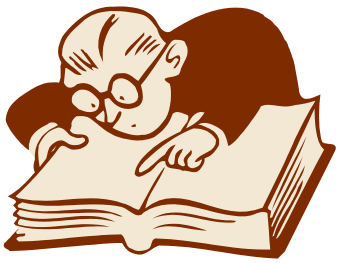
UNIVERSITY OF DUNDEE

Faculty of Medicine, Dentistry & Nursing

Phase 2, Year 2
Week 2
Airflow Obstruction/Pulmonary Function/Blood Gases

RESPIRATORY SYSTEM



Course Organiser: Prof B J Lipworth

2010/2011

Week 2 Airflow Obstruction/Pulmonary Function/Blood Gases

Introduction

During this week you will work through case histories of patients with asthma and chronic obstructive airways disease (COAD).

There are two patient illustrations. Mrs M Morgan has asthma and Mr Jim Crow has COAD.

Aims of the Week

By the end of this week you should be able to:

- Understand how pulmonary function is performed and interpreted
- Explain to a patient how to use a Peak flow meter and interpret a Peak Flow chart
- Understand how to interpret Arterial Blood gas analysis
- Understand the pathophysiology, clinical features, diagnostic criteria and pharmacological management of COPD
- Understand the pathophysiology, clinical features, diagnostic criteria and pharmacological management of Asthma
- Appreciate the role of non-pharmacological treatment in respiratory disease, ie. Smoking Cessation and Pulmonary Rehabilitation
- Complete a full examination of the Respiratory system
- Identify key symptoms from the respiratory history
- Appreciate there are various devices for delivering oxygen to patients and there are target levels of saturations for unwell patients.

Mrs M Morgan - Asthma

The Clinical Problem

Mrs Morgan a 30-year-old woman comes to see you a GP for the third time in six months, with a persistent non-productive cough which was initially triggered by a cold. She has already received two courses of antibiotics with no effect. She has been waking up most nights coughing and wheezing, and running for the bus particularly in cold weather makes her wheeze and breathless.
She also has noticed her symptoms are related to her periods. She is a non-smoker, works as a hairdresser and has a pet cat. She used to have eczema as a child, gets mild hay fever in the summer, and has a young brother with asthma.
One month later she is admitted to hospital with an acute attack of her asthma.

Prerequisites

Revise the anatomy and pharmacology of airways, gas exchange control and acid/base balance.

Learning Issues

1. What do you expect to find on examination - how will this vary with time of day?
2. What tests can you do to confirm the diagnosis?
3. What changes to her lifestyle would you advise?
4. What treatment might you initiate and how could assess whether it is working properly?

Clinical Problem

One month later she is admitted to hospital with an acute attack of her asthma.

Learning Issues

1. How would you assess the severity of her attack?
2. What would be your initial management?
3. How would you assess whether this initial treatment had worked?

Mr Jim Crow - Chronic Obstructive Pulmonary Disease

The Clinical Problem

A 68-year-old man is admitted to hospital with increasing breathlessness. This followed a recent viral type respiratory infection, since when he has been producing green phlegm, and his ankles have also recently become swollen. He smokes 30 cigarettes daily and has a smokers cough with daily production of clear phlegm. He used to work as a coal miner.

Prerequisites

Revise the anatomy and physiology of airways, gas exchange control and acid/base balance.

Learning Issues

1 What is his underlying condition and what has caused him to become decompensated?
2 What signs would you look for in his respiratory and cardiovascular system?
3 Why has he developed ankle swelling?
4 What would you expect to find on blood gas analysis and can you explain why this has occurred in terms of alveolar ventilation?
5 What other tests would you do to assess his overall cardiorespiratory condition?
6 What other tests should you do to assess his overall cardiorespiratory condition?
7 What drugs might you use acutely?
8 Which bacterial pathogens should you cover when choosing an antibiotic and by what route should you give it?
9 How should you treat cor pulmonale in the long term?
10 What immunisation should he be given?

