Obstryctive lung (airway) diseases 2

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Chronic bronchitis :

Is diagnosed on clinical grounds ; it is defined by the persistent productive cough for at least 3 consecutive months in at least 2 consecutive years .

It is common among cigarette smokers and urban dwellers in smog-ridden cities .

20% - 25% of men in the 40-to 65-year-old age group have the disease .

Pathogenesis :

The distinctive feature of chronic bronchitis is hypersecretion of mucous , beginning in the large airways.

The most important cause is cigarette smoking ,sulfur dioxide and nitrogen dioxide .

Chronic bronchitis with significant airflow obstruction almost always is complicated by emphysema .

The effects of environmental irritants on respiratory epithelium are mediated by local release of cytokines such as IL-13 from T cells and innate lymphoid cells .

The transcription of the mucin gene in bronchial epithelium and the production of neutrophil elastase are increased as a consequence of exposure to tobacco smoke .

Microbial infection often is present but has a secondary role .

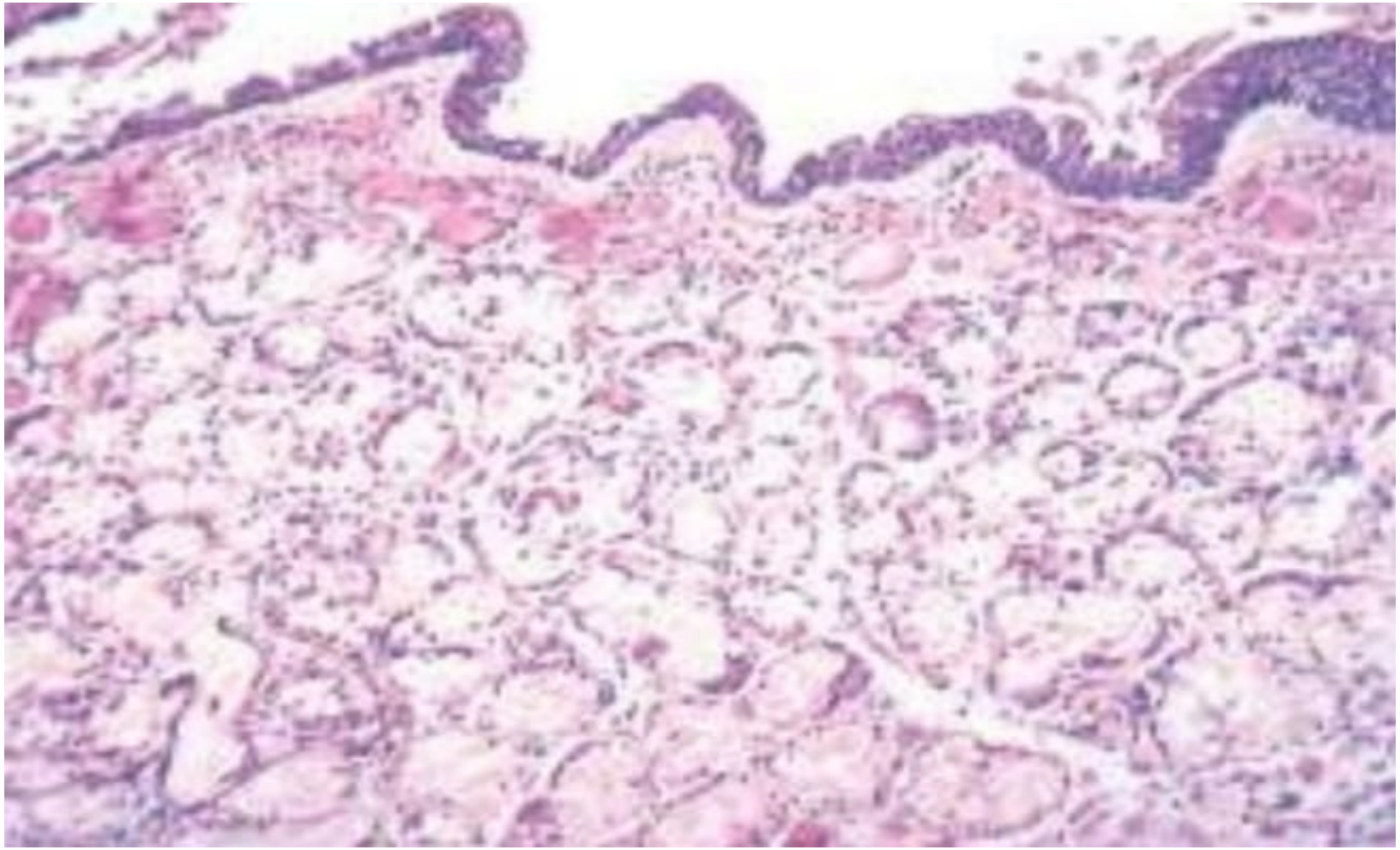
Gross : The mucosal lining of the larger airways usually is hyperemic and swollen by edema fluid and is covered by a layer of mucinous or mucopurulent secretions .

