



## HUMANITAS MEDICAL SCHOOL

**Course: Respiratory Diseases**

**Year (1<sup>st</sup>-2<sup>nd</sup>-3<sup>rd</sup>-4<sup>th</sup>-5<sup>th</sup>-6<sup>th</sup>): 3<sup>rd</sup>**

**Period (1<sup>st</sup>-2<sup>nd</sup> semester – annual): 2<sup>nd</sup> semester**

### **Objectives**

The lungs and the respiratory system are far more complex than many other organs and apparatus. The lungs must play multiple roles, gases exchanges, oxygen supplementation, removing of wastes, toxins, and defense against hostile intruders. Nowadays epidemiological data shows that the respiratory diseases are becoming more and more important in terms of morbidity, invalidity, and mortality. Lung diseases are not only a killer, but an impressive number of patients are now living worldwide with a chronic pulmonary disease with a terrific impact on hospitalization and general economic impact. Based on these data, the present course tries to focus on the most important aspects of respiratory medicine examining prevalence, risk factors, physiopathological and clinical features of the most important chapters of lung diseases. For more complex diseases or clinical presentations, an integrated approach with other specialists (i.e.: radiologists, pathologists, pharmacologists, ENT...) will be used to describe in an accurate way the complexity and the heterogeneity of them. The course has been designed according to the European Curriculum Recommendations for Training in Adult Respiratory Medicine (Loddenkemper R. Breathe 2008, Volume 5, No 1). Specific objectives of the Respiratory Diseases course include:

#### **Patient-oriented approach according to respiratory signs and symptoms**

- Describe characteristics and potential causes of cough, sputum production, dyspnoea, wheeze, stridor, haemoptysis, and chest pain.
- Describe characteristics and potential causes of abnormal examination findings, including cyanosis, finger clubbing, chest wall deformities, abnormal breathing patterns, and abnormal findings on inspection, palpation, percussion, and auscultation.

#### **Respiratory Physiopathology**

- Understand ventilation, mechanics of breathing and cardio-pulmonary relationship.
- Describe principles of plethysmography, bronchial hyper-responsiveness, diffusion, blood flow, ventilation-perfusion relationships, and control of ventilation.
- Interpret pulse oximetry, simple spirometry, plethysmography, bronchodilation test, bronchial provocation testing, single breath diffusing capacity, and peak flow monitoring.

#### **Respiratory imaging**

- Describe basic principles of chest radiography, computed tomography (CT; with and without contrast medium), high-resolution CT (HRCT) and bed-side lung ultrasound (LUS).

- Perform a basic interpretation of chest radiographs (PA, AP and lateral views).
- Perform a basic interpretation of CT scans (identification of mass lesions, consolidation, collapse, mediastinal/hilar lymphadenopathy, interstitial lung disease, hyperinflation/air-trapping, bronchiectasis, ground-glass shadowing, pneumothorax and pleural effusions/plaques).
- Perform a basic interpretation of bed-side LUS images (identification of pleural effusion, aspecific alveolar consolidation, wet lung/interstitial syndrome, diaphragm movements) and understand the role of LUS in assisting pleural procedures.
- Describe the main radiological features of the most common pulmonary and pleural diseases.
- Describe basic principles of chest radiography, computed tomography and molecular imaging.
- Understand and apply the appropriate multimodal imaging techniques (including X-ray, CT and PET) in diagnosing, staging, and managing respiratory diseases, particularly lung cancer, emphasizing the strengths and limitations of each modality.
- Identify and differentiate between the radiological features (CT, X-ray) of focal lung lesions and airway diseases: recognizing patterns, evaluating disease severity.

### **COPD (chronic obstructive pulmonary disease)**

- Define, classify and describe the etiology of COPD, chronic bronchitis and emphysema and awareness of its heterogeneity.
- Describe the epidemiology and pathophysiology of COPD, including mechanisms of inflammation, structural changes and cell damage and repair.
- Recognize risk factors for COPD, including tobacco smoke and anti-protease deficiency
- Understand possible differential diagnoses /co-existent disorders, including asthma, upper respiratory tract disorders, gastro-oesophageal reflux, and bronchiectasis.
- Describe relevant investigations including spirometry, other relevant lung function tests, arterial blood gas analysis, peak flow monitoring, bronchodilator and bronchoprovocation testing. The use of X-Ray, and CT.
- Recognize related complications, including pneumothorax, respiratory failure, pulmonary arterial hypertension and cor pulmonale, as well as systemic effects of COPD.

