

10.4 Interference of gas exchange

p. 452 - 458

Respiratory System

- Primary function of the respiratory system: the uptake and delivery of _____ to the body cells and the removal of carbon dioxide

Diseases and Disorders of the Lungs

- Diseases and disorders of the lungs may _____ the sufficient delivery of air to the alveoli or reduce the surface area for diffusion, impairing the process of gas exchange.
- Regardless of the cause or mechanism, the result is the same: insufficient oxygen is available to the tissues of the body.

1. **Asthma:** a chronic (no cure) respiratory disease characterized by _____ and swelling of the bronchi and bronchioles that _____ airflow

- Inflammation is a protective reaction to eliminate foreign substances or infection. It is characterized by swelling and redness due to increased blood flow to the affected tissue
- When the lining of the airways swell, airflow to the lungs is _____
- Inflammation also stimulates the overproduction of mucus, which contributes to reduced airflow
- Muscles around the bronchi and bronchioles become sensitive and contract, further narrowing the openings and restricting airflow
- **Symptoms:** wheezing, tightness in chest, shortness of breath
 - A _____ worsening of symptoms is called an asthma attack, which can be triggered by cigarette smoke, dust, cold air, physical exertion, allergens etc.
- **Treatments:**
 - Avoid _____
 - Inhalers administer drugs that _____ (widen) the bronchi and bronchioles to allow greater airflow, and/or reduce inflammation
- Worldwide, the most prevalent respiratory problem and the most _____ chronic, or frequently recurring condition in children
- In Canada, nearly 10% of the population suffers from asthma

2. **Chronic Obstructive Pulmonary Disease (COPD):** a chronic, progressive disease that involves both obstructive bronchitis and emphysema

1. **Obstructive Bronchitis** - the _____ and inflammation of the airways

- The linings of the bronchi and bronchioles swell and produce excess _____

2. **Emphysema** causes permanent damage to the alveoli

- Damages the _____ between the alveoli and reduces the alveolar elasticity and shape (less surface area so gas exchange is reduced); worsens over time
- It is estimated that 80-90% of COPD cases are caused by _____ smoke but genetic disorders and prolonged exposure to pollution or fumes can contribute
- **Symptoms:** coughing, wheezing, chest tightness, and shortness of breath
- People with COPD are likely to die from it, or from a related complication
- **Treatments:** Proper management, medications, lifestyle changes may slow the progress of the disease
 - In severe cases, oxygen therapy or lung _____ may be necessary

3. **Respiratory Infections**

- The respiratory system is probably the most _____ part of our body because of the constant exposure of living tissue to the external environment
- Although there are many safety mechanisms (hairs, mucus, cilia etc.), there are many respiratory infections caused by viruses and airborne microorganisms like bacteria or fungi

a) **Influenza – the Flu**

- Caused by a _____ - viruses are always evolving and new strains appear every year
- May affect the whole body or be confined to the lungs
- **Symptoms:** fever, dry cough, sore throat, runny nose, aches and pains
- **Treatment:** Most people recover without treatment in a week, but _____ drugs can also be administered to shorten the length of the infection
- Highly _____ through droplets (cough and sneeze) in the air, as well as through contact with contaminated surfaces
- Vaccines can prevent infection

b) **Pneumonia:** an infection of the lungs that causes the alveoli to fill with _____ and mucus, preventing gas _____

- Also causes inflammation of the lining of the bronchi, bronchioles and alveoli
- Caused by bacteria, viruses, or fungi
- **Symptoms:** fever, cough, shortness of breath
- Diagnosed by analyzing mucus that is coughed up from the lungs, or by x-rays to show areas of the lungs blocked with _____
- Those with weakened immune systems are especially susceptible
- **Treatment:** Bacterial pneumonia can be treated with antibiotics
- 5% fatality rate among those who develop pneumonia

- c) **Tuberculosis (TB):** a _____ infection that damages the tissues of the lungs causing _____ to form that are filled with gas
- Affects the lungs but can move from the lungs to affect the _____ system, the bones and joints in the spine and other parts of the body
 - Spread through the air when infected people sneeze or cough
 - **Symptoms:** coughing, chest pain, weight loss, night sweats, and coughing up blood
 - Estimated that one-third of the world's population is currently infected, but most cases remain inactive
 - Only a 5-10% chance that an inactive infection becomes _____
 - **Treatment:** six month course of antibiotics
 - A vaccine has been available since 1921, however TB persists because some strains of bacteria are resistant to antibiotics
 - TB kills almost 3 million people annually, and is mostly found in _____ countries

4. Cystic Fibrosis (CF)

- A _____ disorder in which the gene that influences mucus production is defective
- This gene was discovered at the Hospital for Sick Children in Toronto!
- A person with CF produces unusually _____ and _____ mucus that clogs the airways; airflow to the lungs is reduced
- **Symptoms:** persistent cough and excess mucus
 - This increased mucus creates the ideal environment for the _____ of bacteria and fungi
 - CF patients often suffer from lung infections
- **Treatment:** _____ excess mucus, ongoing therapy, even lung transplants
- Also affects the digestive system
 - Thick secretions of mucus in the pancreas prevent it from secreting _____ enzymes
 - Scar tissue in the pancreas can also lead to a form of _____
- It gets progressively worse with age so it is important to diagnose and start treatment early
- All _____ in Ontario are checked at birth for CF
- Research continues in gene therapy in hopes to find a cure

Effects of smoking

- Smoking is the single _____ cause of respiratory diseases and preventable deaths in the developed world
- Smoking is known to cause lung cancer, COPD, bronchitis, emphysema and asthma (in addition to diseases of the circulatory system)

Effects of smoking on gas exchange

- Three substances that cause the most problems: nicotine, carbon monoxide, and tar
 - **Nicotine** - addictive chemical that stimulates our body's natural _____ and blocks other chemicals that allow signals to be sent from the brain around the body. Also causes _____ of the arteries and reduced blood flow affecting transport of gases
 - **Carbon monoxide** - can replace oxygen molecules that bind to _____ → reducing the amount of oxygen delivered to the cells
 - **Tar** - black, sticky substance that accumulates in the alveoli
 - contains many chemicals that are carcinogenic, irritate the linings of airways and inactivate _____ on the cells
- Cigarette smoke also contains carcinogenic (_____ causing) substances