

McCance: Pathophysiology, 6th Edition

Chapter 33: Alterations of Pulmonary Function

Key Points – Print

SUMMARY REVIEW

Clinical Manifestations of Pulmonary Alterations

1. Dyspnea is a feeling of breathlessness and increased respiratory effort.
2. Abnormal breathing patterns are adjustments made by the body to minimize the work of respiratory muscles. They include Kussmaul, obstructed, restricted, gasping, Cheyne-Stokes respirations, and sighing.
3. Hypoventilation is decreased alveolar ventilation caused by airway obstruction, chest wall restriction, or altered neurologic control of breathing. Hypoventilation causes increased PaCO₂.
4. Hyperventilation is increased alveolar ventilation produced by anxiety, head injury, or severe hypoxemia. Hyperventilation causes decreased PaCO₂.
5. Cyanosis is a bluish discoloration of the skin caused by desaturation of hemoglobin, polycythemia, or peripheral vasoconstriction.
6. Clubbing of the fingertips is associated with diseases that interfere with oxygenation of the tissues.
7. Coughing is a protective reflex that expels secretions and irritants from the lower airways.
8. Hemoptysis is expectoration of bloody mucus that can be caused by bronchitis, TB, abscess, neoplasms, and other conditions that cause hemorrhage from damaged vessels.
9. Chest pain can result from inflamed pleurae, trachea, bronchi, or respiratory muscles.
10. Hypercapnia is increased PaCO₂ caused by a decrease in minute volume (respiratory rate × tidal volume).
11. Hypoxemia is a reduced PaO₂ caused by (1) decreased oxygen content of inspired gas, (2) hypoventilation, (3) diffusion abnormality, (4) ventilation-perfusion mismatch, or (5) shunting.
12. Acute respiratory failure is caused by inadequate gas exchange or ventilation (PaO₂ ≤50 mmHg or PaCO₂ ≥50 mmHg and pH ≥7.25).

Disorders of the Chest Wall and Pleura

1. Chest wall compliance is diminished by obesity and kyphoscoliosis, which compress the lungs, and by neuromuscular diseases that impair chest wall muscle function.
2. Flail chest results from rib or sternal fractures that disrupt the mechanics of breathing.

3. Pneumothorax is the accumulation of air in the pleural space. It can be caused by spontaneous rupture of weakened areas of a pleura or can be secondary to pleural damage caused by disease, trauma, or mechanical ventilation.
4. Tension pneumothorax is a life-threatening condition caused by trapping of air in the pleural space.
5. Pleural effusion is the accumulation of fluid in the pleural space, usually resulting from disorders that promote transudation or exudation from capillaries underlying the pleura but occasionally resulting from blockage or injury that causes lymphatic vessels to drain into the pleural space.
6. Empyema is the presence of pus in the pleural space (infected pleural effusion). The source of the pus is usually lymphatic drainage from sites of bacterial pneumonia.

Pulmonary Disorders

1. Aspiration is passage of fluid and solid particles into the lung, usually from impaired swallowing and coughing. It frequently results in pneumonitis and pulmonary infection.
2. Atelectasis is the collapse of alveoli resulting from compression of the lung tissue or absorption of gas from obstructed alveoli.
3. Bronchiectasis is abnormal dilation of the bronchi secondary to another pulmonary disorder, usually infection or inflammation.
4. Bronchiolitis is the inflammatory obstruction of small airways. It is most common in children.
5. Pulmonary fibrosis is an excessive amount of connective tissue in the lung. It diminishes lung compliance and may be idiopathic or caused by disease.
6. Inhalation of noxious gases or prolonged exposure to high concentrations of oxygen can damage the bronchial mucosa or alveolocapillary membrane and cause inflammation or acute respiratory failure.
7. Pneumoconiosis, which is caused by inhalation of dust particles in the workplace, including coal dust, can cause pulmonary fibrosis, susceptibility to lower airway infection, and tumor formation.
8. Silicosis is a type of pneumoconiosis caused by inhalation of silica.
9. Allergic alveolitis is an allergic or hypersensitivity reaction to many allergens.
10. Pulmonary edema is excess water in the lung caused by disturbances of capillary hydrostatic pressure, capillary oncotic pressure, or capillary permeability. A common cause is left-sided heart failure that increases the hydrostatic pressure in the pulmonary circulation.
11. ARDS results from an acute, diffuse injury to the alveolocapillary membrane and decreased surfactant production, which increases membrane permeability and causes edema and atelectasis.
12. Obstructive pulmonary disease is characterized by airway obstruction that causes difficult expiration. Obstructive disease can be acute or chronic and includes asthma, chronic bronchitis, and emphysema.