Learning Opportunities

- **Lectures**

- **Integrated Teaching**
  - Spirometry and peak flow practical sessions
  - Smalll group teachig on Arterial blood gas analysis
  - Small group teaching on non-pharmacological methods of management

- **Clinical Skills**
  - Examination of respiratory system
  - Oxygen Prescribing

- **Online Resources and formative assessment**

Examination of Respiratory System

1 General Inspection:
- ❑ cachexia, anaemia, jaundice, pigmentation
- ❑ central cyanosis, clubbing
- ❑ flapping tremor (CO_2 retention)
- ❑ lymph nodes (supraclavicular, cervical)
- ❑ mediastinal location (trachea, apex beat)

2 Chest Inspection:
- a. scars, sinuses, mastectomy
- b. shape: barrel, pigeon, funnel, kyphoscoliosis
- c. distended veins (SVC obstruction)
- d. accessory muscle use
- e. chest wall excursion, costal paradox
- f. respiratory rate and depth

3 Chest Palpation:
- ❑ Front - Upper lobes, back - lower lobes, lateral-lingula/middle lobe
- ❑ Examine in zones: upper, middle, lower (front and back)
- a. expansion (>5cm) - using hands or tape measure: unilateral reduced expansion indicates focal pathology on that side
- b. tactile Vocal Fremitus ("99"): unilateral reduced TVF is due to proximal endobronchial obstruction or pleural effusion on that side
- c. percussion note - tactile as well as auditory: Dull note due to alveolar consolidation/collapse or effusion on that side Hyper-resonant due to pneumothorax or emphysema

4 Chest Auscultation:
- a. air entry: symmetrically reduced breath sounds - emphysema, severe asthma
- ❑ asymmetrically reduced breath sounds - prox endobronchial
- ❑ obstruction/collapse, pneumothorax, effusion
- b. nature of breath sounds - alveolar (normal), bronchial (due to consolidated lung tissue)
- c. additional sounds:
- ❑ crackles (inspiratory) - due to alveolar consolidation or alveolar wall oedema, inflammation or fibrosis
- ❑ stridor (inspiratory and expiratory) - audible tracheal or laryngeal obstruction
- ❑ wheeze (expiratory) - due to turbulent airflow in narrowed bronchi
- ❑ symmetrical - eg asthma, bronchitis, emphysema
- ❑ asymmetrical - eg narrowed bronchus due endobronchial obstruction (ca, foreign body) or extrinsic compression (node)
- ❑ pleural rub (inspiratory and expiratory) - due to pleurisy (transient)
- d. auditory vocal fremitus - equivalent of TVF
- e. whispering Pectoriloquy - in consolidated alveoli

	Wall Movement	Med Shift	Tactile Vocal Fremitus	Percussion Note	Breath Sounds	Added Sounds
Consolidation	Reduced unilaterally	None	Normal	Dull	Bronchial	Crackles, WP
Collapse with prox obstruction	Reduced unilaterally	Towards lesion	Decreased	Dull	Reduced	None
Large pleural effusion	Reduced unilaterally	Towards opposite side	Absent	Stony dull	Absent (Bronchial above effusion)	None (WP above effusion)
Diffuse fibrosing alveolitis	Reduced symmetrically	Normal	Normal	Normal	Normal	Crackles symmetrically
Asthma	Normal (costal paradox if severe)	None	Normal	Normal	Normal (reduced if severe)	Wheezes symmetrically
Emphysema	Reduced symmetrically	None	Normal	Hyper-resonant symmetrically	Reduced symmetrically	Wheezes symmetrically
Large Pneumothorax	Reduced unilaterally	Towards opposite side	Decreased	Hyperesonant	Reduced unilaterally	None

Therapeutics of Asthma

1 Which drug and by what route of administration is used as first-line preventative anti-inflammatory therapy for the treatment of asthma? Please give a generic class of drug followed by a specific drug name.

