonia
What do you see? Tumor

right lung
cancer
left lung
What do you see? Pneumonia
What do you see? Pneumothorax
What do you see? Pleural Effusion
What do you see? Atelectasis

Fig. 1. Homogeneous consolidation and atelectasis on the left lung in the chest X-ray.
What do you see? CHF
What do you see? Emphysema
RESPIRATORY ASSESSMENT
History

• When performing a focused respiratory assessment, the nurse must:
  – 1. determine the chief complaint (onset, symptoms, cough, sputum production, what helps, what makes it worse, pain location/quality),
  – 2. identify elements in the patient’s history that relate to the presenting problem (causes, aggravating factors, patient/family hx, life style, smoking, occupational hx, allergens/environment, anxiety), and,
  – 3. observe the patient.
Physical Exam

- Ensure patient privacy
- Equipment: stethoscope with diaphragm and bell; tubing no more than 18 inches
- Conduct exam in organized progression:
  - Inspection
  - Palpation
  - Percussion
  - Auscultation
- Any abnormalities should be identified using anatomic/topographic landmarks.
INSPECTION
Inspection

• Observe posture and breathing pattern
  – Slight retraction of intercostals is normal
  – Marked retraction = blockage
  – Forward leaning inhalation position: air hunger
  – Lip pursing: COPD
  – Flaring of nares: air hunger

• Listen for audible breath sounds.
  – Normal rate is 12-20 and smooth and even
Inspection

• Note AP to transverse diameter (nl=1:2)
  – Over inflation/COPD: Barrel chest: AP=2:2

• Inspiratory expansion should be symmetric
  – Asymmetry: collapsed lung, extrapleural air, fluid, or mass
  – Bulging intercostal spaces: obstruction/emphysema
Inspection: Breathing patterns

Rate/Pattern:

• Eupnea
  – Normal
  – 12-20 / min

• Tachypnea
  – \( \uparrow \text{rate} > 20 \)
  – Pneumonia, pulmonary edema, acidosis, septicemia, pain

• Bradypnea
  – \( \downarrow \text{rate} < 12 \)
  – \( \uparrow \text{ICP}, \text{drug OD} \)
Inspection: Breathing patterns

Depth

- Hyperpnea
  - ↑ depth/not rate

- Hyperventilation
  - ↑ depth & rate

- Hypoventilation
  - ↓ depth & rate
Inspection: Breathing patterns

Depth abnormalities:

• Kussmaul's
  – ↑ rate & depth
  – Resp compensation for severe acidosis (DKA)

• Apneustic
  – Deep, gasping inspiration with a pause at full inspiration followed by inadequate expiration
  – Brainstem lesion
Rhythm abnormalities:

• Apnea
  – Not breathing

• Cheyne-Stokes
  – Varying depth followed by apnea
  – “Death rattle,” Agonal
Inspection: Breathing patterns

Rhythm

• Biot’s
  – ↑ rate & depth w/ abrupt pauses
  – Assoc w/ ↑ ICP; brainstem lesion
Inspection

- Position of trachea:
  - Normal: central
  - Deviation:
    - Pleural effusion
    - Tension pneumothorax
    - Atelectasis
Inspection

• Funnel Chest/ Pectus Excavatum:
  – depression of lower portion of sternum
  – Complications: heart damage/ ↓ CO

http://t0.gstatic.com/images?q=tbn:ANd9GcRA9400MKgVziP0TGQpYBR9ywprYTs mJ-G-_KHEnRLcSr2fMCktzg
Inspection

• Pigeon Chest/ Pectus Carinatum:
  – sternum protrudes anteriorly
  – Increased AP diameter

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Spine Deformities

- Scoliosis: Lateral/rotational curvature of spine
  - Complications: restrictive lung dx, back problems
- Kyphosis: Hunchback/forward curvature of thoracic spine
- Lordosis: Sway-back; anterior curvature of spine
Inspection

- Cyanosis
  - Late indicator of hypoxia
  - O2 sats<85%

- Pallor (indicates anemia)
Inspection

• Assess for clubbing of fingers (associated with fibrotic lung disease, cystic fibrosis, congenital heart disease with cyanosis)
Respiratory Distress

- Respiratory Distress is indicated by exaggerations/aberrations of the normal respiratory pattern:
  - Barrel chest/enlarged A-P diameter as seen in COPD. Associated with prolonged expiration cycle.
  - Use of accessory muscles as seen in acute respiratory distress. (Retraction of intercostal muscles and contraction of the sternocleidomastoid muscles)