The smaller bronchi and bronchioles also may be filled with secretions.

The diagnostic features of chronic bronchitis in the trachea and larger bronchi is enlargement of the mucus-secreting glands .

Reid index : the magnitude of the increase in size is assessed by the ratio of the thickness of the submucosal gland layer to that of the bronchial wall (normally 0.4) .

Lymphocytes ,macrophages , neutrophils are frequently seen in the bronchial mucosa .



Chronic bronchiolitis : (small airway disease) characteriszedby goblet cell metaplasia , mucous plugging , inflammation and fibrosis .

Bronchiolitis obliterans : severe cases of bronchiolitis there may be complete obliteration of the lumen as consequence of fibrosis. Emphysematous changes often coexist.

Clinical features :

The course is quite variable .

Cough and sputum production persist without ventilatory dysfunction

To COPD with significant outflow obstruction marked by hypercapnia ,hypoxemia and cyanosis .

Asthma

- Is chronic inflammatory disorder of the airways that causes recurrent episodes of wheezing , breathlessness , chest tightness , and cough , particularly at night and / or early morning .
- The hallmarks of asthma are intermittent , reversible airway obstruction; chronic bronchial inflammation with eosinophils ; bronchial smooth muscle cell hypertrophy and hyperreactivity ; and increased mucus secretion .
- Many cells play a role in the inflammatory response in particular :

  eosinophils , mast cells , macrophages , lymphocytes , neutrophils , and epithelial cells .

- Pathogenesis
- Major factors contributing to the development of asthma include genetic predisposition to type I hypersensitivity (atopy) , acute and chronic airway inflammation , and bronchial hyperresponsiveness to variety of stimuli .
- Mast cell-derived mediators produce two waves of reaction :

1. The early-phase reaction is dominated by bronchoconstriction (triggered by histamine , prostaglandin D2 , LTC4 , D4 and E4 , and reflux neural pathways), increased mucus production , and vasodilation .
2. The late-phase reaction is inflammatory in nature . Inflammatory mediators stimulate epithelial cells to produce chemokines (eotaxin a potent chemoattractant and activator of eosinophils) that promote the recruitment of TH 2 cells , eosinophils , and leukocytes .

3. Airway remodeling

- hypertrophy and/ or hyperplasia of bronchial smooth muscle .

- deposition of subepithelial collagen .

- increased submucosal vascularity .

- sub-basement membrane fibrosis .

- submucosal gland hypertrophy and goblet cells metaplasia of the airway epithelium .

- thickening of airway .

Asthma tends to run in families , but the role of genetics is complex

- The classic atopic asthma : the most common type of asthma and is a classic example of type I IgE –mediated hypersensitivity reaction .

  Associated with excessive type 2 helper T cell activation , which produce IL-4 and IL-13 activate IgE production , IL-5 activate eosinophils

  Usually it begins in childhood .

  A positive family history of atopy and/or asthma is common .