### **Asthma**

- Define, classify (including clinical forms, phenotypes, staging and level of control) and describe the etiology of asthma.
- Describe the epidemiology and pathophysiology of asthma, including mechanisms of inflammation, structural changes involved, pathology in allergic and non-allergic asthma, relationship between pathology and asthma severity.
- Recognize risk factors for asthma, including host and environment factors.
- Describe relevant investigations including lung function testing (including bronchodilator and bronchoprovocation tests, as well as peak flow monitoring), chest X-ray, CT, exhaled NO, skin allergy testing, and serum allergy testing.
- Recognize possible differential diagnoses, including early childhood asthma, occupational

asthma, vocal cord dysfunction, gastro-oesophageal reflux, upper respiratory tract disorders, bronchiectasis and COPD.

- Define, classify, describe the etiology and diagnose non-asthma allergic and eosinophilic lung diseases, including hypersensitivity pneumonitis, eosinophilic granulomatosis with polyangiitis (EGPA), acute and chronic eosinophilic pneumonia, allergic bronchopulmonary aspergillosis and drug-induced diseases.

### **Bronchiectasis**

- Define, classify, describe the etiology and diagnose bronchiectasis and be awareness of its heterogeneity.
- Describe the epidemiology and pathophysiology of bronchiectasis.
- Describe basic principles, indications and contraindications of relevant investigations used in the management of bronchiectasis, including spirometry and other relevant lung function tests, arterial blood gas analysis, bronchodilator and bronchoprovocation testing, bronchoscopy, chest X-Ray, and chest CT.
- Understand basic principles for bronchiectasis management (including relevant therapeutic measures, respiratory physiotherapy and pulmonary rehabilitation, patient education, indications for hospitalization, and the role of vaccinations).
- Describe bronchiectasis-related complications, including exacerbations and haemoptysis.
- Define, classify and diagnose respiratory and non-respiratory manifestations of cystic fibrosis (CF).
- Describe the epidemiology and pathophysiology of CF.
- Become familiar with chest physiotherapy techniques used in CF, nutritional programs, indications for lung transplantation and new drugs (potentiators and modulators).
- Understand the importance of a multidisciplinary approach in the management of bronchiectasis and CF.

### **Pulmonary embolism**

- Define, classify, describe the etiology and diagnose pulmonary embolism.
- Describe genetic and acquired risk factors for pulmonary embolism.
- Illustrate current epidemiology and relevant pathology of pulmonary embolism.
- Describe relevant investigations used in the management of pulmonary embolism, including lab tests (D-dimer), scintigraphy, EKG, echocardiography, chest CT, and right heart catheterization.
- Describe respiratory and non-respiratory clinical manifestations and complications of pulmonary embolism.
- Assess severity of respiratory and systemic involvement of pulmonary embolism.

### **Diffuse parenchymal lung diseases (DPLD) and occupational lung diseases**

- Define, classify, describe the etiology and diagnose DPLD.
- Describe the epidemiology and pathophysiology of DPLD.
- Describe relevant investigations used in the management of DPLD, including non-invasive (chest X-ray, high resolution CT-scan, lung function tests) and invasive (broncho-alveolar lavage, transbronchial lung biopsy, and VATS biopsy) procedures.

- Describe the pulmonary and extrapulmonary manifestations of specific DPLD..
- Define, classify, describe the etiology and diagnose occupational/environmental lung disease

### **Respiratory tract infections**

- Define, classify, describe the etiology, diagnose and stratify in terms of disease severity upper respiratory tract infections (URTI), lower respiratory tract infections (LRTI) including pneumonia - community acquired pneumonia (CAP), hospital-acquired pneumonia (HAP), and pneumonia in the immunocompromised host.
- Describe the epidemiology of respiratory tract infections (microbiology, age related factors, geographical issues, occupational considerations, comorbidities, immunological status).
- Describe the clinical manifestations of viral (excluding COVID-19), bacterial, and fungal respiratory infections.
- Illustrate relevant investigations used in the management of respiratory tract infections including noninvasive (sputum induction, chest X-ray, chest CT, lung ultrasound) and invasive (bronchoscopy, thoracentesis, thoracic drainage) techniques
- Describe the related complications of respiratory tract infections such as pleural effusion, lung abscess, empyema, respiratory failure and sepsis.
- Describe preventive measures, including influenza and pneumococcal vaccinations.
- Define, classify, and diagnose infections and pulmonary diseases due to non-tuberculous mycobacteria (NTM)
- Describe the epidemiology and pathophysiology of infections and pulmonary diseases due to NTM.
- Describe the clinical manifestations of pulmonary diseases due to NTM and relevant investigations used in their management.