[Diagram of respiratory muscles]
• Difficulty breathing:
  – Associated with cardiac and respiratory diseases
  – Sudden onset in an otherwise healthy individual could indicate Pneumothorax
  – Sudden onset in ill/post op individual could indicate Pulmonary Embolism
Orthopnea

• Position of comfort to relieve dyspnea
• Associated with COPD/CHF
### Significance of Sputum

<table>
<thead>
<tr>
<th>Description of Mucus/Sputum:</th>
<th>Possible Significance:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thick</td>
<td>Dehydration</td>
</tr>
<tr>
<td>Purulent, thick, green/yellow</td>
<td>Bacterial infx</td>
</tr>
<tr>
<td>Rusty colored</td>
<td>Strep or Staph infx</td>
</tr>
<tr>
<td>Thin</td>
<td>Viral infx</td>
</tr>
<tr>
<td>Bloody/Pink-tinged</td>
<td>Lung CA, TB</td>
</tr>
<tr>
<td>Pink-tinged, profuse, frothy</td>
<td>Pulmonary edema</td>
</tr>
<tr>
<td>Malodorous</td>
<td>Lung abscess</td>
</tr>
</tbody>
</table>
PALPATION
Purpose of Palpation

• Further assess abnormalities suggested by hx or inspection
• Assess skin and subcutaneous structures
• Assess thoracic expansion
• Assess Tactile Fremitus
• Assess Tracheal position
**Palpation: General**

- **Assess Chest Wall for:**
  - Tenderness
  - Masses
  - Lesions
- **Sinuses**
  - Palpate below eyebrow and at cheekbone
- **Crepitus**
  - Crackling (Rice Krispies) in SQ tissue
Palpation: General

• Chest Wall: Use palms of both hand simultaneously to assess symmetry
  – Assess for irregularities, tenderness
  – Crepitus indicates SQ emphysema (? pneumothorax)
  – Spine: straight/nontender
  – Sternum/xiphoid: fixed

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Palpation: Thoracic Expansion

- Thoracic expansion: should be equal bilaterally
  - Asymmetry: atelectasis, bronchiectasis, pleural effusion, pneumonia
  - Decreased expansion: emphysema, age related
Palpation: Tactile Fremitus

- **Tactile Fremitus:**
  - Vibrations in the chest wall during vocalization (“99”)
  - Should be equal bilaterally
  - Decreased/absence: excess air in lungs as in emphysema, pleural effusion, pulmonary edema
  - Increased: pneumonia, tumor, fibrosis
Palpation: Tracheal Position

- Tracheal position
  - Place finger on trachea in suprasternal notch and move laterally
  - Midline/equidistant between sternocleidomastoid muscles
  - **Deviation towards abnormal side:**
    - atelectasis,
    - pulmonary fibrosis
  - **Deviation towards normal side:**
    - neck tumors,
    - thyroid enlargement,
    - enlarged lymph nodes,
    - pleural effusion,
    - pneumothorax

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PERCUSSION
Percussion

• The purpose of percussion is to determine if underlying tissue is filled with air or solid material.
• Avoid bony areas; use interspaces
Percussion

- Normal: resonant/drum like sounds
- Flat/dull sounds:
  - Bone/muscle: flat sounds
  - Viscera/liver: dull sounds
  - Fluid/solid: pleural effusion, pneumonia, tumor
- Stomach: tympanic
- Hyper-resonant: Air trapped in lung; emphysema
AUSCULTATION
Auscultation

- Use the diaphragm of the stethoscope placed firmly against the body using systematic pattern
- Have patient breathe slowly and deeply through the mouth
# Characteristics of Breath Sounds

