

Continuing professional development

Respiratory Infections

Module 1. Anatomy and development of the respiratory system including malformations

1. Pleura
2. Lungs
3. Bronchopulmonary segments
4. Trachea and bronchi
5. Hilus
6. Pulmonary vasculature and lymphatic drainage
7. Mediastinum
8. Diaphragm
9. Pulmonary lobules (site of infections can be lobar or segmental specific)

Module 2. Immunology and defence mechanisms

1. Anatomical barriers (including epithelial barrier function and how this is influenced by pathogens)
2. Reflex mechanisms (sneezing, cough and dyspnoea)
3. Mucociliary clearance and fluid homeostasis
4. Innate defence mechanisms (broad outline): professional phagocytes T and B cells, innate lymphoid cells, etc. and the induction and resolution of inflammatory responses (type 1 and type 2 inflammation). Innate immune defence mechanisms, e.g., recognition of pathogen-associated molecular patterns by structural cells (airway epithelium) and subsequent anti-microbial and pro-inflammatory responses
5. Acquired immune reactions with immunoglobulin and the role of IgM, IgG and IgA
6. IgG subclasses and IgE and immunodeficiencies
7. Complement deficiencies
8. Role of Interferon-gamma and Interferon-gamma receptors

Module 3. Arterial blood gas (ABG) and acid-base status assessment

1. Step 1: Evaluate the utility of ABG, capillary blood gas and venous blood gas
2. Step 2: Diagnosis of A-B disorders: Henderson-Hasselbalch equation and the relationship between arterial pressure of oxygen (PaO₂), partial pressure of carbon dioxide (PCO₂) and pH
3. Step 3: A-B disorders: importance of the D(A-a) difference, fraction of inspired oxygen (FiO₂), the alveolar gas equation and measuring oxygen shunts
4. Management of clinical diseases, e.g. COPD and sepsis with A-B disorders in ABG
5. Ventilation-perfusion defect

Module 4. Symptoms

1. Cough
2. Colour and nature of sputum (clear mucoid, purulent, haemoptysis, etc.)
3. Chest pain: pleuritic pain and others
4. Fever *versus* night sweats
5. Wheezing
6. Haemoptysis (streak/blob, associated sputum, quantity and massive haemoptysis)
7. Chest wall pain
8. Fatigue/malaise
9. Dyspnoea
10. Weight loss
11. Exercise intolerance

Module 5. Signs

1. Temperature
2. Finger clubbing
3. Cyanosis

4. Respiratory rate
5. Oxygen Saturation
6. Heart rate
7. Hypotension and shock
8. Thorax deformations
9. Accessory muscle use
10. Wheezing and stridor
11. Compound scores (Early Warning Signs for example)

Module 6. Syndrome-based approach to diagnosis and differential diagnosis

1. Common upper respiratory tract syndromes (including acute infective rhinitis, sinusitis, pharyngitis, epiglottitis and laryngotracheitis)
2. Acute bronchitis
3. Exacerbation of asthma
4. Exacerbation of COPD
5. Community-acquired pneumonia (CAP) including nursing home-acquired pneumonia (NHAP)
6. Nosocomial pneumonia
7. Pneumonia in immunocompromised conditions
8. Seasonal influenza and other viral respiratory infections
9. Acute bronchiolitis
10. Exacerbation of bronchiectasis
11. Tuberculosis (TB)
12. Viral pneumonia
13. Pulmonary aspects of COVID 19
14. NTM pulmonary diseases

Module 7. Bronchoscopy

1. Bronchoalveolar lavage (BAL)
2. Bronchial brushing samples
3. Protected sampling in an intensive care unit (ICU) to prevent upper airway contamination
4. Endo bronchial and transbronchial biopsy
5. Transbronchial needle aspirate

Module 8. Endobronchial ultrasound (EBUS) and oesophageal ultrasound

1. Endobronchial ultrasound guided mediastinal lymph node biopsy
2. Endoscopic ultrasound (EUS)

Module 9. Thoracentesis

1. Indications
2. Knowledge of indications for thoracentesis and biopsy
3. Thoracentesis
4. Interpretation of results
5. Biochemical analysis for differential diagnosis

Module 10. Thoracoscopy

1. Indications
2. Medical thoracoscopy with biopsy: indications
3. Pleural fluid and pleural biopsy samples

Module 11. Chest X-ray

1. Miliary TB pattern
2. Mediastinal lymph nodes
3. Lung cavities
4. Indirect findings of septic embolism
5. Abscess
6. Hydatid cyst

