Definition

Pulmonary disorder characterized by increased resistance to airflow • FEV₁/FVC < 70%.

► Epidemiology
  Among smokers 15–20% develop COPD.

► Etiology, pathophysiology, pathogenesis
  Inflammatory reaction of the large and small airways caused by inhaled noxious agents and involving bronchial obstruction, mucociliary dysfunction, and structural changes (destruction) • Disruption of the physiologic balance between proteases and protease inhibitors • Oxidative stress.

Imaging Signs

► Modality of choice
  CT.

► Radiographic findings
  Often normal • Bronchial walls may appear more pronounced (“tramline” shadows) • Signs of right heart strain.

► CT findings
  Thickened bronchial walls • Mucus retention • Centrilobular emphysema may be present • Enlarged central pulmonary arteries.

► Pathognomonic findings
  Chronic bronchitis and COPD are not radiologic diagnoses • Morphologic findings on the radiograph essentially depend on the severity of the disorder.

Clinical Aspects

► Typical presentation
  Productive cough • Dyspnea • Hemoptysis • Clubbed fingers.
  Reduced FEV₁, abnormal blood gases, elevated C-reactive protein.

  Functional grading FEV₁ (GOLD): Stages 0–IV (I: mild, ≥ 80%; II: moderate, 50–79%; III: severe, 30–49%; IV: very severe, < 30%).

  Systemic components of COPD: weight loss, cachexia (“pink puffer” • pulmonary cachexia in COPD with emphysema) • osteoporosis, muscle atrophy • heart failure, atherosclerosis.

► Therapeutic options
  Tobacco abstinence • Bronchodilators • Inhalational corticosteroids • Oxygen therapy.

► Course and prognosis
  Chronic progressive disorder • Mortality depends on the stage.

► What does the clinician want to know?
  The diagnosis is based on clinical and especially functional parameters • Radiology plays a supporting role by determining the extent of emphysema and identifying complications.
**Differential Diagnosis**

*Asthma*  
- Hyperinflation without parenchymal destruction

*Emphysema*  
- Centrilobular emphysema is often a component of COPD

*Bronchiectasis*  
- Frequent complication of chronic bronchitis

**Selected References**


Vogelmeier C et al. [Pathogenese der COPD.] Internist 2006; 47: 885–894 [In German]
Definition

Diffuse pulmonary and alveolar hemorrhages from various causes.

**Epidemiology**

The most common cause is Goodpasture syndrome (affects young adults, more common in men than women by a ratio of 9:1). Less common causes include collagen vascular diseases (more common in women than men), idiopathic disease (pulmonary hemosiderosis), hemorrhagic diathesis, and diffuse coagulation disorder.

**Etiology, pathophysiology, pathogenesis**

Bleeding into the alveoli due to immune-mediated capillary damage (antibodies to glomerular and alveolar basement membranes in Goodpasture syndrome) or due to nonimmune-mediated capillary damage. Leads successively to recurrent hemorrhage, hemosiderin deposits, and fibrosis.

Imaging Signs

**Modality of choice**

CT is preferable to plain radiography.

**Radiographic findings**

Nodular, confluent to patchy, edemalike shadows. Predominantly basal and central. In the acute stage there is alveolar shadowing. In the subacute stage there is an interstitial reticulonodular pattern. Resolves within 1–2 weeks. Chronic stage (recurrent hemorrhages) leads to fibrosis.

**CT findings**

Findings in the acute stage include ill-defined acinar nodules, circumscribed ground-glass opacities, or diffuse bilateral consolidation that spares the pulmonary periphery. The subacute stage includes micronodules and septal thickening. In the chronic stage there are signs of fibrosis.

**Pathognomonic findings on CT**

Acute nodular or interstitial shadowing that rapidly resolves spontaneously.

Clinical Aspects

**Typical presentation**

Hemoptysis (in 80% of cases but not invariably), dyspnea, cough, and iron-deficiency anemia. Goodpasture syndrome also includes hematuria, renal insufficiency, hypertension. Bronchoalveolar lavage shows hemosiderin-laden macrophages.

**Therapeutic options**


**Course and prognosis**

Variable. Depend on the underlying disorder.