  Asthmatic attack is often preceded by allergic rhinitis , urticaria , or eczema , pollen , animal dander ,food or infection .

  Skin test positive .

  RAST serum for specific allergens .

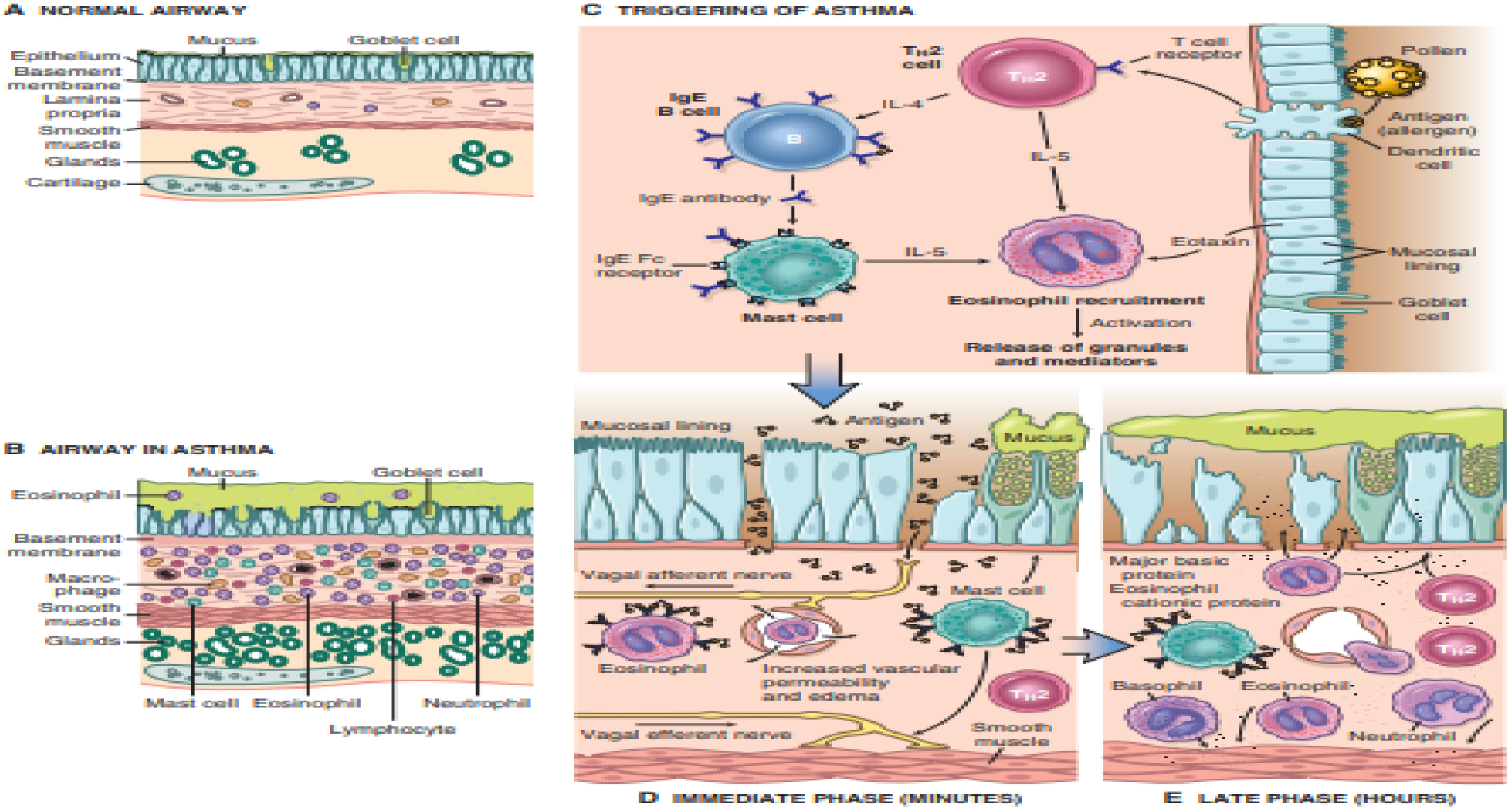


Fig. 13.10 (A and B) Comparison of a normal airway and an airway involved by asthma. The asthmatic airway is marked by accumulation of mucus in the bronchial lumen secondary to an increase in the number of mucus-secreting goblet cells in the mucosa and hypertrophy of submucosal glands; intense chronic inflammation due to recruitment of eosinophils, macrophages, and other inflammatory cells; thickened basement membrane; and hypertrophy and hyperplasia of smooth muscle cells. (C) Inhaled allergens (antigen) elicit a T_H2-dominated response favoring IgE production and eosinophil recruitment. (D) On reexposure to antigen (Ag), the immediate reaction is triggered by Ag-induced cross-linking of IgE bound to Fc receptors on mast cells. These cells release preformed mediators that directly and via neuronal reflexes induce bronchospasm, increased vascular permeability, mucus production, and recruitment of leukocytes. (E) Leukocytes recruited to the site of reaction (neutrophils, eosinophils, and basophils; lymphocytes and monocytes) release additional mediators that initiate the late phase of asthma. Several factors released from eosinophils (e.g., major basic protein, eosinophil cationic protein) also cause damage to the epithelium.

Non-Atopic Asthma :do not have evidence of allergen sensitization , and skin test result usually negative .

A positive family history of asthma is less common .

Respiratory infections due to viruses (rhinovirus , parainfluenza virus) and inhaled air pollutants (sulfur dioxide , ozone , nitrogen dioxide) are common triggers .

Drug-induced Asthma :Aspirin is the most striking example . Patients present with recurrent rhinitis , nasal polyps , urticaria and bronchospasm .

The pathogenesis is unknown .

- Occupational Asthma : may triggers by fumes (epoxy resin , plastic) , organic and chemical dusts (wood , cotton , platinum) , gases (toluene) .