7. Sequester
8. Signs of pleural infection/parapneumonic effusion
9. Atelectasis signs
10. Signs of bronchiectasis
11. Consolidation and air bronchogram sign
12. Ground glass opacities
13. Solitary nodule
14. Signs of cardiac pathologies
15. Parenchymal infiltrates
 - 15.1. linear
 - 15.2. reticular
 - 15.3. solitary
 - 15.4. nodular
 - 15.5. consolidation
 - 15.6. homogeneous opacities
 - 15.7. nonhomogeneous opacities

Module 12. Thoracic ultrasound in respiratory infections

1. Thoracic ultrasound to guide thoracentesis/aspiration
2. ICU patients that cannot be moved
3. Pneumonia diagnosis
4. Empyema diagnosis
5. Complicated parapneumonic effusion

Module 13. Computed tomography scan in respiratory infections

1. Tree-in-bud sign
2. Bronchiectasis
3. Fungal respiratory infections
4. Pneumocystis Jiroveci Pneumonia (PJP)
5. Non-resolving pneumonia
6. Interstitial lung diseases
7. Empyema
8. Mediastinal lymph nodes
9. Bronchopleural fistula
10. Radiological signs of:
 - 10.1. Non-tuberculous mycobacteria (NTM)
 - 10.2. Early (sub-clinical) tuberculosis
 - 10.3. COVID-19

Module 14. Sputum assessment and basic microbiological methods

Sample collection: spontaneous sputum (pro/con), induced sputum (pro/con) and interpretation of adequate sample.

1. Conventional microbiological methods such as Gram staining, culture and sensitivity testing for different pathogens, such as atypical bacteria, viruses and fungi, and for *Pneumocystis pneumonia* (PCP) due to *Pneumocystis jirovecii* (previously *carinii*)
2. Indications for and collection of biological specimens, Gram staining, culture, molecular methods, IF and genetic testing
3. Common pathogens and their antibiotic sensitivities
4. Uncommon Respiratory pathogens and their meaning in clinical practice
5. Samples and specific pathogens
 - 5.1. Bacteria
 - 5.2. Fungi
 - 5.3. Mycobacteriae

- 5.4. Other pathogens (PJP, Nocardia, actinomyces, etc.)
6. Acid-fast bacilli: number (WHO and CDC USA), interpretation of quality, sputum induction indication and culture *versus* immunofluorescence (IF) *versus* PCR
7. Likelihood of a laboratory report being correct (*e.g.* Gram-negative pathogens or gonococcal pharyngitis); Nocardia as an acid-fast organism
8. Whole-genome sequencing (WGS) and targeted next-generation sequencing of *Mycobacterium tuberculosis* and other mycobacteria
9. Microbiologic diagnosis of TB (smear examination, liquid and solid culture media, molecular study of resistance and phenotypic/genotypic methods)
10. Interferon gamma release assay, interpretation of microbiological results provided by BAL, quantitative culture, particularities in immunocompromised patients, particularities in nosocomial infection and types of sputum harvest (spontaneous, induced and bronchial aspirate)
11. Airway microbiome in relation with/to epigenetic and transcriptomic profiles in lung tissue

Module 15. Inhaled drug therapy for respiratory infections

1. Principles of inhaled therapy (understand drug delivery and dosing and the reasons to use inhaled antibiotics)
2. When to use inhaled drugs, *e.g.* nebulised amikacin in NTM disease, nebulised colistin in bronchiectasis for treatment of *Pseudomonas aeruginosa*
3. Delivery modes
4. Indications and challenges of application at an ICU
5. Adverse effects of inhaled therapy

Module 16. Systemic pharmacotherapy

1. Interpreting laboratory results and choosing treatment according to the category:
 - 1.1. Bacteria
 - 1.2. Fungi
 - 1.3. Mycobacteria
2. Methods of drug delivery
3. Use of antivirals (*e.g.* remdesivir) in epidemics (flu, COVID-19)
4. Use of antifungal drugs
5. Antibiotic stewardship and adherence to guidelines
6. Place of corticosteroids
7. Pharmacokinetics and pharmacodynamics

Module 17. Respiratory physiotherapy

1. Role of physiotherapy in sputum induction
2. Airways clearance techniques in Bronchiectasis and other Chronic Respiratory conditions with hypersecretion
3. The role of aerobic exercise and muscle strengthening in airways clearance