2 Which drug and by what route of administration is used as first-line rescue bronchodilator therapy in asthma? Please give a generic class of drug followed by a specific drug name.

3 In addition to the class of drug named in Question 1 above, name examples of three drugs which may be used as additional second-line controller therapy to optimise disease control – again give for each example a class of drug and a specific drug name as well as the administration route.

4 Name a first-line anti-inflammatory and first-line bronchodilator drug to be used in acute asthma and by which route of administration – give the class name and the specific drug name as well as the administration route.

5 Patients who fail to respond to first-line therapy as outlined above in Question 4. Name two additional second-line bronchodilator drugs and their route of administration.

6 In chronic persistent asthma, if there is an apparent failure to respond to optimised first and second-line therapy, list five possible reasons for the failure of treatment response.

Therapeutics of COPD

1 Name two bronchodilator drugs which are commonly used on a regular basis for the treatment of COPD and their route of administration. For each name the class of drug and the specific drug name.

2 For patients who are thought to have an inflammatory component to their COPD (ie chronic bronchitis), which drug and by what route of administration would you administer – name the class of drug and a specific drug name.

3 Name the first-line of antibiotics you would use to treat an infected exacerbation of COPD (endobronchial infection without pneumonia) and the route of administration.
   a. Name the general class of antibiotic and the specific drug name
   b. Name the two commonest organisms which you hope to cover with this antibiotic.

4 If your patient is hypoxaemic ($Pa0_2$,<8KPa, SaO_2<90%)
   a. What long-term domiciliary treatment can you offer and how should this be administered?
   b. Is there anything else you can do to improve pulmonary arterial oxygenation?

5 What is the single most important part of management to prevent deteriorating lung function and impending respiratory failure?

6 In an acute exacerbation of COPD with type 2 respiratory failure, what inspired concentration of oxygen mask should you give empirically before you obtain the results of your initial blood gas assessment.

7 If you administer an appropriate inspired concentration of oxygen, but the patient becomes increasingly drowsy, what type of drug should you administer in combination with the oxygen and by what route of administration.

Glossary of Terms – Week 2

Airway resistance (Raw) - Related to calibre of airway - increased in obstructive defect; normal in restrictive defect

Atopy - An allergic state predisposition.

Chronic airflow obstruction - A condition caused by smoking resulting in airflow obstruction which does not vary with time.

Bronchodilator - A drug which relaxes bronchial smooth muscle and improves airflow obstruction.

Cor-pulmonale - Pulmonary hypertension due to chronic hypoxic lung disease - pulmonary heart disease.

Hypercapnic drive - Normal stimulus to breathing driven by $PaCO_2$.

Hypoxic drive - Abnormal stimulus to breathing driven by PaO_2 - in response to CO_2 desensitisation during chronic CO_2 retention in COPD.

Obstructive defect - Pattern of pulmonary function abnormality resulting in reduced expiratory airflow rates, reduced forced expiratory ratio and expiratory air trapping.

Forced expiratory ratio - Ratio of forced respiratory volume in 1 second (FEV1) to forced vital capacity (FVC). Ratio <75 per cent indicates obstructive defect.

Peak expiratory flow rate - The maximum flow rate (L/min) achieved on forced expiration from total lung capacity - reduced in obstructive defect, normal in restrictive defect.

Gas transfer diffusion (TLCO or DLCO) - Capability to transfer carbon monoxide (CO) across the alveoli-vascular bed - reduced in restrictive defect, normal in obstructive defect (unless emphysema).

Residual volume (RV) - Volume of air in lungs after vital capacity (VC) after full expiration from total lung capacity (TLC). Increased in air trapping due to obstructive defect; reduced in restrictive defect (TLC = VC + RV).

Spacer - A device which acts as a holding chamber for a pressurised metered dose aerosol - reduces mouth deposition (and hence local side effects) and improves lung deposition (and hence efficacy).

Nebuliser - A device which vaporises a liquid drug to be inhaled as an aerosol or droplets - driven by an air compressor or oxygen.

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