13. In asthma, obstruction is caused by episodic attacks of bronchospasm, bronchial inflammation, mucosal edema, and increased mucus production.
14. COPD is the coexistence of chronic bronchitis and emphysema.
15. Chronic bronchitis causes airway obstruction resulting from bronchial smooth muscle hypertrophy and production of thick, tenacious mucus.
16. In emphysema, destruction of the alveolar septa and loss of passive elastic recoil lead to airway collapse and obstruct gas flow during expiration.
17. Emphysema in which septal deterioration is caused by α_1 -antitrypsin deficiency or old age tends to be panacinar.
18. Emphysema in which septal deterioration results from smoking tends to be centriacinar.
19. Upper respiratory tract infections, which are the most common cause of short-term disability in the United States, include rhinitis (the common cold), pharyngitis, and laryngitis.
20. Serious lower respiratory tract infections, which occur most often in older adults and individuals with impaired immunity or underlying disease, include pneumonia and tuberculosis.
21. Pneumococcal pneumonia is an acute lung infection resulting in an inflammatory response with four phases: (1) consolidation, (2) red hepatization, (3) gray hepatization, and (4) resolution.
22. Viral pneumonia is an acute, self-limiting lung infection usually caused by the influenzavirus.
23. TB is a lung infection caused by *M. tuberculosis* (tubercle bacillus).
24. In TB the inflammatory response isolates colonies of bacilli by enclosing them in tubercles and surrounding the tubercles with scar tissue.
25. Bacilli may remain dormant within the tubercles for life or, if the immune system breaks down, cause recurrence of active disease.
26. Abscesses are circumscribed areas of destruction of lung parenchyma with suppuration usually resulting from aspiration pneumonia.
27. Pulmonary vascular diseases are caused by embolism or hypertension in the pulmonary circulation.
28. PE is occlusion of a portion of the pulmonary vascular bed by a thrombus (most common), a tissue fragment, or an air bubble. Depending on its size and location, the embolus can cause hypoxic vasoconstriction, pulmonary edema, atelectasis, pulmonary hypertension, shock, and even death.
29. Pulmonary hypertension (pulmonary artery pressure 5 to 10 mmHg greater than normal) is caused by (1) elevated left ventricular pressure, (2) increased blood flow through the pulmonary circulation, (3) obliteration or obstruction of the vascular bed, or (4) active constriction of the vascular bed produced by hypoxemia or acidosis.

30. Cor pulmonale is right ventricular enlargement caused by chronic pulmonary hypertension. Cor pulmonale progresses to right ventricular failure if the pulmonary hypertension is not reversed.
31. Lip cancer is most common in men and represents about 1% of all cancers. In the most common cell type, squamous cell, metastasis is rare when lesions are diagnosed and treated early.
32. Laryngeal cancer occurs primarily in men and represents 2% to 3% of all cancers. Squamous cell carcinoma of the true vocal cords is most common and manifests with a clinical symptom of progressive hoarseness.
33. Lung cancer, the most frequent cause of cancer death in the United States, is commonly caused by cigarette smoking.
34. Cancer cell types include squamous cell carcinoma, small cell (oat cell) carcinoma, adenocarcinoma, large cell carcinoma, bronchial adenoma, and mesothelioma. Each type arises in a characteristic site or type of tissue, causes distinctive clinical manifestations, and differs in likelihood of metastasis and prognosis.
35. Bronchial carcinoid and adenocystic tumors are rare tumors of the bronchial airways.