Module 18. Pulmonary rehabilitation

1. Rehabilitation and airway clearance to help reduce exacerbations of chronic respiratory diseases such as COPD and bronchiectasis
2. Prevention of infections

Module 19. Preventative measures

1. Patient factors
 - 1.1. Vaccines
 - 1.2. Other preventive treatments
2. Environmental factors
 - 2.1. Segregation (segregation under infection control and relevance to CF and TB)
 - 2.2. Air pollution
 - 2.3. Occupational hazards and safety measures

Module 20. Intercostal drain (ICD) insertion and medical thoracoscopy

1. Indications for and management of ICD ~~chest tube insertion~~
2. Empyema (including complicated parapneumonic effusion)
3. Intrapleural fibrinolytic therapy for empyema ~~endopleural lysis~~

Module 21. Lung transplantation

1. Opportunistic infections after lung transplantation
2. Differentiation between organ rejection and infection
3. Antibiotic prophylaxis
4. Post-transplant management
5. Graft versus host disease

Module 22. Evaluation of respiratory emergencies and immediate management steps

1. CAP
2. Hospital-acquired pneumonia (HAP)
3. Ventilator-associated pneumonia (VAP)
4. NHAP
5. Sepsis
6. Bioterrorism
7. Epi/pandemics
8. Empiric antibiotic therapy – when and how to build the regimen
9. Use of oxygen (pneumonia *versus* COPD)

Module 23. Differential diagnosis

1. Differential diagnosis using clinical and radiological findings of infectious diseases (*i.e.* those caused by bacteria, viruses, fungi, mycobacteria and other difficult-to-treat microorganisms) in contrast with those of non-infectious disorders

Module 24. Upper airway diseases

1. Common upper respiratory tract syndromes (including acute infective rhinitis, sinusitis, pharyngitis, epiglottitis, laryngotracheitis and tonsillitis)

Module 25. Asthma

1. Pathophysiological mechanisms of exacerbation
2. Infectious management of exacerbation
3. Allergic bronchopulmonary aspergillosis
4. Infectious causes of eosinophilia

Module 26. Bronchitis

1. Acute bacterial and viral bronchitis
2. Chronic bronchitis
3. Aspergillus tracheobronchitis
4. Treatment approach

Module 27. COPD and emphysema

1. Pathophysiological mechanisms of exacerbation
2. Infectious management of exacerbation, *i.e.* viral and bacterial
3. Immunomodulatory therapy
4. Risks associated with inhaled corticosteroids
5. Vaccination
6. Bacterial colonisation
7. Long-term macrolides

Module 28. Bronchiolitis

1. Respiratory syncytial virus
2. Other viruses and bacteria
3. Differential diagnosis
4. Treatment approach

Module 29. Bronchiectasis

1. Diagnostic and aetiological work-up
2. Management of exacerbation
3. Haemoptysis and management
4. Bacterial and non-bacterial surveillance
5. Eradication
6. Long-term antibiotic including nebulised antibiotics and immunomodulatory therapy
7. Long term management of bronchiectasis (ADD)
8. Respiratory physiotherapy
9. Rehabilitation
10. Classification severity
11. Vaccination

Module 30. Lower respiratory tract infections

1. CAP (including NHAP and HCAP))
2. Nosocomial pneumonia
3. Non-responding pneumonia (CAP or nosocomial)

Module 31. Pleural infections

1. Diagnostic methods in radiology and ultrasound parapneumonic effusion and empyema pleuritis
2. Indication for large-bore pleural drainage
3. Indication for medical and surgical thoracoscopy
4. Evaluating the accuracy of microbiological methods

Module 32. Lung abscesses and other infections

1. Choice and duration of antibiotic treatment in particular situations, such as intravenous drug users, and aspiration
2. Surgical intervention

Module 33. Influenza, pandemics and severe acute respiratory syndrome prophylaxis

1. Population groups with a worse prognosis
2. Infection control
3. Medical treatment
4. COVID-19

Module 34. Respiratory infections in an immunocompromised host

1. Pneumocystis jirovecii
2. Empirical antibiotic selection and treatment particularities in patients with acquired immunodeficiency, neutropenic patients, patients with solid organ malignancy, lung and other solid organ transplant recipients, haematopoietic cell transplant recipients, patients with other haematological conditions, patients with secondary immunodeficiency induced by drugs and biologicals and patients with primary immune deficiency syndromes
3. Antibiotic prophylaxis
4. Fungal infections
5. Pulmonary TB

