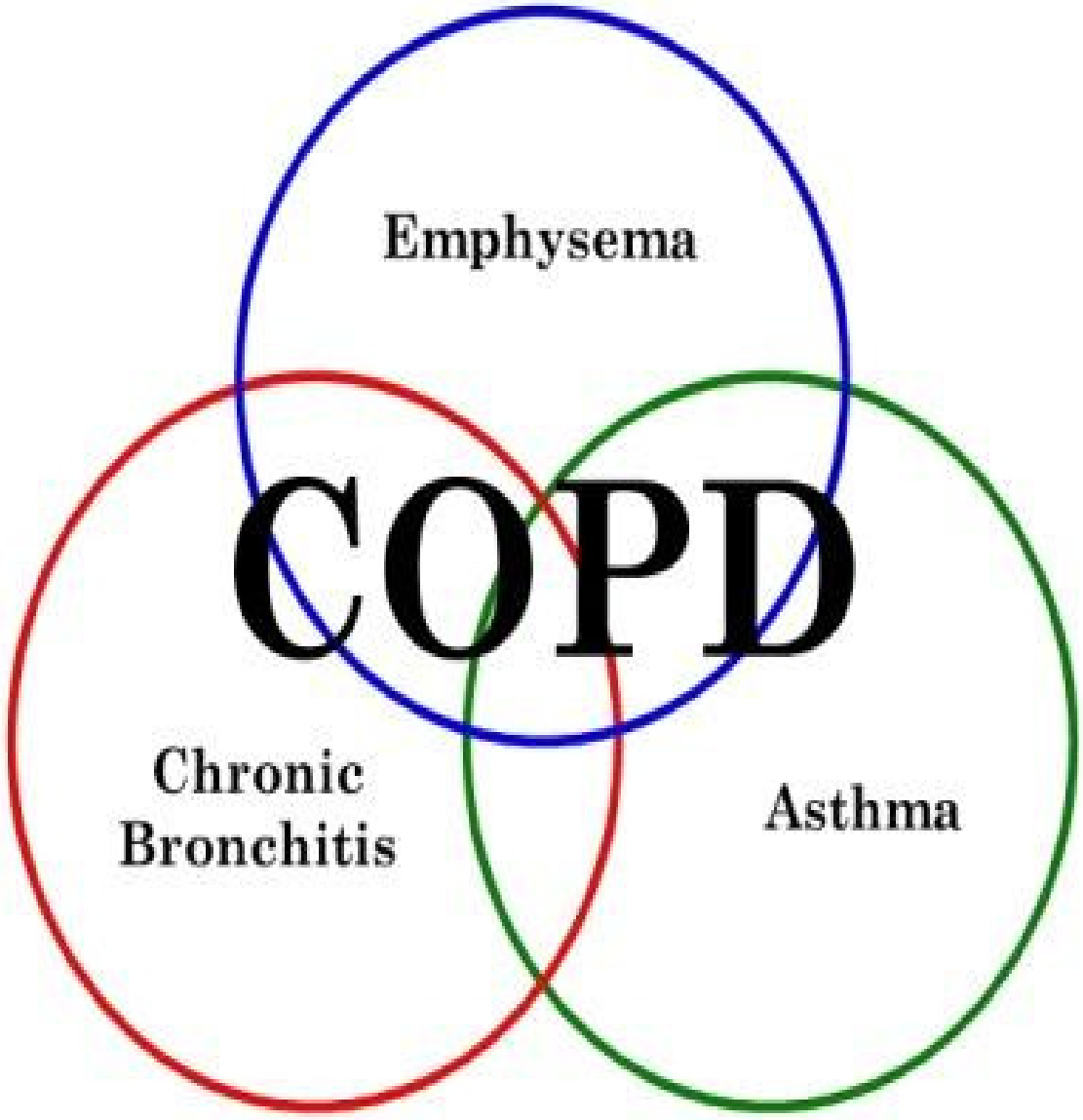
Chronic Obstructive Pulmonary Disease (COPD) workbook



Scenario 2: Chronic Obstructive Pulmonary Disease (COPD)

Section 1: Pathology of COPD

Introduction
You now have a good foundation of knowledge regarding the cardiovascular respiratory system. With this knowledge of normal anatomy and physiology as well as the effects of asthma on the lung tissues you can begin to clinically reason how different diseases of the lung can affect the respiratory system.

