

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. Hila
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

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 (PaO_2), partial pressure of carbon dioxide (PCO_2) and pH
3. Step 3: A-B disorders: importance of the D(A-a) difference, fraction of inspired oxygen (FiO_2), 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. Saturation

6. Heart rate
7. Hypotension and shock
8. Pulmonary infiltrates
9. Pleural effusion
10. Accessory muscle use
11. Wheezing and stridor
12. 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. Seasonal influenza and other viral respiratory infections
8. Acute bronchiolitis
9. Exacerbation of bronchiectasis
10. Pulmonary TB
11. Viral pneumonia
12. Pulmonary impact of COVID 19

Module 7. Bronchoscopy

1. Bronchoalveolar lavage (BAL)
2. Brushing samples
3. Protected sampling in an intensive care unit (ICU) to prevent upper airway contamination
4. Biopsy

Module 8. Endobronchial ultrasound (EBUS) and oesophageal ultrasound (EUS)

1. Transbronchial lung biopsy; culture and analysis of transbronchial needle aspirates (for differential diagnosis)
2. GeneXpert

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. Halo-sign
5. Septic emboli
6. Abscess
7. Hydatid cyst
8. Sequestrum
9. Signs of pleural infection/parapneumonic effusion

10. Atelectasis signs
11. Signs of bronchiectasis
12. Consolidation and air bronchogram sign
13. Ground glass opacities
14. Solitary nodule
15. Signs of cardiac involvement

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. Aspergillus-related appearances
2. Tree-in-bud sign and infections
3. Bronchiectasis
4. Non-resolving pneumonia
5. Cryptogenic organising pneumonia
6. Empyema
7. Mediastinal lymph nodes
8. Bronchopleural fistula
9. Radiological signs of:
 - 9.1. Diseases associated with Aspergillus
 - 9.2. Non-tuberculous mycobacteria (NTM)
 - 9.3. Early (sub-clinical) tuberculosis
 - 9.4. COVID-19

Module 14. Sputum assessment

1. Common pathogens and their antibiotic sensitivities
2. Uncommon Respiratory pathogens and their meaning in clinical practice
3. Samples and specific pathogens
4. Acid-fast bacilli: number (WHO and CDC USA), interpretation of quality, sputum induction indication and culture *versus* immunofluorescence (IF) *versus* PCR
5. Likelihood of a laboratory report being correct (*e.g.* Gram-negative pathogens or gonococcal pharyngitis); *Nocardia* as an acid-fast organism
6. Whole-genome sequencing (WGS) and targeted next-generation sequencing of *Mycobacterium tuberculosis* and other mycobacteria
7. GeneXpert

Module 15. Basic microbiological methods

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. 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)
4. Airway microbiome in relation with/to epigenetic and transcriptomic profiles in lung tissue
5. Microbiologic diagnosis of TB (smear examination, liquid and solid culture media, molecular study of resistance and phenotypic/genotypic methods)

Module 16. 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.* Amikacin in NTM, Colistin in bronchiectasis
3. Delivery modes
4. Indications and challenges of application at an ICU
5. Problems with inhaled therapy

Module 17. Systemic pharmacotherapy

1. Interpreting laboratory results and choosing antibiotics
2. Use of antivirals (*e.g.* remdesivir) in epidemics (flu, COVID-19)
3. Antibiotic stewardship and adherence to guidelines
4. Place of corticosteroids
5. Pharmacokinetics and pharmacodynamics

Module 18. 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 19. 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 20. Palliative care

1. Oxygen therapy
2. Sedation
3. Therapy for pain and psychiatric disorders (anxiety, etc.) associated with Respiratory end-stage conditions

Module 21. Preventative measures

1. Vaccinations
 - 1.1. Influenza
 - 1.2. Pneumococcal
 - 1.3. Bacillus Calmette–Guérin (BCG)
 - 1.4. Other vaccinations
2. Smoking cessation
3. Dental care
4. Aspiration management
5. Infection control including universal precautions for respiratory isolation
6. Cough hygiene
7. Infection surveillance
8. Isolation and reverse isolation, including specific microbes in cystic fibrosis (CF) and bronchiectasis (*e.g.* Pseudomonas)
9. Infectious risks to healthcare workers (HCWs)
10. Control and elimination of TB including the BCG vaccine
11. Segregation under infection control and relevance to CF and TB
12. Study of TB patient contacts, TB isolation criteria and indications for diagnosis and treatment of TB
13. Role of air pollution

Module 22. Chest tube insertion

1. Indications for and management of chest tube insertion
2. Empyema (including complicated parapneumonic effusion)
3. Endopleural lysis

Module 23. Lung transplantation

1. Course of opportunistic infections after lung transplantation
2. Differentiation between organ rejection and infection
3. Prophylaxis
4. Post-transplant management
5. Graft versus host disease

Module 24. Evaluation of respiratory emergencies

1. CAP
2. Hospital-acquired pneumonia (HAP)
3. Sepsis
4. Bioterrorism
5. Epi/pandemics

Module 25. 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 26. Immediate management steps

1. Choice of empiric antibiotic therapy according to site of infection and risk factors
2. Time to first intravenous antibiotics
3. Use of oxygen (pneumonia *versus* COPD)
4. Sepsis

Module 27. Guidelines for first-line treatment of:

1. CAP
2. HAP
3. Ventilator-associated pneumonia (VAP)
4. NHAP

Module 28. Upper airway diseases

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

Module 29. Asthma

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

Module 30. Bronchitis

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

Module 31. 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 32. Bronchiolitis

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

Module 33. 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 and immunomodulatory therapy
7. Long term management of bronchiectasis (ADD)
8. Respiratory physiotherapy
9. Rehabilitation
10. Classification severity
11. Vaccination

Module 34. Lower respiratory tract infections

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

Module 35. 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 36. 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 37. 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 38. 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. Role of invasive diagnostic testing
5. Fungal infections
6. Pulmonary TB

Module 39. Aspiration pneumonitis

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

Module 40. Pulmonary 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. Drug susceptibility and treatment
6. Directly observed therapy (DOT) / Video observed therapy (VOT)
7. Miliary TB
8. Adverse events (AEs)
9. Diagnostic tests
10. Molecular tests
11. Whole genome sequencing (WGS)

Module 41. Extrapulmonary TB

1. Differential diagnosis
2. Diagnosis of lymphatic 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

Module 42. Latent TB infection

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

Module 43. Non-TB mycobacterial diseases

1. Clinical presentation of NTM diseases
2. Adherence to 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 44. Mediastinitis

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

Module 45. 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 46. Secondary immunodeficiency syndromes/immunosuppression

1. Indications for screening and follow-up
2. Multidisciplinary approach to secondary immunodeficiency syndromes

Module 47. 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 48. Genetic susceptibility to respiratory infections

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

Module 49. 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

Module 50. Epidemiological and statistical methods for critical appraisal

1. Assessment of national TB programme
2. Approach to pandemics/epidemics data analysis

Module 51. Lifestyle

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