



Focused Pulmonary Assessment

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Purpose & Objectives

Focused Pulmonary Assessment offers an overview of basic pulmonary assessment, including normal and abnormal findings.

After successful completion of this course, you will be able to:

1. Discuss the components of a focused pulmonary assessment.
2. Discuss specific assessment findings that are determined by the history and examination, including inspection, palpation, percussion, and auscultation.
3. Identify breath sounds that are often heard in specific pulmonary disorders.

Introduction

Respiration can be defined as the process in which we take in oxygen and release carbon dioxide during the process of breathing.

Sometimes, this term is extended to include the transfer of oxygen from the lungs to the bloodstream and, eventually, into cells and the release of carbon dioxide from cells into the bloodstream and then to the lungs, from whence it is expelled to the environment.

The function of the respiratory system is to take in oxygen use on a cellular level, and this is what keeps each and every cell in our body alive. If there is a disruption to this process, the whole body suffers.

This course will discuss physical exam techniques such as inspection, palpation, percussion, and auscultation.

Throughout the course you will learn how alterations in pulmonary assessment findings could indicate potential pulmonary problems.

Glossary

Barrel chest: A rounded, barrel shape of the chest wall that may indicate an underlying medical condition, such as chronic obstructive pulmonary disease (COPD). The diameter of the chest is increased.

Bronchial breath sounds: Normal sounds heard over the upper half of the sternum.

Bronchophony: Muffled and indistinguishable word sounds heard when listening to the chest wall with a stethoscope, while the patient vocalizes a repetitive phrase such as "ninety-nine."

Bronchovesicular breath sounds: Normal sounds heard over the trachea.

Consolidation: Areas of consolidation in the lungs occur when lung tissue are filled with fluid.

Crepitus: Grating, crackling or popping sensation felt on palpation. Also known as subcutaneous emphysema, and is caused by air trapped in tissues under the skin covering the chest wall or neck.

Diaphoretic: Excessive perspiration.

Dullness: A dull sound usually heard over a solid mass, such as a tumor.

Dyspnea: Difficulty breathing or shortness of breath (SOB).

Egophony: The distortion of sound due to lung pathology.

Flatness: Flat sound heard when dense tissue is palpated.

Fremitus: A vibration felt on palpation. Usually indicates some pathology.

Hyperresonance: A long, low-pitched hollow sound heard over areas with trapped gas, of increased air such as pneumothorax or emphysema.

Inspiratory: Expiratory ratio: The ratio of the length of time spent on inhaling air, compared to the length of time spent on exhaling air.

Nasal Turbinates: A long, narrow and curled bone shelf which protrudes into the breathing passage of the nose.

Orthopnea: Shortness of breath (SOB) when lying flat.

Palpation: Process of using the hands to explore underlying organs to determine pathology.

Paroxysmal Nocturnal Dyspnea (PND): Intermittent, recurrent episodes of shortness of breath that usually occur while lying down at night.

Pectus carinatum: Anterior protrusion of the sternum.

Pectus excavatum: Posterior depression of all or part of the sternum.

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Resonance: Normal sound heard on percussion over healthy lung tissue.

Respiration: The process in which oxygen is taken in and carbon dioxide is released, during the process of breathing.

Scoliosis and kyphosis: Abnormal lateral curvatures of the spine may affect expansion of the thoracic cage.

Trachea: Also known as windpipe, and extends from the larynx to the primary bronchi.

Transport: Refers to the carrying of oxygen and carbon dioxide throughout the circulatory system.

Ventilation: The exchange of air between the atmosphere and the alveoli.

Vesicular breath sounds: Normal sounds heard over most of the lungs.

Wheezing: A continuous, coarse, whistling sound produced in the respiratory airways during breathing.

Whispered Pectoriloquy: A whispered phrase is muffled when heard through dense lung tissue. Ask the patient to whisper a phrase such as "one-two-three". If the sounds are muffled, some degree of pathology is present.

Adult Pulmonary Assessment

When conducting a focused pulmonary assessment on an adult, it is important to begin with a thorough history of chest or pulmonary complaints.

Elicit any information about any experienced signs or symptoms of chest disease. Chest disease usually manifests as the presence of any of the following:

- Cough
- Sputum
- Dyspnea
- Wheezing
- Chest pain

Assessment of Cough

Duration:

An acute cough usually represents a viral infection or allergic response.