In this workbook we will be looking at COPD and considering the signs and symptoms that your patients may present. You will already have been introduced to COPD and its effect on a person as well as the family unit in your trigger. Considering your patient holistically is vital and this will become more evident as you proceed through week two of the cardiovascular unit.

Where to start?
Having knowledge of the pathology of COPD will help you to develop your clinical reasoning, so it is recommended that you begin by completing activity 1.

Intended Learning Outcomes (ILOs)
Please refer to the ILOs for the cardio-vascular respiratory unit which can be found in your level I unit guide, page 8. Each section in this workbook is designed to help you meet those ILO's, which have been outlined below;

Section 1: Pathology of COPD
When you have worked through section 1 you'll be able to describe the causes, tests and diagnosis of COPD and it's effect on normal lung tissue

Section 2: Management of COPD
When you have worked through section 2 you'll be able to list the medication and method of application used to control COPD

Section 3: Pulmonary rehabilitation
When you have worked through section 3 you'll be able to list different outcome measures and discuss the role of the multi-disciplinary team (MDT)

Section 4: CPAP / BiPAP
When you have worked through section 4 you'll be able to state when CPAP and BiPAP should be administered

Section 5: Psychosocial
When you have worked through section 5 you'll be able to identify problems with your patient's mobility and functional impairment due to psychosocial aspects of their well-being.

Section 6: Case study
When you have worked through section 6 you'll be able to clinically reason a treatment plan using SMART (specific, measurable, achievable, realistic, time-based) goals using evidence-based practice (EBP)

Activity 1 (one and a half hours): Using either Hough (2001) or Pryor and Prasad (2004) read about the pathology of COPD and fill in the gaps to test your knowledge on the definition, causes, tests and diagnosis of COPD.

COPD means ---------- ---------- ---------- ----------and includes two respiratory disorders ---------- and ----------. These two disorders cause ----------and commonly occur together. ---------- causes inflammation of the bronchi while ----------causes damage to the small airways and ---------- which leads to ---------- where there is a loss in the surface area reducing gaseous exchange.

The main cause of COPD is ----------, but ---------- ---------- can also be a contributing factor. Chronic is defined as----------and obstruction is caused by----------. Pulmonary is a term meaning ----------.

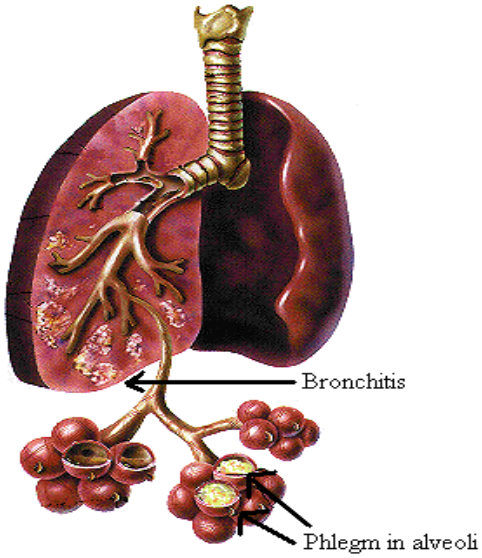
COPD and asthma have similar symptoms but they are very different diseases. In COPD the damage to the airways is ---------- whereas in asthma it is ----------. It is important to remember that some people with COPD also have asthma. In order to confirm the diagnosis of COPD a ---------- test is carried out. This test measures ---------- and with a result of a ---------- value combined with four typical symptoms of COPD 1.----------2,----------3,----------4,---------- confirms the diagnosis of COPD.