<table>
<thead>
<tr>
<th>Sound</th>
<th>I:E</th>
<th>Pitch</th>
<th>Intensity</th>
<th>Nl. Location</th>
<th>Abnl. Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bronchial</td>
<td>I&lt;E</td>
<td>High</td>
<td>Loud</td>
<td>Anteriorly: Over trachea Posteriorly: upper right lung field</td>
<td>Lung area</td>
</tr>
<tr>
<td>Broncho-vesicular</td>
<td>I=E</td>
<td>Mod.</td>
<td>Mod.</td>
<td>Anteriorly: 1st &amp; 2nd ICS at sternal border Posteriorly: between scapulae</td>
<td>Peripheral lung</td>
</tr>
<tr>
<td>Vesicular</td>
<td>I&gt;E</td>
<td>Low</td>
<td>Soft</td>
<td>Peripheral lung</td>
<td>n/a</td>
</tr>
<tr>
<td>Sound</td>
<td>Origin</td>
<td>Characteristics</td>
<td></td>
<td></td>
<td></td>
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<td>------------------------</td>
<td>------------------------------------------------------------------------</td>
<td>---------------------------------------------------------------------------------</td>
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<tr>
<td>Fine Crackles (Fr.: Rales)</td>
<td>Air passing through moisture in small air passages and alveoli</td>
<td>End of inspiration; non-continuous; not cleared by coughing; sounds like hair rolled b/t fingers</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Medium/Coarse Crackles</td>
<td>Air passing through moisture in bronchioles, bronchi, &amp; trachea</td>
<td>As above but louder; moister sound at early to mid-inspiration</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sibilant Ronchi/Wheezees</td>
<td>Air passing through small air passages narrowed by secretions, swelling, tumors, etc (Asthma)</td>
<td>Continuous sounds; predominately in expiration; high pitched, musical, wheezing</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sonorous Ronchi/Wheezeed</td>
<td>Air passing through large air passages narrowed by secretions</td>
<td>Continuous sounds; predominately in expiration; clear with cough</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Friction Rubs</td>
<td>Rubbing together of inflamed and roughened pleural surfaces</td>
<td>Creaking/grating quality; heard in I &amp; E; heard best in lower anterolateral chest; no change with cough</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stridor</td>
<td>Partially obstructed trachea</td>
<td>Crowing sound</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>
## Assessment of Common Conditions

<table>
<thead>
<tr>
<th>Condition</th>
<th>Inspection/ Palp</th>
<th>Percussion</th>
<th>Breath Sounds</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>Consolidation</td>
<td>Guarding; expansion</td>
<td>Dull to flat</td>
<td>↑ intensity</td>
<td>Inspiratory rales; friction rub</td>
</tr>
<tr>
<td>Pneumothorax</td>
<td>Trach shift</td>
<td>Hyperresonant</td>
<td>↓ or absent</td>
<td>-</td>
</tr>
<tr>
<td>Emphysema</td>
<td>↑ A:P diam.</td>
<td>Resonant/Hyperresonant</td>
<td>↓ intensity</td>
<td>Sibilant ronchi; expiration</td>
</tr>
<tr>
<td>Pleural Effusion</td>
<td>↓ excursion</td>
<td>Flat to dull</td>
<td>↓ intensity</td>
<td>-</td>
</tr>
<tr>
<td>Atelectasis</td>
<td>Trach shift</td>
<td>Dull to flat over consolidation</td>
<td>↓ or absent intensity</td>
<td>Fine rales</td>
</tr>
<tr>
<td>CHF</td>
<td>Normal</td>
<td>Normal</td>
<td>Normal</td>
<td>Fine to medium rales at bases</td>
</tr>
<tr>
<td>Acute Bronchitis</td>
<td>Normal</td>
<td>Normal</td>
<td>Normal</td>
<td>Rales/ronchi/ wheezes</td>
</tr>
</tbody>
</table>
MISCELLANEOUS
O2 Administration

• O2 administration may be delegated to unlicensed staff
• PRN usage requires orders from the HCP with clear criteria for starting and stopping O2 therapy.
• Criteria must be objective (e.g., Pulse Ox <92%, Resp Rate > 26, etc) and not based on nursing assessment (e.g., breath sounds)
Pulse Oximetry

• The photodetector distinguishes between the color of oxygenated and deoxygenated hemoglobin to determine the percentage of O2 saturation.

• Normal – w/o COPD: 95-99%

• Normal – w/ COPD w/hypoxic drive: 88-94%
C-PAP/B-PAP

• C-PAP: Continuous Positive Airway Pressure therapy
• Indications: Obstructive Sleep Apnea
• Mechanism: increases air pressure in respiratory tree to prevent airway collapse
• Results: decreases daytime sleepiness, positive effect on heart health
• B-PAP: Bilevel Positive Airway Pressure: inspiratory PAP and a lower expiratory PAP for easier exhalation