

## OVERVIEW OF OBSTRUCTIVE AIRWAYS DISEASE (OAD)

### Definition of OAD

Obstructive airways disease is a group of conditions distinguished by increased resistance and obstruction in the air passages, especially during expiration. The term OAD includes bronchial asthma; chronic obstructive pulmonary disease (COPD), consisting of chronic bronchitis and emphysema; and the common cold. The basic causes of OAD are irritants, infections, and allergies.

Asthma is a disease involving increased responsiveness of the airways to various stimuli, with a narrowing of the airways that is at least partially reversible. Chronic bronchitis is characterized by a productive cough, and emphysema is defined in terms of microscopic pathologic changes in the alveoli. Chronic bronchitis and emphysema may coexist, and are often misinterpreted as one disease (COPD). Chronic bronchitis and especially emphysema are associated with some irreversible bronchial obstruction, but often a reversible component exists as well. The degree of each component varies with the progression of the disease.

### Diagnosis of OAD

Diagnosis is based on the patient's history, signs, and symptoms, and on the results of spirometry and other pulmonary function tests.

Spirometry assesses the obstruction of expiratory airflow, which is the characteristic functional defect in OAD. Critical parameters include forced vital capacity (FVC) and forced expiratory volume in one second (FEV<sub>1</sub>). FVC, the maximum volume forcefully exhaled, is considered abnormal if it is less than 80% of the value in a healthy comparable person. FEV<sub>1</sub> is normally greater than 75% of the FVC. OAD is associated with a decrease in FEV<sub>1</sub> and FEV<sub>1</sub>% (the ratio of FEV<sub>1</sub> and FVC), and FVC may also be decreased.

Figure 1: Normal and Abnormal Spirograms

maximum expiratory flow rate = an indication of the rate of air flow in the smaller airways

peak expiratory flow rate = the highest rate at which air flows in the airways

Diagnosis of OAD

|                 | Chronic Bronchitis   | Emphysema   | Asthma  |
|-----------------|--|---|---|
| Patient History | Cigarette smoking, productive cough, dyspnea upon exertion   | Cigarette smoking, dyspnea without productive cough                                 | Episodic wheezing, persistent cough, shortness of breath in nonsmoker           |
| Physical Exam   | Wheezing, rhonchi, distant breath sounds, evidence of heart failure and cyanosis only in most severe cases | Distant breath sounds, wheezing, barrel chest                                       | Wheezing, distant breath sounds, cyanosis only during very severe acute attacks |
| Spirometry      | Decreases in FVC and especially FEV1 parallel the severity of the patient's disease                        | Decreases in FVC and especially FEV1 parallel the severity of the patient's disease | Decreased FVC and FEV1 during acute attacks; may persist to some degree         |

## Overview of OAD Therapy

The primary goal of therapy is to improve pulmonary airflow. Treatment is directed toward relieving the patient's symptoms, preventing exacerbations, and allowing the patient to live a more active life. Bronchodilators (adrenergic agents, theophyllines, and anticholinergic agents) relax bronchial smooth muscle and increase the caliber of the bronchial lumina. They are considered first-line therapy in OAD. Corticosteroids are helpful in severe, acute situations and refractory cases. Cromolyn is used prophylactically in asthma.

Many OAD patients require continuous therapy, and drug combinations are sometimes used to increase bronchodilation. Some patients need ancillary therapy with antibiotics, mucolytics, antihistamines, other drugs, and/or supplemental oxygen.

### Goals of Therapy in OAD

Chronic  
Bron-  
chitis  
and Em-  
physema

- o Reduce bronchial irritation
- o Control respiratory infection
- o Reduce bronchospasm

Acute  
Asthma

- o Alleviate the attack (relieve bronchospasm):
  - bronchodilation
  - prevention of mediator release

Chronic  
Asthma

- o Prevent acute attacks:
  - avoidance of allergens and/or irritants, stimuli
  - desensitization (?)
  - prophylactic drug therapy

## Anatomy and Physiology of the Respiratory System

The respiratory system consists of passageways that convey air between the external environment and the alveoli. Within the respiratory tract, cilia, mucus, and macrophages help prevent foreign particles from reaching the alveoli.

Figure 2: Anatomy of the Respiratory System

## The Respiratory Process

| System in Control | Stage | Process   |
|-------------------|-------|---|
| respiratory       | I     | ventilation<br><ul style="list-style-type: none"><li>o exchange of O<sub>2</sub> and CO<sub>2</sub> between external environment and the lungs</li></ul>  |
| respiratory       | II    | external respiration<br><ul style="list-style-type: none"><li>o exchange of O<sub>2</sub> and CO<sub>2</sub> between the lungs and blood in pulmonary capillaries</li></ul>                               |
| circulatory       | III   | transport<br><ul style="list-style-type: none"><li>o blood transport of O<sub>2</sub> from the lungs to body tissues</li><li>o blood transport of CO<sub>2</sub> from body tissues to the lungs</li></ul> |
| circulatory       | IV    | internal respiration<br><ul style="list-style-type: none"><li>o exchange of O<sub>2</sub> and CO<sub>2</sub> between systemic circulation and body tissues</li></ul>                                      |

### Role of the Nervous System in Respiration

The autonomic nervous system (ANS) regulates respiration and other involuntary functions. A network of nerves connects the ANS with the central nervous system (CNS), which mediates many autonomic functions.