Chronic cough may be more ominous.

Chronic coughs may manifest from underlying disease processes such as gastroesophageal reflux disease, asthma, chronic allergies, bronchitis, tuberculosis, or cancer.

Certain drugs may produce a side effect of a cough. Therefore, a thorough medication history is also warranted.

Type:

A productive cough usually indicates some infection or inflammatory process. Chronic bronchitis presents with a history of productive cough for 3 months of the year, for 2 years in a row (Jarvis, 2012).

A dry or non-productive cough may indicate an "atypical" pneumonia, such as mycoplasma pneumonia which presents with a hacking cough, early heart failure which presents with a dry, non-productive cough or croup which has a characteristic barking sound (Jarvis, 2012).

Severity:

Ask your patient to rank their cough on a scale of 1 - 10 to determine their perception of the severity of their cough. Most patients can use a numerical rating scale to quantify their symptom. When using a numerical scale, you should ask the patient to rate their cough on a scale from 0 to 10. Zero means no cough. Ten means the worst cough they have ever experienced.

Irritants and aids:

Coughs that increase in severity and frequency at night may indicate an underlying cardiac condition.

Coughs that increase after meals may indicate gastroesophageal reflux disease.

A cough that is worse upon waking may indicate bronchitis and is sometimes termed a “smokers cough.”

Assessment of Sputum Production

If your patient has a productive cough, investigate the characteristics of their sputum. Begin by asking your patient about the following:

How long have you been coughing up sputum?

This will help you quantify the severity of the symptoms.

What color is your sputum?

- Pink-tinged, frothy sputum may indicate pulmonary edema, which is a respiratory emergency.
- Purulent, rust-colored sputum may indicate tuberculosis or pneumococcal pneumonia (Jarvis, 2012).
- Green sputum may indicate a viral process or pseudomonas.
- Yellow sputum is usually indicative of a bacterial infection.
- Black sputum may be consistent with occupational pneumoconiosis or “black lung.”
- Clear to mucoid sputum that occurs in the mornings is consistent with colds, bronchitis and other viral infections (Jarvis, 2012).

Assessment of Sputum Production

Presence of foul odor: An odor to sputum usually indicates an infectious process.

Presence of blood in the sputum: If blood is present, further investigation is needed to determine if the blood is pulmonary in origin or from the gastrointestinal tract. Often the patient will perceive that they have “coughed up blood” when the blood actually traveled up through their esophagus to the carina, which causes the patient to cough. Blood tinged sputum may indicate tuberculosis.

Assessment of Dyspnea

Diseases associated with dyspnea include:

- Congestive heart failure
- Chronic bronchitis
- Asthma
- Emphysema
- Airway obstruction
- Tuberculosis
- HIV-related pulmonary disorders

- Pulmonary fibrosis
- Infectious or inflammatory processes

If your patient complains of shortness of breath (SOB), determine when this occurs. Paroxysmal nocturnal dyspnea (PND) wakes the patient up at night. If the patient is short of breath at rest or with exertion, orthopnea (shortness of breath when lying flat) may be present, and may indicate an underlying cardiac condition.

Chest Pain

Often your patient with an underlying pulmonary condition will complain of chest pain. It is important to rule out cardiac chest pain and chest pain from other origins before assuming the chest pain is pulmonary in nature. Question your patient about the nature of their chest pain.

- Describe your chest pain.
- Cardiac chest pain is usually squeezing or gripping in nature.
- Esophageal or gastric chest pain is usually increased or decreased depending on food intake or antacid ingestion.
- Tracheal chest pain burns during inhalation.
- Chest wall or rib pain is easily localized and recurs with palpation.
- Pleural chest pain is usually described as “stabbing.”
- Pain associated with lung diseases such as tuberculosis and cancer may be described as boring, dull, and aching.

Mnemonic For Assessing Chest Pain & Pulmonary Symptoms

P: Provocative or Palliative: What makes the pain or symptom(s) better or worse?

Q: Quality: Describe the pain or symptom(s) (burning, dull, sharp).

R: Radiation: Where in the body does the pain or symptom(s) occur? Is there radiation or extension of the pain or symptom(s) to another area of the chest?

S: Severity: On a scale of 1-10, (10 being the worst) how bad is the pain or symptom(s)?

T: Timing: Does it occur in association with something else (e.g. eating, exertion, movement)?

