

## **SPUTUM EXAMINATION**

The mucous blanket is an important cleansing mechanism of the tracheobronchial tree. Inhaled particles stick to the mucus. The distal ends of the cilia continually strike the innermost portion of the gel layer and propel the mucous layer, along with any foreign particles, toward the larynx. At this point, the cough mechanism moves secretions beyond the larynx and into the oropharynx. This mucociliary mechanism is commonly referred to as the mucociliary transport or the mucociliary escalator.

Excessive sputum production is commonly seen in respiratory diseases that cause an acute or chronic inflammation of the tracheobronchial tree. Depending on the severity and nature of the respiratory disease, sputum production may take several forms. For example, during the early stages of tracheobronchial tree inflammation, the sputum is usually clear, thin, and odorless. As the disease intensifies, the sputum becomes yellow-green and opaque. The yellow-green appearance results from an enzyme (myeloperoxidase) that is released during the cellular breakdown of leukocytes. It may also be caused by retained or stagnant secretions or secretions caused by an acute infection. Thick and tenacious sputum is commonly seen in patients with chronic bronchitis, bronchiectasis, cystic fibrosis, and asthma. Patients with pulmonary edema expectorate a thin, frothy, pinkish sputum. Technically, this fluid is not true sputum. It results from the movement of plasma and red blood cells across the alveolar-capillary membrane into the alveoli. Hemoptysis is the coughing up of blood or bloodtinged sputum from the tracheobronchial tree. In true hemoptysis the sputum is usually bright red and interspersed with air bubbles. Clinically, hemoptysis may be confused with hematemesis, which is blood that originates from the upper gastrointestinal tract and usually has a dark, coffee-ground appearance. Repeated expectoration of blood-streaked sputum is seen in chronic bronchitis, bronchiectasis, cystic fibrosis, pulmonary embolism, lung cancer, necrotizing infections, tuberculosis, and fungal diseases. A small amount of hemoptysis is common after bronchoscopy, particularly when biopsies are performed. Massive hemoptysis is defined as coughing up 400 to 600 mL of blood within a 24-hour period. Death from exsanguination resulting from hemoptysis is rare.

<b>TABLE 2-12 Analysis of Sputum Color and Characteristics</b>	
<b>Color/Characteristics</b>	<b>Indications and Conditions</b>
Brown/dark	Old blood
Bright red (hemoptysis)	Fresh blood (bleeding tumor, tuberculosis)
Clear and translucent	Normal
Copious	Large amount
Frank hemoptysis	Massive amount of blood
Green	Stagnant sputum or gram-negative bacteria
Green and foul smelling	Pseudomonas or anaerobic infection
Mucoid (white/gray)	Asthma, chronic bronchitis
Pink, frothy	Pulmonary edema
Tenacious	Secretions that are sticky or adhesive or otherwise tend to hold together
Viscous	Thick, viscid, sticky, or glutinous
Yellow or opaque	Presence of white blood cells, bacterial infection

## Sputum Examination

A sputum sample can be obtained by expectoration, tracheal suction, or bronchoscopy. In addition to the analysis of the amount, quality, and color of the sputum, the sputum sample may be examined for (1) culture and sensitivity, (2) Gram stain, (3) acid-fast smear and culture, and (4) cytology. For a culture and sensitivity study, a single sputum sample is collected in a sterile container. This test is performed to diagnose bacterial infection, select an antibiotic, and evaluate the effectiveness of antibiotic therapy. The turnaround time for this test is 48 to 72 hours. Gram staining of sputum is performed to classify bacteria into gram-negative organisms and gram-positive organisms. The results of the Gram stain tests guide therapy until the culture and sensitivity results are obtained.

**BOX 8-1 Common Organisms Associated With Respiratory Disorders**

**Gram-Negative Organisms**

*Klebsiella*  
*Pseudomonas aeruginosa*  
*Haemophilus influenzae*  
*Legionella pneumophila*

**Gram-Positive Organisms**

*Streptococcus* (80% of all bacterial pneumonias)  
*Staphylococcus*

**Viral Organisms**

*Mycoplasma pneumoniae*  
Respiratory syncytial virus

The acid-fast smear and culture is performed to determine the presence of acid-fast bacilli (e.g., *Mycobacterium tuberculosis*). A series of three early morning sputum samples is tested. The respiratory therapist should take care in obtaining a clean sample that is not contaminated. Cytology examination entails the collection of a single sputum sample in a special container with fixative solution. The sample is evaluated under a microscope for the presence of abnormal cells that may indicate a malignant condition. The amount, color, and components of the sputum are often important in the assessment and diagnosis of many respiratory disorders, including tuberculosis, pneumonia, cancer of the lungs, and pneumoconiosis.

**TABLE 8-1 Sputum Correlations**

Sputum Characteristics	Correlations
Yellow Sputum	Acute infection
Green Sputum	Associated with old, retained secretions. Green and foul-smelling secretions are frequently found in patients with anaerobic or <i>Pseudomonas</i> infection, such as bronchiectasis, cystic fibrosis, and lung abscess
Thick, stringy, and white or mucoid sputum	Bronchial asthma
Brown sputum	Presence of old blood
Red sputum	Fresh blood