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Professional Version

Evaluation of the Pulmonary Patient

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Key components in the evaluation of patients with pulmonary symptoms are the history, physical examination, and, in most cases, a chest x-ray. These components establish the need for subsequent testing, which may include pulmonary function testing and ABG analysis, CT or other chest imaging tests, and bronchoscopy.

History

The history can often establish whether symptoms of dyspnea, chest pain, wheezing, stridor, hemoptysis, and cough are likely to be pulmonary in origin. When more than one symptom occurs concurrently, the history should focus on which symptom is primary and whether constitutional symptoms, such as fever, weight loss, and night sweats, are also present. Other important information includes

- Occupational and environmental exposures
- Family history, travel history, and contact history
- Previous illnesses
- Use of prescription, OTC, or illicit drugs
- Previous test results (eg, tuberculin skin test, chest x-rays)

Physical Examination

Physical examination starts with assessment of general appearance. Discomfort and anxiety, body habitus, and the effect of talking or movement on symptoms (eg, inability to speak full

sentences without pausing to breathe) all can be assessed while greeting the patient and taking a history and may provide useful information relevant to pulmonary status. Next, inspection, auscultation, and chest percussion and palpation are done.

Inspection

Inspection should focus on

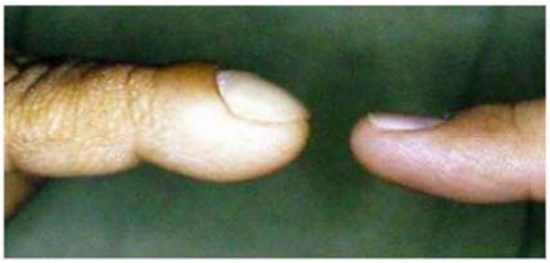
- Signs of respiratory difficulty and hypoxemia (eg, restlessness, tachypnea, cyanosis, accessory muscle use)
- Signs of possible chronic pulmonary disease (eg, clubbing, pedal edema)
- Chest wall deformities
- Abnormal breathing patterns (eg, Cheyne-Stokes respiration, Kussmaul respirations)
- Jugular venous distention

Signs of hypoxemia include cyanosis (bluish discoloration of the lips, face, or nail beds), which signifies low arterial oxygen saturation (< 85%); the absence of cyanosis does not exclude the presence of hypoxemia.

Signs of respiratory difficulty include tachypnea, use of accessory respiratory muscles (sternocleidomastoids, intercostals, scalene) to breathe, intercostal retractions, and paradoxical breathing. Patients with COPD sometimes brace their arms against their legs or the examination table while seated (ie, tripod position) in a subconscious effort to provide more leverage to accessory muscles and thereby enhance respiration. Intercostal retractions (inward movement of the rib interspaces) are common among infants and older patients with severe airflow limitation. Paradoxical breathing (inward motion of the abdomen during inspiration) signifies respiratory muscle fatigue or weakness.

Signs of possible chronic pulmonary disease include clubbing, barrel chest (the increased anterior-posterior diameter of the chest present in some patients with emphysema), and pursed lip breathing. Clubbing is enlargement of the fingertips (or toes) due to proliferation of connective tissue between the fingernail and the bone. Diagnosis is based on an increase in the profile angle of the nail as it exits the finger (to >176°) or on an increase in the phalangeal depth ratio (to > 1—see Figure: Measuring finger clubbing.). "Sponginess" of the nail bed beneath the cuticle also suggests clubbing. Clubbing is most commonly observed in patients with lung cancer but is an important sign of chronic pulmonary disease, such as cystic fibrosis and idiopathic pulmonary fibrosis; it also occurs (but less commonly) in cyanotic heart disease, chronic infection (eg, infective endocarditis), stroke, inflammatory bowel disease, and cirrhosis. Clubbing occasionally occurs with osteoarthropathy and periostitis (primary or hereditary hypertrophic osteoarthropathy); in this instance, clubbing may be accompanied by skin changes, such as hypertrophied skin on the dorsa of the hands (pachydermoperiostosis), seborrhea, and coarse facial features. Digital clubbing can also occur as a benign hereditary abnormality that can be

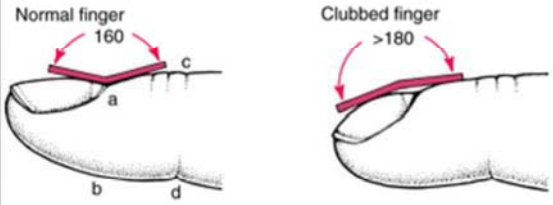
distinguished from pathologic clubbing by the absence of pulmonary symptoms or disease and by the presence of clubbing from an early age (by patient report).