### **COVID-19**

- Define, classify, describe the etiology, and diagnose COVID-19, and stratify it in terms of disease severity.
- Describe the epidemiology and pathophysiology of COVID-19.
- Describe the clinical manifestations of COVID-19 (acute disease and long-COVID) and relevant investigations used in the management of COVID-19.
- Describe the differential diagnosis of COVID-19 among respiratory tract infections.

### **Tuberculosis (TB) and latent TB infection**

- Define, classify and diagnose tuberculosis.
- Illustrate epidemiology and pathophysiology of TB.
- Describe transmission of mycobacteria and risk factors for developing TB.
- Illustrate the pathogenesis of TB (events in non-immunised host, immunologic response to *M. tuberculosis*, exogenous versus endogenous infection, latent TB infection).
- Illustrate immunological features of latent TB (tuberculin sensitivity and interferon gamma release).
- Describe the general manifestations, clinical and radiological features of pulmonary TB.
- Become familiar with treatment of TB (general principles, drugs, combination regimens)

and special problems in treatment (e.g. multidrug resistant TB, extensively resistant TB, pregnancy and breast feeding, TB and HIV infection, and latent TB infection).

#### **Pleural diseases and procedures**

- Define, classify, describe the etiology, and diagnose pleural effusions (serothorax, chylothorax, hemothorax, and empyema)
- Describe epidemiology and pathophysiology of infectious, inflammatory, and neoplastic pleural disorders.
- Describe the macroscopic appearance of pleural fluids, distinction between transudative and exudative pleural effusions.
- Define, classify, describe the etiology, and diagnose pneumothorax (primary and secondary) and related complications such as tension pneumothorax.
- Illustrate relevant investigations to manage pleural diseases, including non-invasive (chest X-ray, ultrasound, and chest CT) and invasive (thoracentesis, pleural biopsy, pleural drainage, medical thoracoscopy, and biopsy) techniques.
- Understand indications for pleural ultrasound, thoracentesis, and intercostal tube drainage.

#### **Sleep-related, chest and neuromuscular disorders**

- Define, classify, describe the etiology, and diagnose obstructive sleep apnoea syndrome (OSA), central sleep apnoea syndrome (CSA), periodic breathing (PB), and obesity hypoventilation syndrome (OHS).
- Describe the epidemiology and pathophysiology of OSA, CSA, PB, and OHS.
- Illustrate relevant investigations used in the management of sleep-related disorders, including pulmonary function tests, respiratory polygraphy and polysomnography.
- Recognize complications of OSA, CSA, PB, and OHS.
- Define, classify, describe the etiology and diagnose chest wall diseases -CW-(including kyphoscoliosis, ankylosing spondylitis, flail chest, pectus excavatum), diseases of the respiratory muscles -RM-, and diseases of the diaphragm -D- (including diaphragmatic paralysis)

#### **Thoracic tumours**

- Define, classify and describe the etiology of thoracic tumours: lung cancer (LC), mesothelioma (M), metastatic TT (MTT), benign intrathoracic tumours, mediastinal (MT), chest wall tumours, sarcoma and lymphoma (L)
- Describe the epidemiology, risk factors, clinical symptoms, syndromes and physical signs of TT, including paraneoplastic syndromes.
- Describe relevant investigations used in the management of TT, including noninvasive (chest X-ray, ultrasound, chest CT, PET-CT) and invasive (sampling methods for cytology and histology) techniques.
- Describe tumour markers, histological and TNM classification of TT.
- Become familiar with therapeutic modalities in LC, M, MT and in other TT, including chemotherapy (including targeted molecular therapy), radiotherapy, interventional bronchoscopic techniques, palliative therapy, and best supportive care.
- Understand the importance of a multidisciplinary approach in the management of TT.