Data Collection: Medical History

It is important to document a comprehensive medical history that includes details about:

- Current symptoms
- Previous hospitalizations
- Chronic medical conditions, especially any respiratory conditions
- Acute medical conditions presenting at the time of the examination
- Allergies
- Trauma or surgeries

Data Collection: Family History

After eliciting information about any experienced signs or symptoms of chest disease, the healthcare provider should obtain a detailed and thorough medical history, including a family history, social history, occupational history, communicable disease risk, and medications.

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Family History: Ask about hereditary disorders such as: cystic fibrosis, alpha 1 antitrypsin deficiency, asthma, and allergies.

Data Collection: Social History

Smoking:

Cigarette smoking has been identified as the most important source of preventable morbidity and premature mortality worldwide (American Lung Association, 2014). Cigarette smoke contains over 4,800 chemicals, 69 of which are known to cause cancer (American Lung Association, 2014). Nicotine is an addictive drug, and a social activity, which makes it a difficult habit to break (American Lung Association, 2014).

Ascertain the pack per year smoking history. This is done by multiplying the number of years your patient has smoked with the number of packs per day they have smoked. Smokers or past-smokers that have over a 30-year-pack history have the greatest risk of developing lung cancer (Cancer Treatment Centers of America, 2014).

Smokers Pack Per Day History

2 packs per day x 10 years = 20 pack-year history

1 pack per day x 20 years = 20 pack-year history

3 packs per day x 7 years = 21 pack-year history

Data Collection: Social History

Work-related Risk Factors:

Ask your patient about environment or work-related risk factors for pulmonary disease. Have they worked in a glass factory, coal mine or around asbestos? Also, ask about the amount and duration of their exposure to fumes in the workplace.

Communicable Disease Risk:

Establish any previous exposure to tuberculosis, and the patient's HIV status or risk. Review personal living conditions, presence of birds in the home, and possible travel outside the United States.

Data Collection: Medication History

Completing a detailed medication history is important to determine a possible relationship between medication use and clinical symptoms.

More than 100 medications are known to affect the lungs adversely.

Symptoms of adverse medication interactions or side effects of drug therapy may manifest in several different ways:

- Cough
- Asthma
- Interstitial pneumonitis
- Non-cardiac pulmonary edema
- Pleural effusions

Cardiovascular drugs that most commonly produce pulmonary problems include amiodarone, angiotensin-converting enzyme (ACE) inhibitors, and beta-blockers.

Pediatric Patients

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To obtain information about your pediatric patient you will most likely need to rely on your observation skills and any information that the parents and/or caregiver can provide.

Additional questions to ask about your patient are:

- History of frequent or severe colds: Excessive illness may be symptomatic of an underlying pathology.
- History of allergies: If the child is young, new foods or a change in formula may be a possible allergen source. Determine if the child is breastfeeding or bottle-feeding.
- Determine if there are smokers in the home: Second-hand smoke may increase the frequency and duration of respiratory infections in children.

The Elderly and Special Needs Patients

The elderly and special needs patients may not have the ability to effectively communicate information about their health; additional information may need to be obtained from the family or caregiver.

Observations about the patient's current status will also assist in determining their history. Additional questions to consider include:

- Inquiring about any shortness of breath or fatigue in daily activities: May be a sign of pulmonary compromise.
- Inquiring about energy levels and fatigue, especially in patients with existing medical conditions: Increasing fatigue can indicate exacerbation of pulmonary disease.
- Clarifying if there is any chest pain present with breathing: Painful breathing may indicate a rib fracture or muscle injury, or be symptomatic of underlying disease progression.

The Physical Exam: Inspection of the Chest

When you are using inspection as a physical exam tool, examine your patient and observe with all your senses. Examples of conditions you will want to inspect are skin color, location of lesions, bruises or rash, symmetry, size of body parts, sounds, and odors. Note any abnormal findings.

As you inspect the thoracic cage, pay particular attention to the symmetry of expansion during inspiration and expiration and note the anterior-posterior (A/P) diameter of the chest. Unequal symmetry of expansion during inspiration and expiration may indicate a pneumothorax or flail chest.