Finger Clubbing

Measuring finger clubbing.

The ratio of the anteroposterior diameter of the finger at the nail bed (a–b) to that at the distal interphalangeal joint (c–d) is a simple measurement of finger clubbing. It can be obtained readily and reproducibly with calipers. If the ratio is > 1, clubbing is present. Finger clubbing is also characterized by loss of the normal angle at the nail bed.



Chest wall deformities, such as pectus excavatum (a sternal depression usually beginning over the midportion of the manubrium and progressing inward through the xiphoid process) and kyphoscoliosis, may restrict respirations and exacerbate symptoms of preexisting pulmonary disease. These abnormalities can usually be observed during careful examination after the patient's shirt is removed. Inspection should also include an assessment of the abdomen and the extent of obesity, ascites, or other conditions that could affect abdominal compliance.

Abnormal breathing patterns cause fluctuations in respiratory rate so respiratory rate should be assessed and counted for 1 min.

- **Cheyne-Stokes respiration** (periodic breathing) is a cyclic fluctuation of respiratory rate and depth. From periods of brief apnea, patients breathe progressively faster and deeper (hyperpnea), then slower and shallower until they become apneic and repeat the cycle. Cheyne-Stokes respiration is most often caused by heart failure, a neurologic disorder (eg, stroke, advanced dementia), or drugs. The pattern in heart failure has been attributed to delays in cerebral circulation; respiratory centers lag in recognition of systemic acidosis/hypoxia (causing hyperpnea) or alkalosis/hypocapnia (causing apnea).

- **Biot respiration** is an uncommon variant of Cheyne-Stokes respiration in which irregular periods of apnea alternate with periods in which 4 or 5 deep, equal breaths are taken. It differs from Cheyne-Stokes respiration in that it is characterized by abrupt starts and stops and lacks periodicity. It results from injury to the CNS and occurs in such disorders as meningitis.

- **Kussmaul respirations** are deep, regular respirations caused by metabolic acidosis.

Pulmonary hypertension, sometimes observed during inspection, indicates an increase in right atrial and usually in right ventricular pressure. The elevated pressure is usually caused by left ventricular dysfunction, but it may also be due to a pulmonary disorder causing pulmonary hypertension. The presence of jugular venous distension should prompt a search for other signs of cardiac disorder (eg, 3rd heart sound [S_3] gallop, dependent edema).

Auscultation

Auscultation is arguably the most important component of the physical examination. All fields of the chest should be listened to, including the flanks and the anterior chest, to detect abnormalities associated with each lobe of the lung. Features to listen for include

- Character and volume of breath sounds
- Presence or absence of vocal sounds
- Pleural friction rubs
- Ratio of inspiration to expiration (I : E ratio)

Cardiac auscultation may reveal signs of pulmonary hypertension, such as a loud pulmonic 2nd heart sound (P_2), and of right heart failure, such as a right ventricular 4th heart sound (S_4) and tricuspid regurgitation.

The character and volume of breath sounds are useful in identifying pulmonary disorders. Vesicular breath sounds are the normal sounds heard over most lung fields. Bronchial breath sounds are slightly louder, harsher, and higher pitched; they normally can be heard over the trachea and over areas of lung consolidation, such as occur with pneumonia.

Typical breath sounds heard over most lung fields.

Normal Breath Sounds

Audio file courtesy of David W. Cugell, MD.

Typical breath sounds heard over the trachea and areas of lung consolidation.

Normal Bronchial Breath Sounds

Audio file courtesy of David W. Cugell, MD.

Crackles

Audio file courtesy of David W. Cugell, MD.

Prolonged expiratory phase with wheezing.

Wheezing

Audio file courtesy of David W. Cugell, MD.

Inspiratory stridor in croup.

Stridor

Audio file courtesy of David W. Cugell, MD.

A leathery sound that fluctuates with the respiratory cycle.

Friction Rub

Audio file courtesy of David W. Cugell, MD.

Areas of consolidation cause a patient's vocalized "E" to sound like "A."

E to A Change

Audio file courtesy of David W. Cugell, MD.

Adventitious sounds are abnormal sounds, such as crackles, rhonchi, wheezes, and stridor.

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