Symptoms usually begin at the age of ---------- after smoking for -------years or more. There is usually a gradual ---------- over the years with a ---------- cough, and increased ----------. Chest infections become more frequent and there is often an increase of symptoms which is known as an ----------. As the disease becomes more severe there is a lack of ---------- to the lungs due to the ----------. This in turn decreases the amount of ----------entering the blood stream, which can lead to ----------.

Notes

Activity 2 (30 mins): As you have discovered from your learning, COPD is a combination of bronchitis and emphysema, so lets now look at these two pathologies separately to consolidate your learning by completing part 1 and part 2. Remember there may also be elements of asthma so don't forget what you learnt in week 1!

Part 1: Consider what happens to normal lung tissue when Bronchitis is present



Describe what you see happening to the lung tissue in the above diagram.

What are the symptoms of Bronchitis?

How long does Bronchitis normally last for?

What happens if the secretions (phlegm) are not removed from the lung tissues? ----------
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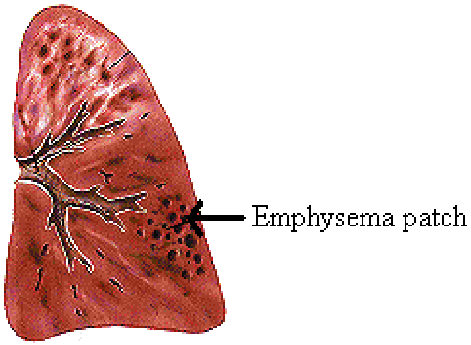
Part 2: Consider what happens to normal lung tissue when emphysema is present

Alveoli with blood vessels

Describe what happens to the alveoli in the lung tissue of someone with emphysema.



Why do people with emphysema become short of breath?

Describe how and why the chest shape changes?

Notes

Section 2: Management of COPD

 In this section we will be drawing upon your previous knowledge of skills techniques taught in week 1 of the cardiovascular respiratory unit. This section will help you to apply those techniques to practice.

You have been taught “percussions” and “vibrations” as two-hands-on physiotherapy techniques, which can be used to remove secretions from the lungs. These techniques cause movements within the lung tissues and help to dislodge the secretions that are ‘stuck’ in the airways. The latter enables the patient to cough the secretions out of the lungs more efficiently. This can be enhanced by positioning the patient according to where the secretions are. Your stethoscope will provide you with this information as well as helping you to diagnose your patient’s condition.

At this stage we expect you to practice listening to ‘normal’ lungs not only in skills sessions but at every opportunity you have. This skill comes with practice. A CD Rom is available to help you to learn different sounds and their diagnosis and you will be introduced to this in your skills sessions. Please take the opportunity to listen to this at regular intervals throughout the unit.

COPD patients will be on certain medications to help ease their symptoms. As physiotherapists it is paramount that you understand what each medication does and how it helps in the management of COPD. With this knowledge you will be able to time your treatment accordingly so that your manual skills will be effective and beneficial for your patient. Knowing when and when not to carry out your physiotherapy treatment, is vital in maintaining compliance and preventing your patients from discomfort and increased breathlessness.

Following reading ‘Drug therapy’ page 133 to 144 in Hough (2001) complete the multiple-choice questionnaire on the following page to test your knowledge in this subject.

Using the skills learnt from CARP find the following articles to help you to link evidence based practice (EBP) to your COPD management.

1. Shrestha. M, O'Brien. T, Haddox. R., 1991. Decreased duration of emergency department treatment of chronic obstructive pulmonary disease exacerbations with the addition of ipratropium bromide to beta-agonist therapy *Ann Emerg Med.* 20:1206-9
2. Moayyedi. P, Conglton. J, Page. R L., 1995. Comparison of nebulised salbutamol and ipratropium bromide with salbutamol alone in the treatment of chronic obstructive pulmonary disease *Thorax*. 50:834-7
3. Koutsogiannis. Z, Kelly. A M., 2000. Does high dose ipratropium bromide added to salbutamol improve pulmonary function for patients with chronic obstructive airways disease in the emergency department? *Aus New Zealand Med J*. 30:38-40.