- The most striking finding in Asthma is occlusion of bronchi and bronchioles by thick , tenacious mucous plug containing whorls of shed epithelium Curschmann spirals . Numerous eosinophils and Chacot-Leyden crystals (crystalloids made up of the eosinophil protein galectin-10).
- Clinical features :

characterized by severe dyspnea and wheezing .

attacks last from 1 to several hours and subside either spontaneously or with therapy .if lasts days to weeks (status asthmaticus) .

BRONCHIECTASIS

- Is a permanent dilation of bronchi and bronchioles caused by destruction of smooth muscle and the supporting elastic tissue ; it typically results from or is associated with chronic necrotizing infections.
- It always occurs secondary to persistent infection or obstruction .
- Characteristic symptomare cough and expectorationof copious amounts of purulent sputum .
- Diagnosis depends on an appropriate history and radiographic demonstration of bronchial dilation .

- The conditions that most commonly predispose to bronchiectasis include :
    1. Bronchial obstruction .
    2. Congenital or hereditary conditions :
        . Cystic fibrosis
        . Immunodeficiency state , (immunoglobulin deficiencies)
        .Primary ciliary dyskinesia (immotile cilia syndrome) AR
        . Necrotizing or suppurative pneumonia (staphylococcus aureus , klebsiella spp.)

  Bronchiectasis usually affects the lower lobes bilaterally , particularly those air passage that are most vertical.

- The airway may be dilated to as much as four times their usual diameter .
- Histologic findings : Active phase – intense acute and chronic inflammatory exudate within the walls of the bronchi and bronchioles leads to desquamation of lining epithelium and extensive areas of ulceration . When healing occurs the lining epithelium may regenerate completely or abnormal dilation and scaring .
- Clinical features :

Dyspnea

Rhinosinusitis

Hemoptysis

- Severe widespread bronchiectasis may leads to :

  hypoxemia

  hypercapnia

  pulmonary hypertension

  cor pulmonale

Complications :

  brain abscess

  amyloidosis

  cor pulmonale