

# **SYLLABUS**

**YEARS THREE AND FOUR**

## **RESPIRATORY PHYSIOLOGY (2)**

### Exercise physiology

- Muscle metabolism including type 1 and 2 fibres, glycolysis, Krebs' cycle etc
- Normal cardiorespiratory response to exercise
- Cardiac response to exercise – heart rate, stroke volume, heart rate reserve, oxygen pulse
- Ventilatory response to exercise – breathing frequency, tidal volume, breathing reserve
- Circulatory response to exercise - redistribution of blood flow to muscles
- Anaerobic threshold - definition of AT, acid base balance, respiratory quotient, oxygen deficit and oxygen debt
- Limitations to exercise in normal subjects
- Effects of ageing, obesity and being underweight on exercise performance
- Reference values
- Maximal oxygen uptake/peak oxygen uptake – definition and determination
- Exercise induced asthma – physiology of response, airway reactivity
- Use of pulse oximetry in exercise, sleep and principles and limitations of the measurement (advantages and disadvantages of different probes ie finger vs ear probes)
- Recovery from exercise - heart rate, stroke volume, cardiac output, ventilation
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### Respiratory muscle physiology

- Anatomy of respiratory muscles: inspiratory and expiratory muscles
- Pressure changes and pressure volume changes during ventilation (relationship of pleural pressure, alveolar pressure and mouth pressure to airflow)
- Airway resistance and work of breathing

### Sleep physiology

- Circadian rhythm, diurnal rhythm, melatonin
- Effects of shift work and jet lag on diurnal rhythm
- Respiration and gas exchange during sleep
- Use of pulse oximetry in simple sleep studies and overnight oximetry

### Gas exchange and acid base balance

- processes of gas exchange
- oxygen and carbon dioxide transport
- ventilation/perfusion ratio
- effects of shunts
- acid base balance - metabolic acidosis, respiratory acidosis, metabolic alkalosis, respiratory alkalosis
- blood gases - partial pressures of oxygen and carbon dioxide, pH
- bicarbonate, base excess, oxygen saturation
- type 1 and type 2 respiratory failure

## **RESPIRATORY MECHANICS (2)**

- Dynamic properties of the lungs including airways resistance, pulmonary resistance, flow volume relationships and the effects of density and viscosity of inspired gas
- Airways resistance and conductance
- Compliance

- Work of breathing
- Measurements obtained in obstructive and restrictive ventilatory disorders – changes in mechanics with different diseases

## **PATHOPHYSIOLOGY (2)**

### Lung function

- Pathophysiology in different diseases and effects on lung function:
  - Intrathoracic airways obstruction (asthma, chronic bronchitis, emphysema)
  - Extrathoracic airways obstruction (fixed, variable)
  - Restrictive ventilatory defects (pulmonary fibrosis, diseases of the chest wall, neuromuscular disorders)
  - Hypoxaemia (ventilatory failure, V/Q inequality, anatomical shunts)
  - Hypercapnia (disorders of the respiratory centre, respiratory nerves and muscles, disorders of the chest wall, airways and lung parenchyma)
  - Hyperventilation (acidaemia, psychogenic)
  - Cardiac disease (secondary to lung disease and hypertension; secondary to left ventricular failure or mitral stenosis)
  - Pulmonary embolism
  - Effects of cigarette smoking (chronic bronchitis and emphysema, carcinoma of the bronchus)
  - Occupational lung disease (pneumoconioses, asbestosis, farmers lung, asthma, extrinsic allergic alveolitis)

### Exercise physiology

Exercise response in **field exercise tests** to include:

- Cardiac and respiratory – patterns of response (heart rate reserve, oxygen desaturation, major limiting factors and assessment of symptoms)
- Other disorders – obesity, unfitness, malingering, deconditioning
- Contraindications to exercise testing and safety during tests
- Recognition of indications to terminate the exercise test prematurely in relation to field exercise tests

Indications for performing field exercise tests:

- Objective assessment of exercise capacity
- Assessment of symptoms
- Unexplained dyspnoea on exertion
- Assessment of disability
- Desaturation during exercise
- Assessment of therapeutic intervention eg change in bronchodilator therapy; pulmonary rehabilitation
- Serial monitoring
- Exercise induced asthma
- Assessment for ambulatory oxygen
- Exercise prescription
- Occupational health

### Sleep physiology

- Use of domiciliary sleep screening
- Pulse oximetry in detecting abnormal sleep disorders

- Recognition of obstructive sleep apnoea
- Interpretation and limitations of overnight sleep screening using pulse oximetry and recording of snoring