Activity 3 (30 mins): Complete the multiple choice questionnaire on the medication used to treat COPD

1. Bronchodilators
    a) Open your airways
    b) Close your airways
    c) Narrow your airways
    d) Block your airways

2. Bronchodilators are administered by
    a) Liquid
    b) Pills
    c) Inhalers
    d) All of the above

3. Beta-antagonist are
    a) Steroids
    b) Bronchodilators
    c) Anti-biotics
    d) None of the above

4. Anti-cholenergics are
    a) Steroids
    b) Bronchodilators
    c) Anti-biotics
    d) None of the above

5. Beta-antagonists work by
    a) Relaxing the muscles around the airways
    b) Increasing the blood flow to the muscles around the airways
    c) Reducing the inflammation in the muscles around the airways
    d) Decreasing the blood flow to the muscles around the airways

6. The most common side-effect of beta-antagonist is
    a) Nausea
    b) Fatigue
    c) Muscle tremor
    d) Cramp

7. Anti-cholonergics work by

    a) Contracting the muscles around the airways
    b) Blocking the chemical which our bodies produce preventing inflammation
    c) Relaxing the muscles around the airways
    d) Blocking the chemical produced by our bodies that normally causes the airways to contract

8. Steroids work by
    a) Reducing muscle contraction in the airways
    b) Increasing the blood flow to the airways
    c) Reducing secretions and inflammation in the airways
    d) None of the above

9. Anti-biotics are necessary to
    a) Protect the lungs
    b) Prevent infections
    c) Reduce inflammation
    d) Prevent inflammation

10. Oxygen is required when the patient is
    a) Breathless
    b) Fatigued
    c) Experiencing increased heart rate, increased respiratory rate and confusion
    d) Hyperventilating (breathing at speed)

Well done you now have a base-line knowledge of the medication used to control COPD.

Activity 4 (10 mins): To help you to comprehend and search for medication that your patients may be on, subscribe to the on-line British National Formulary (BNF) which is available at www.bnf.org/bnf/registration and is free of charge.

Notes

Activity 5 (40 mins): To build on your knowledge of COPD medication find out the following;

Name four commonly used steroidal drugs

1. ----------
2. ----------
3. ----------
4. ----------

List four ways of administering medication for airway obstruction

1. ----------
2. ----------
3. ----------
4. ----------

Name the device used to help prevent oral thrush (fungal infection of the mouth)

List three side effects of corticosteroids inhalers

1. ----------
2. ----------
3. ----------

Name four beta-antagonists

1. ----------
2. ----------
3. ----------
4. ----------

List five adverse effects of high does Beta-antagonists

1. ----------
2. ----------
3. ----------
4. ----------
5. ----------

Name two anticholinergic drugs

1. ----------
2. ----------

Which one of the above is no longer used and why?

Why should we be careful when administering oxygen to people with COPD?

Activity 6 (15 mins): To finish this section complete the table below to consolidate your learning about the medication and methods of application used to control COPD

Drug	Method of delivery	Side effects
Beclomethosone		Oropharyngeal candidasis (thrush)
	Oral	Tachycardia (Increased heart rate)
Hydrocortisone		Muscle atrophy
Salbutamol (ventolin)	Intravenous	
	Inhalation	
Ipratropium (Atrovent)		Constipation

(Modified from Hough 2001)