**What does the clinician want to know?**

Diagnosis and differential diagnosis. Stage. Follow-up.
Fig. 7.6  Goodpasture syndrome in a 35-year-old man. The CT scans show bilateral, homogeneously dense, ground-glass opacification that has spared only the subpleural parenchyma.
### Differential Diagnosis

**Pulmonary hemorrhage**
- Goodpasture syndrome: antibodies to basement membrane
- Wegener granulomatosis: ANCA-positive involvement of the paranasal sinuses
- Churg–Strauss syndrome: asthma, blood eosinophilia
- Systemic lupus erythematosus: ANCA-positive
- Polyangiitis: pulmonary and renal syndrome, fever, myalgia, joint pain, 80% of patients are ANCA-positive
- Idiopathic hemosiderosis: occurs in children, no renal involvement, no antibodies

**Pulmonary edema (cardiac, not cardiac)**
- Hemoptyisis rare
- Associated pleural effusion

**Interstitial pneumonia**
- Fever, inflammation parameters
- No hemoptyisis
- No renal involvement

### Tips and Pitfalls

Can be misinterpreted as pulmonary edema or atypical pneumonia.
**Definition**

Lymphoma limited to the chest and lungs, with or without mediastinal lymphadenopathy • No extrathoracic manifestation for at least 3 months.

- **Epidemiology**
  Rare compared with secondary lymphoma arising via hematogenous dissemination or by direct extension from hilar or mediastinal lymphomas.

- **Etiology, pathophysiology, pathogenesis**
  **Forms:**
  - In combination with intrathoracic lymphadenopathy • 10–15% of lymphomas • More common in Hodgkin disease than in non-Hodgkin lymphoma.
  - Primary pulmonary lymphoma (at most with minimal lymph node involvement) • Rare, < 1% of all malignant lymphomas • Either Hodgkin or non-Hodgkin lymphoma • In primary pulmonary non-Hodgkin lymphoma, a distinction is made between low-grade MALT B-cell lymphoma, high-grade non-Hodgkin lymphoma of B-cell type (about two-thirds of cases, usually associated with Epstein–Barr virus; risk groups—HIV-infected patients and organ transplant recipients), and the angioimmunoblastic lymphomas of T-cell type.

**Imaging Signs**

- **Modality of choice**
  CT is preferable to plain radiography.

- **Radiographic findings**
  Broad spectrum of findings ranging from miliary foci to nodules, pneumonia-like infiltrates (with or without air bronchogram), and interstitial and even ground-glass changes.

- **CT findings**
  Broad spectrum of findings (in two-thirds of cases there are bilateral and/or multiple foci)—one or more nodules with or without cavitation • Round or segmental infiltrates (with or without an air bronchogram) • Up to 50% of high-grade lymphomas include liquefaction that may be rapidly progressive • Reticulonodular changes.

- **Pathognomonic findings**
  Rapidly progressive consolidations with an air bronchogram and elongated bronchovascular structures (CT angiogram sign).

**Clinical Aspects**

- **Typical presentation**
  *Low-grade lymphoma:* Asymptomatic in > 50% of cases, otherwise mild nonspecific symptoms (cough, slight dyspnea, chest pain) • *High-grade lymphoma:* Generally symptomatic (symptoms of hepatitis B infection).

- **Confirmation of the diagnosis**
  Biopsy.
Fig. 8.9  Highly malignant Epstein–Barr virus-associated B-cell non-Hodgkin lymphoma in a 39-year-old man with HIV infection. Two-week history of fever, nonproductive cough, and rapid deterioration of general health.

a  The plain chest radiograph shows an extensive, relatively homogeneous infiltration of the right lower lobe, enclosing a small radiolucency consistent with liquefaction.

b  On CT (coronal MIP slices) the finding also appears relatively homogeneous. The major vessels and bronchi are intact (CT angiogram sign and air bronchogram).
Fig. 8.10 MALT lymphoma in a 40-year-old man with HIV infection and weight loss and limited exercise tolerance. Both lungs show large infiltrates resembling round focal lesions that are partially confluent in the basal segments, forming pneumonia-like areas of consolidation. The bronchovascular structures coursing through these areas appear intact; they are not significantly shifted, compressed, or obstructed. These findings suggest lymphoma infiltrates. There may be hilar lymphadenopathy on the right side.
Therapeutic options

Low-grade lymphoma: Watch and wait, resection, or single-modality therapy.

High-grade lymphoma: Treatment depends on the underlying disorder, chemotherapy, modulation of immunosuppression.

Course and prognosis

Low-grade lymphoma has a good prognosis (5-year survival rate is over 80%).

High-grade lymphoma has a poor prognosis, depending on the initial situation (HIV infection, organ transplantation).

What does the clinician want to know?

Staging after diagnosis by biopsy.

Differential Diagnosis

Nodular lesions
- Bronchial neoplasm
- Metastases

Areas of consolidation
- Pneumonia
- Distinguished by history, clinical findings, and course

Interstitial changes
- Pulmonary interstitial disorder

Kaposi sarcoma
- Radiographically indistinguishable

Tips and Pitfalls

Because pulmonary lymphomas are rare, radiographic findings may variously be misinterpreted as pneumonia, malignancy (lung carcinoma, metastases), or pulmonary interstitial disease.

Selected References

