Continuing Professional Development - Sleep and breathing disorders

Module 1. Neuroanatomy and neurobiology of sleep

1. Regulation of the sleep-wake cycle
   1.1. Basic neural processes and transmitters that control wakefulness, non-rapid eye movement and rapid eye movement sleep states
2. Sleep architecture in a normal adult
   2.1. Ageing process from foetal life to old age affects the sleep cycle

Module 2. Physiology of sleep and breathing

1. Factors that control breathing during sleep and wakefulness
2. Ventilatory response to hypercapnia and hypoxaemia (including loop gain), arousal and the apnoea threshold
3. Molecular mechanisms of hypercapnia and hypoxemia e.g. master regulators and signalling pathways involved
4. Functional anatomy of the upper airway
5. Factors that cause upper airway collapse during sleep
6. Relation of control of breathing and upper airway function to the pathophysiology of obstructive sleep apnoea (OSA) and central sleep apnoea (CSA)
7. Influence of respiratory mechanics and ventilation from pathology
8. Sleep-related changes in respiratory mechanics in the aetiology of nocturnal hypoventilation

Module 3. Cardiovascular and homeostatic mechanisms and sleep

1. Cardiovascular function (*e.g.* blood pressure and heart rate) during sleep and arousal from sleep
2. Impact of sleep on autonomic regulation and the consequences of sleep pathology, *e.g.* in OSA and CSA

Module 4. Physiology of arterial blood gas (ABG) and the acid-base status

1. Utility of ABG, capillary blood gas and venous blood gas
   1.1. Diagnosis of A-B disorders: Henderson-Hasselbalch equation and the relationship between partial pressure of oxygen (PO_2), partial pressure of carbon dioxide (PCO_2) and pH
   1.2. A-B disorders: importance of the D(A-a) difference, fraction of inspired oxygen (FiO_2), the alveolar gas equation and measuring oxygen shunts

Module 5. Definition of sleep-disordered breathing (SDB)

1. Obstructive sleep apnoea hypopnoea syndrome (OSAHS), CSA, periodic breathing, Cheyne-Stokes respiration, obesity hypoventilation syndrome (OHS), nocturnal hypoventilation and upper airway resistance syndrome
2. Epidemiology of OSAHS and CSA
3. Clinical phenotypes of OSA and their relationship to the underlying pathophysiology

Module 6. Assessment of the patient

1. Sleep history including:
   1.1. Sleepiness and fatigue
   1.2. Insomnia
   1.3. Poor sleep quality
   1.4. Nocturnal choking and gasping
   1.5. Snoring
   1.6. Morning headaches
   1.7. Impotence
   1.8. Low mood or labile mood
   1.9. Memory disturbance
   1.10. Differential diagnosis of sleepiness and insomnia, *e.g.* consider lifestyle choices, sleep hygiene and medication
2. Signs

2.1. Clinical examination of the upper airway, nasal obstruction, tonsils and adenoids
2.2. Craniofacial disorders
2.3. Hypothyroidism
2.4. Obesity
3. Comorbidities, *e.g.* COPD, chest wall disease, neuromuscular or neurological disorders, cardiovascular disease and endocrine or metabolic disorders

Module 7. Evaluation of the impact of symptoms and establishment of the pre-test probability of SDB

1. Usage of questionnaires: Epworth sleepiness scale, STOP-BANG score, Berlin questionnaire and SF-36
2. Identification of high-risk patients, *e.g.* those with severe sleepiness, unstable cardiac disease, nocturnal arrhythmia or baseline hypoxaemia or those who drive or have another occupational risk

Module 8. Diagnosis of respiratory sleep disorder

1. Methodology of different sleep tests (oximetry, respiratory polygraphy and full polysomnography (PSG))
2. Limitations of overnight oximetry, respiratory polygraphy, PSG, and home *versus* hospital-based sleep studies
3. Appreciation of which patients to refer for PSG, *e.g.* those with an unclear diagnosis on respiratory polygraphy, a poor treatment response or a suspected non-respiratory sleep disorder such as narcolepsy or restless leg syndrome
4. Identification of cases that require further specialised examinations, *e.g.* ear-nose-throat (ENT) review of the upper airway
5. Review of cardiovascular, respiratory and metabolic disorders often associated with OSA
6. High cardio-metabolic risks associated with untreated OSA
7. Value of making lifestyle improvements including weight loss, adherence to drug treatment for hypertension or diabetes, smoking cessation and alcohol reduction

Module 9. Nocturnal capnography

1. Role of capnography in patients with nocturnal hypoventilation
2. Limitations of overnight transcutaneous carbon dioxide (TCO_2) and end-tidal carbon dioxide ($ETCO_2$) monitoring
3. Use of capnography to establish ventilator settings

Module 10. OSA/hypopnoea syndrome management

1. Distinguish mild, moderate and severe cases of OSA from normal results and upper airway resistance syndrome
2. Lifestyle interventions including weight loss, smoking cessation, alcohol reduction, avoidance of night sedation and sensible sleep hygiene measures
3. Role of ENT intervention
4. Role and types of mandibular advancement splints and other oral devices
5. Definition of positional sleep apnoea and the role of positional devices
6. Indications for continuous positive airway pressure (CPAP) therapy
7. Differences between fixed level CPAP, variable CPAP, and bi-level positive pressure therapy
8. Identification of patients to refer for these interventions depending on local pathways
9. CPAP-related side effects such as interface problems, airway drying and sleep disturbance
10. Issues leading to poor adherence and how these may be addressed
11. Different ways of monitoring positive pressure therapy: clinic visits, data downloads from devices and telemonitoring
12. Follow-up including assessment of the efficacy of therapy in controlling OSA and also the impact on comorbidities and health-related quality of life
13. Importance of explaining the rationale and likely outcomes of treatment to patients and of providing advice about medico-legal aspects such as driving
14. Awareness and importance of following local guidelines on the diagnosis and management of OSAHS