Notes

This is a table showing the Summary of treatments at each stage of COPD

Mild COPD	Need strong anti-smoking advice Few symptoms so that most will not even need a bronchodilator
Moderate COPD	Need strong anti-smoking advice Breathlessness usually sufficient to justify and get benefit from a single drug bronchodilator inhaler-unlikely to need combinations of bronchodilators Antibiotics for exacerbations A steroid trial useful diagnostically and if positive should have inhaled steroids Unlikely to require oral steroids even in exacerbations
Severe COPD	Very symptomatic and limited Will always need an inhaled bronchodilator and often will report benefit from combinations of beta-antagonist and anticholinergic Subject to side effects-theophyllines may help An oral steroid trial can help selet patient for regular inhaled steroids Acute exacerbations often, severe requiring hospital care and oral steroids, antibiotics, nebulised bronchodilators, and sometimes respiratory support. Selected patients will need further long term support to maintain an acceptable quality of life

(Simonds et al 1996)

You are now equipped with all the information you need to apply this knowledge to the case studies, which will be provided to you via black board for your self managed learning (SML) session.

Activity 7 (20 mins) Complete the two case studies on COPD

Section 3: Pulmonary rehabilitation

You have now discovered how medication can help manage the symptoms of COPD but how does physiotherapy help? This question leads us onto the subject of pulmonary rehabilitation, which is described as;

> "Pulmonary rehabilitation is an evidence based, multidisciplinary and comprehensive intervention for patients with chronic respiratory disease who are symptomatic and often have decreased daily life activities. Integrated into the individualised treatment of the patient, pulmonary rehabilitation is designed to reduce symptoms, optimize functional status, increase participation, and reduce health-care costs through stabilising or reversing systemic manifestations of the disease."
>
> (ATS & ERS, 2006)

Pulmonary rehabilitation programmes consist of a multidisciplinary team (MDT) and cover patient and family education; treatment of bronchospasm by means of bronchodilators or reduction in bronchial secretions; treatment of bronchial infections; treatment of congestive heart failure; oxygen therapy; chest physiotherapy including breathing technique training; exercise reconditioning; psychosocial therapy and vocational rehabilitation (Simonds et al 1996).

The role of the physiotherapist

1. A subjective and objective assessment (as taught in week 1) is carried out
2. Identification of general and physiotherapeutic goals in collaboration with the MDT, patient and family
3. Advice and education on breathing control (Sharp et al 1980 & Webber 1991)
4. Active Cycle of Breathing Technique (ACBT) to remove secretions
5. Thoracic mobilisations (if applicable), posture correction, transcutaneous electrical nerve stimulation (TENS) or stretching of muscles and ligamentous tissues to reduce chest wall pain due to joint dysfunction
6. Increase functional ability through a progressive exercise programme (Toshima et al 1990 & Niederman et al 1991)

Outcome measures

Outcome measures such as the treadmill walking or shuttle-walking test can be used to determine maximum endurance. The modified BORG scale can be used in conjunction with one of these tests to determine the maximum level of perceived respiratory effort by the patient. In addition the Health Related Quality of Life (HRQL) questionnaire can be used as an assessment tools for a person with COPD entering a pulmonary rehabilitation programme.

EBP

Borg, GAV., 1982. Psychophysical basis of perceived exertion. *Medical Science Sports Exercise.* 14: 377-81

Curtis, J. R. Deyo, R. A. Hudson, L. D. 1994. Health-related quality of life among patients with chronic obstructive pulmonary disease. *Thorax*. 49: 162-70

Singh, S. J. Morgan, M. D. L. Scott, S. Walters, D. Hardman, A. E., 1992. Development of a shuttle-walking test of disability in patients with chronic airways obstruction. *Thorax* 47: 1019-24

Activity 8 (30 mins): So that you can complete the activities in this section it is suggested that you now read chapter 14: Pulmonary rehabilitation: a multidisciplinary intervention: pages 471 to 488 in Pryor and Prasad (2004).

Notes

Activity 9 (40 mins): Physiotherapy assessment
It is essential that as a physiotherapist you identify your patient's individual problems before they commence pulmonary rehabilitation. Complete the following activity to help you to achieve this.