The Physical Exam: Inspection of the Chest

Additionally, you may visualize various thoracic shapes. These include:

- Barrel chest – A rounded, barrel-shaped appearance of the chest. The lateral diameter of the chest is increased and may be related to advancing age or an underlying disease processes, such as Chronic Obstructive Pulmonary Disease (COPD).
- Scoliosis and kyphosis – Abnormal lateral curvatures of the spine may affect expansion of the thoracic cage.
- Pectus carinatum – Anterior protrusion of the sternum.
- Pectus excavatum – Posterior depression of all or part of the sternum.

The Physical Exam: Inspection of Respiration

Note the rate and depth of respirations. In the healthy adult:

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- A normal respiratory rate is 12-20 breaths/minute.
- A normal inspiratory to expiratory ratio (I:E) is 1:2. Patients with COPD have a prolonged expiratory phase of about 3-4 seconds.
- Normal pulse oximetry is 95% - 100%.

Observe the patient for:

- A change in rate, rhythm and depth of respirations.
- A change in the I:E ratio.
- Nasal flaring.
- Pursed lip breathing.
- Retractions of the intercostal space during inspiration.
- Diaphoresis and clamminess.
- Inability to talk easily.

Lung Volume Terminology

Tidal Volume (VT): The normal volume of air inhaled or exhaled with each breath. About 500 ml is the normal value in a healthy young male. Comparative value = about 2 cups.

Inspiratory Reserve Volume (IRV): The volume of air inhaled during maximum inspiration beyond normal tidal volume. About 3,000 ml is the normal value in a healthy young male. Comparative value = 1 and ½ 2 liter bottles of soda.

Inspiratory Capacity (IR): The maximum volume of air that can be expired after the end of normal quiet inhalation. About 3,500 ml is the normal value in a healthy young male. Comparative value = Just under 1 gallon.

Expiratory Reserve Volume (ERV): The volume of air that can be forcefully exhaled beyond normal tidal volume. About 1,000 ml is the normal value in a healthy young male. Comparative value = Approximately 1 quart.

Residual Volume (RV): The amount of air left in the lungs after a forced exhalation. About 1,200 ml is the normal value in a healthy young male.

Functional Residual Capacity (FRC): The amount of air remaining in the lungs at the end of quiet exhalation. About 2,200 ml is the normal value in a healthy young male. Comparative value = A bit more than a 2 Liter bottle of soda.

Total Lung Capacity (TLC): The total volume of air in the upper and lower conducting airways and alveoli at the end of maximum inspiration. About 5,700 ml is the normal value in a healthy young male.

Vital Capacity (VC): The maximum amount of air that can be exhaled after maximal inspiration. About 4,500 ml is the normal value in a healthy young male. Comparative value = About the same as 6 bottles of wine.

Minute Ventilation (VE): Total expired volume of air after one minute (This equals the VT times respiratory rate). About 6,000 ml is the normal value in a healthy young male.

The Physical Exam: Palpation

Palpation is another commonly used physical exam technique that requires you to touch your patient with different parts of your hand using different strengths and pressures. During light palpation, you press the skin about 1/2 inches to 3/4 inches with the pads of your fingers. When using deep palpation, use your finger pads and compress the skin about 1.5 to 2 inches.

Palpation allows you to evaluate fremitus (a palpable vibration that should feel the same on both sides), estimate thoracic chest expansion and assess the skin and subcutaneous tissues of the chest (Kaplow & Hardin, 2007).

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When palpating the thoracic cage, you will want to confirm symmetry of chest expansion and note any unusual crepitations of the chest wall that may occur with subcutaneous emphysema.

The Physical Exam: Palpation

Fremitus is a palpable vibration, generated from the larynx and transmitted through the patient's bronchi and lung parenchyma to the chest wall. You may ask your patient to repeat a phrase such as "ninety-nine" or "blue moon" as you palpate their chest wall.

Increased fremitus may be noted over areas of consolidation, such as lobar pneumonia where the consolidation extends to the lung surface.

Decreased fremitus occurs with any condition that would decrease this sound transmission. Some of these conditions include obstructed bronchus, pleural effusion, fibrosis, pneumothorax, and emphysema (Stephen et al., 2010).

Crepitus, also known as subcutaneous emphysema, is palpable air trapped in tissues under the skin covering the chest wall or neck. When palpated, it produces a coarse, crackling sensation as gas moves under the skin. Crepitus may result after thoracic surgery or trauma to the chest.

The Physical Exam: Percussion

Percussion is the process of tapping on a surface to evaluate the size and density of the underlying structure (Kaplow & Hardin, 2007).