Module 11. CSA

1. Classification of the aetiology of CSA: idiopathic, heart failure-related and induced by a cerebrovascular cause (*e.g.* a cerebrovascular accident, opioid or other drug use and high altitude)
2. Differential symptoms and signs of OSA and CSA
3. Pathophysiology of different types of CSA
4. Recognition of which patients to refer for sleep studies

Module 12. Management of CSA

1. Impact of CSA on underlying pathology
2. CSA in chronic heart failure:
3. Importance of optimising therapy for heart failure
4. Role of CPAP in specific patients including those with mixed OSA and CSA
5. Adaptive servo-ventilation use in heart failure patients with a left ventricular ejection fraction of <45%
6. Other forms of CSA
7. CPAP or adaptive support ventilation (ASV) in patients with opioid-induced SDB
8. Awareness of trials in progress to assess O_2 therapy in patients with CSA and the further role of ASV

Module 13. OHS

1. Pathophysiology
2. Symptoms and clinical presentation
3. Consequences (vascular disease, polycythaemia and cor pulmonale)
4. Indications for CPAP and non-invasive ventilation (NIV); application or supervision of a mask and interface
5. Description of the illness and risk of obesity and offer advice about how to decrease body mass index through physical activity, training and diet
6. Role of bariatric surgery, preoperative assessment surgical risk and postoperative management in OHS patients

Module 14. Neuromuscular disorders

1. Neuromuscular diseases that cause respiratory failure
2. Neuromuscular conditions associated with respiratory muscle weakness
3. Methods to assess respiratory muscle weakness: spirometry, mouth pressures, peak cough flow, sniff inspiratory pressure and diaphragm electromyographic studies
4. Symptoms and signs of nocturnal hypoventilation and the probability of respiratory failure
5. Role of NIV *versus* invasive ventilation
6. Cough augmentation (cough assist) techniques
7. Use of NIV
8. Perioperative assessment and management of neuromuscular disease patients

Module 15. Chest wall disorders

1. Chest wall deformities that cause respiratory failure
2. Symptoms and signs of nocturnal hypoventilation and the probability of respiratory failure
3. Role of NIV *versus* invasive ventilation and cough augmentation (cough assist) techniques
4. Use of NIV

Module 16. Chronic respiratory failure

1. Causes of respiratory failure
2. Principles of interpretation of blood gas analysis
3. National and international treatment guidelines for acute and chronic hypercapnic respiratory failure
4. Indications for additional O_2 treatment
5. Indications for long-term (home) mechanical ventilation

Module 17. Assisted ventilation

1. Treatment of ventilatory failure
2. Types of positive pressure ventilation and different modes, *e.g.* bi-level positive airway pressure, volume ventilation, assured volume ventilation (average volume assured pressure support and intelligent volume assured pressure support) and other NIV modes
3. Principles of therapy titration with sleep studies and ABG measurement

4. Concepts of compliance and adherence
5. Assessment of compliance and reasons for poor and good compliance
6. Indications for tracheostomy ventilation and which patients to refer for this
7. Potential role of NIV in palliative care and the importance of palliative therapy
8. Use of advance directives in end-stage diseases

Module 18. Asthma/COPD and sleep

1. Prevalence of SDB in asthma and COPD
2. Symptoms, clinical presentation, pathophysiology and treatment of asthma, COPD and restrictive lung disorders
3. Influence of comorbid respiratory disorders on breathing during sleep
4. Impact of drug therapy on sleep quality
5. Understand the role of CPAP therapy in overlap syndrome (COPD-OSAHS) and asthma

Module 19. Endocrine and metabolic disorders and SDB

1. Prevalence of OSAHS in patients with endocrine disorders (*e.g.* hypothyroidism and acromegaly) and metabolic disorders (*e.g.* diabetes mellitus and metabolic syndrome)
2. Impact of OSAHS treatment on underlying endocrine/metabolic disorders

Module 20. Non-respiratory sleep disorders

1. Consideration of non-respiratory sleep disorders and identify which patients to refer for further investigation
2. Insomnia
   - 2.1. Primary and secondary insomnia and management techniques including the role of cognitive behavioural therapy for insomnia and medication
   - 2.2. Presence of insomnia in some OSAHS phenotypes and its impact on the choice of and adherence to therapy
3. Other conditions:
   - 3.1. Restless leg syndrome
   - 3.2. Narcolepsy, benign idiopathic hypersomnolence, parasomnias and associated conditions

Module 21. Assessment of excessive sleepiness

1. Principles of the tests for assessing excessive daytime somnolence in patients with respiratory and non-respiratory sleep conditions, their advantages, their imitations and which patients to refer for these, including:
   - 1.1. Sleep questionnaires
   - 1.2. Sleep diary
   - 1.3. Multiple Sleep Latency Test (MSLT)
   - 1.4. Maintenance of Wakefulness Test (MWT)
   - 1.5. OSLER wake test

Module 22. Circadian disorders

1. Principles of circadian rhythms and their impact on the sleep-wake cycle across a range of ages
2. Molecular basis of the circadian rhythm and its dysfunction in disease
3. Impact of circadian disruption such as shift work and jet lag
4. Interactions between work and SDB *e.g.* shift work
5. Other circadian disorders such as delayed and advanced sleep phase disorders
6. Role of interventions such as melatonin and bright-light therapy
7. Identification of patients to refer for actigraphy and the advantages and disadvantages of this investigation

Module 23. Medico-legal

1. Medico-legal, social and economic impacts of respiratory sleep disorders