Name five resources where you can obtain information about your patient that is available to you.

1. ----------
2. ----------
3. ----------
4. ----------
5. ----------

What should your subjective information from your patient include? List ten areas that you ought to discuss with your patient.

1. ----------
2. ----------
3. ----------
4. ----------
5. ----------
6. ----------
7. ----------
8. ----------
9. ----------
10. ----------

What objective information should you collect from your patient? Consider six and write them down in the space provided.

1. ----------
2. ----------
3. ----------
4. ----------
5. ----------
6. ----------

Activity 10 (40 mins): Practice obtaining subjective and objective information from your patient by role-playing with a peer and give each other feedback. You might find it helpful to read pages 3 to 25 on assessment and investigation of patient's problems in Pryor and Prasad (2004) to guide you.

Activity 11 (20 mins): Draw a spider diagram below to demonstrate who is involved in the MDT and their role within the pulmonary rehabilitation programme. Consider who would be included in goal setting. Don't forget the patient should be at the centre!

Notes

Activity 12 (1 hour): Pulmonary rehabilitation programmes are set up to compliment rather than replace existing services for people with chronic disabling lung diseases such as COPD. Complete the activity below to consolidate your learning on this subject.

Think about what a routine service would offer and then consider what would be the fundamental components of a pulmonary rehabilitation programme and write them down in the space provided.

1. ----------
2. ----------
3. ----------
4. ----------
5. ----------
6. ----------
7. ----------
8. ----------
9. ----------
10. ----------

Outcome measures

Describe the 12-minute walking test

Describe the shuttle-walking test

Describe the modified BORG scale

Activity 14 (1 hour): During your video skills session this week, practice what you learnt in week 1 on giving advice and education to your patient on breathing control and ACBT and relate it to a COPD patient. Also revise your upper quadrant mobilisation techniques for thoracic pain and the use of TENS using a visual analogue scale (VAS) to record your patient's outcome measure.

Section 4: CPAP / BiPAP

You have now looked at the pathology, medication and rehabilitation programmes for people with COPD. This section will be taking you a step further to consider equipment that could benefit and support your patient. You need to be aware of how this equipment functions and who to refer your patient to if they start to deteriorate. At this stage it would be a good idea to remind yourself about the vital signs that you learnt in week 1.

The equipment that we will discuss in this section is CPAP (Continuous Positive Airway Pressure) and BiPAP (Bilevel Positive Airway Pressure). Evidence demonstrates that they are effective in preventing intubation (a tube placed into the mouth to attach to a ventilator machine in intensive care) and decreasing mortality in patients with Acute Respiratory Failure (Kramer et al 1995, Poponick et al 1999 and Brochard et al 1995).

CPAP

CPAP works by delivering a continuous positive air pressure of about 10 cm of water throughout the respiratory system. The sensation that your patient will experience when using CPAP is equivalent to sticking your head out of a moving car. CPAP is thought to improve breathing by counteracting intrinsic PEEP (positive end expiratory pressure) and decreasing the work of breathing.

Intrinsic PEEP

In patients with severe COPD, the lung does not fully empty due to the obstruction in the airway resulting in a positive pressure in the airways at end expiration. Therefore for a patient with severe COPD they must initially overcome this positive airway pressure before a negative pressure can be generated to breathe in more air. This is called intrinsic PEEP and in patients with respiratory failure due to COPD it is often about 5cm H2O, but it can be higher.

BiPAP

BiPAP delivers CPAP but also senses when an inspiratory effort is being made and delivers a higher pressure during inspiration. When flow stops, the pressure returns to the CPAP level. This positive pressure wave during inspiration unloads the diaphragm decreasing the work of breathing. In patients with respiratory failure, a common technique is to begin with the expiratory level at 5 and the inspiratory level at 15. The levels are adjusted based on the patient's comfort, tidal volume achieved and blood gases.