Module 35. Aspiration pneumonitis

1. Choice of antibiotics
2. Risk factors for aspiration pneumonitis
3. Prognosis
4. Supportive care
5. Preventative measures

Module 36. TB including multidrug-resistant/extensively drug-resistant (MDR/XDR) TB

1. Consideration of TB in the differential diagnosis of respiratory infections
2. Epidemiology, burden of disease and risk factors: know when to investigate and what tests to ask for
3. Indication for isolation and discontinuation of isolation

4. Risk factors for MDR/XDR TB
5. Diagnostic tests, molecular tests, whole genome sequencing (WGS)
6. Drug susceptibility and treatment
7. Directly observed therapy (DOT) / Video observed therapy (VOT)
8. Miliary TB
9. TB drugs-related adverse events (AEs)
10. How to increase compliance to treatment
11. The role of active TB drug safety monitoring – when and how
12. TB sequelae and pulmonary rehabilitation

Module 37. Extrapulmonary TB

1. Differential diagnosis
2. Diagnosis of mediastinal adenitis TB and indication for EBUS
3. Rate of associations with pulmonary TB
4. Role of immunological tests for increasing the probability of diagnosis in patients with relevant risk factors and symptoms
5. Pleural TB
6. Specific extrapulmonary TB involvement: Liver, CNS, polyserositis, intestinal etc

Module 38. Latent TB infection

1. Diagnosis
2. Contact investigation
3. Treatment
4. Surveillance of side effects
5. Alternative TB preventive regimens in case of AEs
6. TBI management in immunocompromised patients
7. Selection of candidates to treat

Module 39. Non-TB mycobacterial diseases

1. Clinical presentation of NTM diseases
2. Diagnostic criteria
3. Indication for treatment
4. Treatment
5. Monitoring of drug responses including relapse, re-infection and cure
6. Epidemiology and risk factors for NTM
7. HIV co-infection
8. Immunosuppression

Module 40. Mediastinitis

1. Differential diagnosis and testing
2. Treatment
3. Antibiotics
4. When to perform surgery
5. Oesophageal perforations
6. Transoesophageal fistulae

Module 41. Primary immunodeficiency syndromes

1. Patterns of pulmonary involvement in primary immunodeficiency disorders
2. Recognition, assessment and management of the severity of respiratory disease in patients with primary immunodeficiency disorders
3. Appropriate vaccination and prophylaxis regimens
4. Emphasise the most common primary immunodeficiency syndromes
5. Indications for immunoglobulin replacement therapy

Module 42. Secondary immunodeficiency syndromes/immunosuppression

1. Indications for screening and follow-up

2. Multidisciplinary approach to secondary immunodeficiency syndromes

Module 43. CF

1. Diagnosis and differential diagnosis
2. When and how to go for screening
3. Microbiological evaluation
4. Infection control and cross-infection
 - 4.1. Isolation and reverse isolation
 - 4.2. Infection surveillance
5. Antibiotic management for eradication
6. Suppression
7. Acute exacerbation
8. NTM infections in CF
9. Particularities in treatment (pharmacokinetics)
10. Immunomodulatory drugs
11. Physiotherapy
12. New CF transmembrane conductance regulator (CFTR)-specific medications
13. Multidisciplinary CF management
14. Non-respiratory management
15. CFTR modulators

Module 44. Genetic susceptibility to respiratory infections

1. Differential diagnosis and recognition of primary ciliary dyskinesia
2. Diagnostic testing
3. α 1-antitrypsin

Module 45. Occupational respiratory infections in HCWs

1. TB screening in HCWs
2. TB prevention in HCWs
3. TB infection control training for HCWs
4. Precautions for pregnant HCWs: measles, influenza and TB
5. Zoonosis
6. Influenza in exposed HCWs
7. COVID-19

Module 46. Epidemiological and statistical methods

1. General aspects of epidemiological and statistical methods for critical appraisal
2. Assessment of national TB programme
3. Approach to pandemics/epidemics data analysis

Module 47. Lifestyle

1. Alcohol abuse
2. Smoking including electronic cigarettes, marijuana and water pipes

Module 48. Respiratory hazards associated with environmental and occupational risk factors, to be considered in:

1. Clinical evaluation of patient
2. Differential diagnosis
3. Treatment, intervention, mitigation
4. Disability, vocational considerations, Workers' Compensation considerations
5. Public health approach