### **Acute and chronic respiratory failure and respiratory high-dependency unit**

- Define, classify and describe the etiology of both acute and chronic respiratory failure (RF).
- Describe the pathophysiology of RF.
- Describe relevant investigations used in the management of RF including non-invasive (chest x-ray, ultrasound, chest CT, pulmonary function tests) and invasive (bronchoscopy) techniques
- Become familiar with relevant therapeutic measures such as oxygen therapy (including high-flow nasal cannula oxygen therapy), continuous positive end-expiratory pressure and non-invasive ventilatory support.
- Become familiar with the “respiratory HDU culture” and the multidisciplinary team work which includes respiratory physiotherapists, critical care physicians, ER physicians, nurses, etc.

### **Interventional pulmonology**

- Describe normal and variant bronchial anatomy.
- Recognize indications and contraindications for bronchoscopy and other interventional techniques.

### **Thoracic surgery**

- Define and describe the most common surgical procedures performed in general non-oncological thoracic surgery
- Define, classify and describe the most common surgical resective procedures in thoracic surgery (wedge resection, segmentectomy, lobectomy, bi-lobectomy, and pneumonectomy).
- Become familiar with the oncological principles of lung cancer thoracic surgery (lymphadenectomy and extension of lung parenchymal resection)
- Understand the importance of mini-invasive thoracic surgery in management of stage I lung cancer
- Become familiar with the clinical and surgical management of chest trauma
- Understand indications for lung transplantation

### **Pathology of non-neoplastic diseases of the lung**

- Describe gross and microscopic anatomy of the lung
- Define the differences between the terms obstructive and restrictive lung diseases
- Describe the most common airways pattern of response to damage discussing bronchiectasis and cystic fibrosis
- Define and describe the pathogenesis and the microscopic features of emphysema and chronic bronchitis
- Describe the response of the parenchyma to damage defining diffuse alveolar damage (DAD), bronchiolitis obliterans organizing pneumonia (BOOP)
- Define the differences between the terms restrictive and interstitial lung diseases

- Describe the classification of idiopathic interstitial pneumonias, focusing on the role of the pathologist in the diagnosis
- Describe the morphologic features of idiopathic pulmonary fibrosis (IPF)
- Describe the morphologic features of non-specific interstitial pneumonia (NSIP)
- Define pneumoconiosis, list the main etiologies, describe the morphology of silicosis and asbestosis
- Describe morphologic features of sarcoidosis
- Understand the difference among pneumonia's classification
- Describe the typical phases of bacterial pneumonia
- Describe the complication of pneumonia
- Describe the main etiologic agents of viral pneumonia and describe the main morphologic features
- Describe the main gross and morphologic features of tuberculosis
- Recognize other causes of lung infection
- Define and discuss the etiologies and the pathophysiology of pulmonary embolism

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- Pleural diseases
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- Respiratory Imaging: Multimodality imaging in Lung Cancer
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- Principles of Thoracic Surgery
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### Teaching Methods

- Lectures. Students are encouraged to actively participate to the lectures with questions and comments.

### Assessment

- Written examination only. No oral examination.
- 40 MCQs
- Each MCQ will have 5 answers (only 1 correct)
- 75 minutes total to answer the 40 MCQs
- 60% of the 40 MCQs should be correct to pass the exam

The final score will be calculated according to the number of correct answers out of the 40 MCQ as follows: <= 23 correct answers: Failure; 24 correct answers: 18/30; 25 correct answers: 19/30; 26 correct answers: 20/30; 27 correct answers: 21/30; 28 correct answers: 22/30; 29 correct answers: 22/30; 30 correct answers: 23/30; 31 correct answers: 24/30; 32 correct answers: 25/30; 33 correct answers: 26/30; 34 correct answers: 26/30; 35 correct answers: 27/30; 36 correct answers: 28/30; 37 correct answers: 29/30; 38 correct answers: 30/30; 39 correct answers: 30/30; 40 correct answers: 30/30 cum laude

### Texts

- Essentials of Clinical Pulmonology. Edited by Pallav L. Shah, Felix JF Herth, YC Gary Lee, Gerald J Criner. CRC Press
- Robbins & Cotran Pathologic Basis of Disease (Robbins Pathology) 10th Edition, Elsevier 2020
- Lawrence Martin. All You Really Need to Know to Interpret Arterial Blood Gases (Includes ABC Quik Course) Second Edition
- Harrison's Principles of Internal Medicine, Twenty-First Edition (Vol.1 & Vol.2) McGraw-Hill Education, 2022