## **PHARMACOLOGY (2)**

- Airway reactivity with relation to exercise induced asthma and methacholine/histamine challenge testing
- Hypersensitivity – types 1 and 3
- Inflammation
- Bronchodilators: action of bronchodilators, mediators of response, theophyllines, long acting bronchodilators, cromoglycate therapy
- Distribution of receptors in the airways
- Antibiotics
- Steroids: steroid inhalers and oral corticosteroids
- Drugs that may affect lung function: amiodarone

## **PHYSIOLOGICAL MEASUREMENT THEORY (2)**

### *Field exercise tests*

- 6 minute and 12 minute walking tests
- Incremental and endurance shuttle walking tests
- assessment of desaturation during exercise
- assessment of supplementary oxygen requirements
- objective measure of exercise tolerance
- Use of measurements of symptoms (Borg scale, Visual Analogue Scale, Rating of Perceived Exertion) and pulse oximetry
- Indications and contraindications for performing field exercise tests and indications to terminate the test procedure
- Practical experience at performing tests, obtaining measurements and reporting results
- Concepts of full cardiorespiratory exercise testing and indications for performing tests (**not assessed**)

### *Exercise induced asthma*

- indications for tests and contraindications
- pre test requirements and precautions during test procedure
- measurements obtained during tests interpretation of results
- guidelines for the performance of the test
- practical experience and observation of tests including obtaining measurements and reporting of the observed response

### *Challenge testing*

#### Skin prick tests

- Indications and contraindications for performing skin prick tests
- Procedure and safety precautions
- Interpretation of results
- Allergens commonly used to perform tests

- Limitations of measurements
- Acknowledgement of other methods such as Patch tests, RAST tests

#### Methacholine/Histamine challenge

- Yan, dosimeter and tidal breathing methods
- Indications and contraindications for performing tests
- Safety precautions and safe handling of reagents
- Protocols for tests
- Graphical representation of results and interpretation methods

#### Respiratory mechanics

- Use of body plethysmography to measure lung mechanics
- Measurement of airways resistance and conductance
- Measurement of compliance

#### Respiratory muscle function

- Simple respiratory muscle strength assessment: including mouth pressures (MIP and MEP) using hand held mouth pressure meter; sniff pressures; vital capacity (seated and supine).
- Normal values and interpretation of results - common diseases in which respiratory muscle weakness may occur - muscular dystrophy, diaphragmatic paralysis, polio

#### Invasive and non-invasive measurement of blood gases

- procedures for the safe handling of blood - sharps awareness, safe disposal of equipment, infection control
- blood gas analysers - principles of operation and electrodes, calibration and maintenance
- normal values
- Ear lobe capillary sampling, venous blood sampling, arterial cannular and arterial puncture
- Transcutaneous measurement of oxygen and carbon dioxide: to include principles of measurement and limitations, applications in sleep, exercise, LTOT and non-invasive ventilation
- Indications for measurements of blood gases in sleep, exercise and LTOT
- Assessment for supplemental oxygen (to include LTOT, flight assessment, ambulatory oxygen assessment)

#### Introduction to sleep investigations

- Overnight oximetry (practical experience required)
- Sleep staging – recognition and interpretation of abnormal sleep patterns
- Indications for complex sleep studies (full PSG mentioned)
- Interpretation of results of simple overnight oximetry
- Obstructive sleep apnoea (main features and symptoms and treatment with CPAP mentioned)
- Other sleep related breathing disorders
- Epworth sleepiness scale
- Knowledge of the DVLA regulations
- Concepts of full polysomnography and indications for complex sleep investigations (**not assessed**)

## **INTERPRETATION (2)**

- Full lung function tests (recognition of patterns in COPD, asthma, emphysema, restrictive ventilatory disorders including interstitial lung disease, respiratory muscle disorders and neuromuscular disorders)
- Flight assessments and LTOT
- Pulse oximetry – overnight oximetry and field exercise tests
- Respiratory muscle function (MIP, MEP, sniff and supine vital capacity)

## **PRACTICAL COMPETENCIES (2)**

- Bronchodilator reversibility testing (recognition of need to deliver bronchodilator)
- Field exercise tests (eg ISWT, 6 MWT)
- Respiratory muscle function (MIP, MEP, sniff, supine VC)
- Pulse oximetry

## **TRAINING EXPERIENCE ONLY (2)**

- Exercise induced asthma
- Challenge testing (skin prick tests, methacholine/histamine challenge)
- Overnight oximetry
- Transcutaneous monitoring
- Airways conductance/resistance measurement
- Lung volumes (**alternative method to that assessed in part I**)