Percussion is performed by placing the distal portion of the middle finger of the non-dominant hand firmly on the chest wall, and using the fingers of the dominant hand to strike the middle finger behind the nail bed, and evaluate the sound emitted (Kaplow & Hardin, 2007).

Sounds produced by percussion include:

- Resonance: Normal sound heard on percussion over healthy lung tissue.
- Hyperresonance: A long, low-pitched hollow sound heard over areas with trapped gas, or increased air such as pneumothorax or emphysema.
- Dullness: A dull sound usually heard over a solid mass, such as a tumor.
- Flatness: Is heard over dense tissues.

The Physical Exam: Auscultation

When auscultating, ensure your room is quiet, use a stethoscope to auscultate over bare skin, and listen to one sound at a time. The bell or diaphragm of the stethoscope should be placed firmly enough to leave a slight ring on the skin when removed. Be aware that excessive chest hair may also interfere with true identification of certain sounds.

Auscultate the anterior and posterior chest. Have your patient breathe slightly deeper than normal through their mouth, then, auscultate from C-7 to approximately T-10, in a left to right comparative sequence. You should auscultate laterally from the axilla down to the 7th or 8th rib, listening between each rib.

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Listen for normal breath sounds, which are:

- Vesicular breath sounds: normal sounds heard over most of the lungs.
- Bronchial breath sounds: normal sounds heard over the upper half of the sternum.
- Bronchovesicular breath sounds: normal sounds heard over the trachea.

Adventitious Breath Sounds

Identify any abnormal breath sounds, known as adventitious sounds. These are added sounds that are not normally heard in the lungs. If present, they are heard as being superimposed on normal breath sounds. They are caused by moving air colliding with secretions in the tracheobronchial passages or by the popping open of previously deflated airways (Jarvis, 2012).

These are some of the most common adventitious breath sounds heard:

Crackles: High-pitched sound heard on inspiration. Also known as rales or crepitation, and is noted as a "popping" sound. May be fine or coarse crackles. Usually caused by pulmonary edema or pneumonia.

Wheeze: Musical high-pitched sound heard mainly during expiration. Occurs in conditions in which the airways are narrowed, such as asthma or aspiration.

Stridor: Loud, high-pitched crowing heard in the upper airways, due to an obstruction or croup. Is usually an emergent situation.

Rhonchi: A low-pitched wheeze that occurs when there are large amounts of secretions in the airways.

Pleural friction rub: Coarse, grating sounds created when inflammation of the parietal or visceral pleura cause a decrease in the normal lubricating fluid. As the opposing surfaces rub together during breathing, a coarse grating sound is heard (Jarvis, 2012).

Adventitious Breath Sounds Found in Various Pulmonary Disorders

Adventitious Breath Sound	Pulmonary Condition
Crackles	Lobar pneumonia, bronchitis, heart failure & TB
Wheeze	Emphysema
Bilateral wheezing on expiration	Asthma

Crackles & Rhonchi	Acute Respiratory Distress Syndrome (ARDS)
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Modified from Jarvis (2012).

Abnormal Voice Sounds

Auscultate voice sounds including bronchophony, egophony, and whispered pectoriloquy:

Bronchophony: When a patient vocalizes a repetitive phrase such as "ninety-nine," the patient's voice remains loud at the periphery of the lungs or sounds louder than usual, over a distinct area of consolidation. Bronchophony is a repetitive phrase that sounds louder than normal, over a consolidated area.

Egophony: The distortion of sound due to lung pathology. The "eee-eee" sound is heard as "aaa-aaa" when heard through dense lung tissue.

Whispered Pectoriloquy: A whispered phrase is muffled when heard through dense lung tissue. Ask the patient to whisper a phrase such as "one-two-three." If the sounds are muffled, some degree of pathology is present.

Conclusion

Pulmonary assessment is a critical part of the total nursing assessment. This course provides the information necessary to delve into pulmonary issues with your patients as you complete a pulmonary assessment.

It should be noted that the examination techniques presented in this course are intended for use and interpretation for the adult patient. As a nurse caring for diverse population, you must adapt your assessment based upon developmental, age-appropriate, and cultural considerations of your patient population.

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Note: All dosages given are for adults unless otherwise stated. The information on medications contained in this course is not meant to be prescriptive or all-encompassing. You are encouraged to consult with physicians and pharmacists about all medication issues for your patients.

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