

2 PATHOPHYSIOLOGY OF LUNG DISEASE

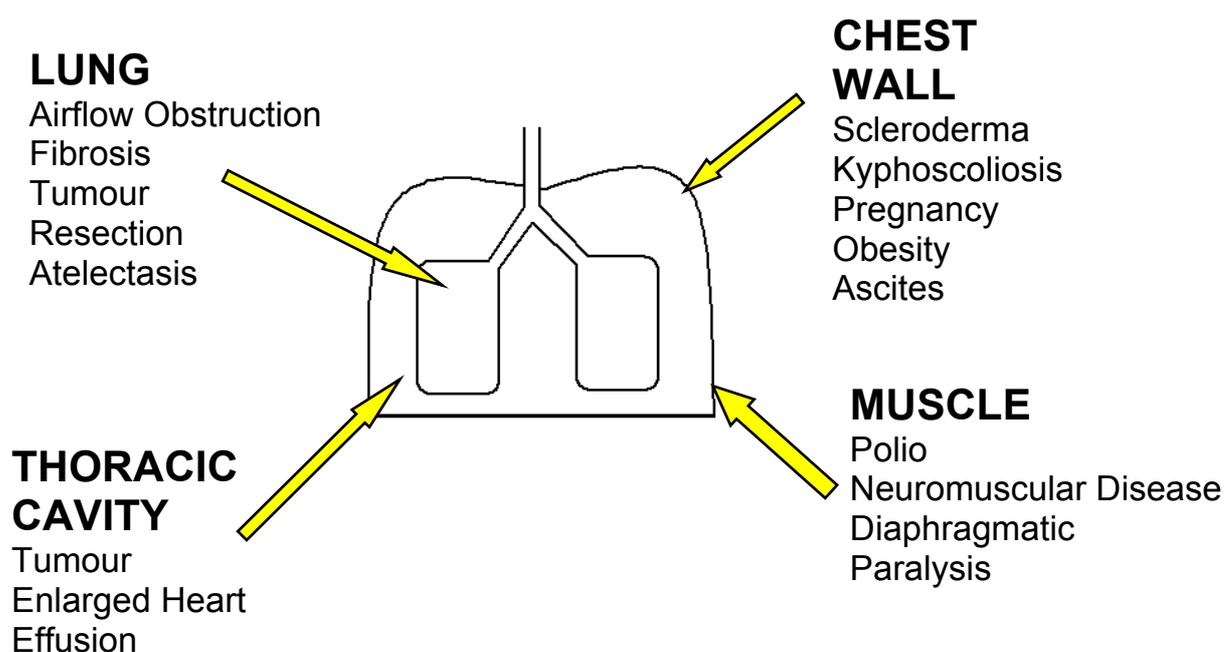
2.1 Introduction

Diseases that affect lung function cause one of two patterns of dysfunction – ‘obstructive’ and ‘restrictive’. Obstructive diseases include diseases characterised by a reduction in airflow and airflow limitation including asthma, chronic bronchitis, chronic obstructive pulmonary disease (COPD) and emphysema. Restrictive lung diseases are characterised by a reduction in lung size or an increase in lung stiffness resulting in a decrease in the maximum volume of air that is able to be moved in and out of the lungs e.g. pulmonary fibrosis, asbestosis. Restrictive disorders may also occur as a result of mechanical abnormalities such as respiratory muscle weakness (neuromuscular disorders) and abnormalities of the chest wall (e.g. kyphoscoliosis, thoracic wall deformity). Other systemic diseases are also known to affect the function of the lung including rheumatoid arthritis, congestive heart failure, and scleroderma. Furthermore, certain commonly used drugs are known to cause abnormalities within the lung e.g. methotrexate, amiodarone.

These two patterns of lung dysfunction may arise from one of five main abnormalities:

- Respiratory disorders e.g. fibrosis, oedema, congestive heart failure (CHF), pleural disease, resection, emphysema
- Airway disease e.g. asthma, COPD
- Pleural cavity e.g. effusion, enlarged heart, tumour
- Chest wall e.g. scleroderma, ascites, pregnancy, obesity, kyphoscoliosis
- Muscle disorders e.g. neuromuscular disease, polio, diaphragmatic paralysis

Figure 2.1 Classification of respiratory disorders



2.2 Obstructive Lung Disorders

Obstructive diseases of the lung are extremely common and second only to heart disease as a cause of disability, with mortality rates also increasing. The distinction between different types of obstructive lung disease may be difficult to ascertain such that differential diagnosis may be difficult.

Airway obstruction may be due to one of three conditions (1) obstruction inside the airway lumen; (2) obstruction in the wall of the airway; (3) obstruction outside the airways in the peribronchial region.

1. Obstruction inside the airway lumen may be a result of occlusion by excessive secretions as occurs in chronic bronchitis. Pulmonary oedema or inhalation of a foreign body may result in a partial obstruction and post-operatively, secretions retained within the airway may also result in narrowing of the lumen.
2. Obstruction in the wall of the airway may be due to contraction of bronchial smooth muscle, as in asthma or hypertrophy of the mucus glands, as in chronic bronchitis. Both asthma and chronic bronchitis are also associated with inflammation and oedema of the airway wall both of which predispose to narrowing of the airway lumen.
3. Outside the airway, airway narrowing is caused by a loss of radial traction due to destruction of the surrounding lung parenchyma. This occurs in diseases such as emphysema. Local obstruction may also be caused by a tumour or enlarged lymph node.

2.2.1 Asthma – Definition and Characteristics

This disease is characterised by inflammatory changes in the airway wall leading to irritability and responsiveness to various stimuli. The inflammation involves:

- Oedema
- Infiltration with cells
- Disruption and detachment of the epithelial layer
- Mucous gland hypertrophy
- Sub epithelial layer – laying down of collagen
- Also other extracellular matrix proteins

This remodelling of the airway in response to inflammation can resolve but may result in permanent fibrotic changes. The inflammation is due to increased responsiveness of the airways to various stimuli and manifest by widespread narrowing of the airways that changes in severity either spontaneously or a result of treatment. The clinical features of asthma are shown in Table 2.1. Symptoms of asthma are commonly encountered in childhood but the disease can occur at any age. While many asthmatic children 'outgrow' the disease, in other individuals the problems persist into adulthood.

Patients may often be able to relate their symptoms to a specific stimulus or 'antigen', for example, pollen or animal fur. Such individuals are said to have atopic or extrinsic asthma. In contrast, if there is no general history of allergy and no external allergen can be identified, the terms non-atopic asthma or intrinsic asthma are sometimes used.