EBP

Brochard, L. et al 1995. Noninvasive Ventilation for Acute Exacerbations of COPD, *NEJM*. 333:817-822.

Kramer, N. et al 1995. Randomized, prospective trial of noninvasive positive pressure ventilation in acute respiratory failure. *American Journal of Respiratory and Critical Care Medicine*, 151, 1799-1806

Poponick, J. et al 1999. Use of a Ventilatory Support System (BIPAP) for Acute Respiratory Failure in the Emergency Department. *Chest*, 116, 166-171

Notes

Activity 15 (1 and half hours): Please refer to pages 175 to 181 'Mechanical aids' in Hough (2001) to extend your knowledge on CPAP and BiPAP. If you can complete the 'mini case studies' for 'mechanical aids' (p 181-182) you are well on your way to clinically reasoning a treatment plan for your patient.

In addition you will need to know about type 1 and type 11 respiratory failure before reading about NPPV (non-invasive positive-pressure ventilation) below. I would therefore recommend that you read page 117 in Hough (2001) to familiarise yourself with this.

Information on NPPV

NPPV is delivered by a nasal or face mask, therefore eliminating the need for intubation or tracheostomy. NPPV can be given by a volume ventilator, a pressure-controlled ventilator, a bilevel positive airway pressure (BiPAP or bilevel ventilator) device, or a continuous positive airway pressure (CPAP) device. Volume ventilators are often not tolerated because they generate high inspiratory pressures that result in discomfort and mouth leaks.

NPPV delivers a set pressure for each breath (with a bilevel or standard ventilator in the pressure-support mode). Although positive-pressure support is usually well tolerated by patients, mouth leaks or other difficulties are sometimes encountered. BiPAP ventilators provide continuous high-flow positive airway pressure that cycles between a high positive pressure and a lower positive pressure.

NPPV may be used as an intermittent mode of assistance depending on patients' clinical situations. Instantaneous and continuous support is given to the patients in acute respiratory distress. As the underlying condition improves, ventilator-free periods are increased as tolerated, and support is discontinued when the patient is deemed stable. In most studies, the duration of NPPV use in patients with acute on chronic respiratory failure averages 6-18 hours. The total duration of ventilator use varies with the underlying disease; approximately 6 hours is used for acute pulmonary oedema and more than 2 days is used for COPD exacerbation.

Honrubia et al (2005) compared the efficacy and resource consumption of NPPV against conventional mechanical ventilation in patients with acute respiratory failure. Avoidance of intubation, mortality, and consumption of resources were the outcome variables. Thirty-one patients were assigned to the non-invasive group, and 33 were assigned to the conventional group. NPPV reduced the need for intubation in patients with acute respiratory failure from different causes. A trend of reduction in intensive care units (ICUs) and hospital mortality together with fewer complications during ICU stay was observed (Honrubia et al 2005).

NPPV and COPD

Acute exacerbation of COPD is a frequent cause of admission to hospital and ICU. Patients develop a deterioration of gas exchange accompanied by rapid shallow breathing, severe dysponea (breathlessness), right ventricular failure,

and encephalopathy. The respiratory system is unable to maintain adequate alveolar ventilation in the presence of abnormalities in respiratory mechanics. Patients develop a shortened inspiratory time, decrease in tidal volume, and increased respiratory frequency of the excessive respiratory load. Therefore, treatment should be directed at reducing the loads imposed on the respiratory muscles.

Benefits of NPPV
In acute respiratory failure, NPPV offers a number of potential advantages over invasive positive pressure ventilation (PPV). These advantages include the avoidance of intubation-related trauma, a decreased incidence of nosocomial pneumonia, enhanced patient comfort, a shorter duration of ventilator use, a reduction in hospital stay, and ultimately, reduced cost.

Mechanisms of action
NPPV decreases the work of breathing and thereby improves alveolar ventilation while simultaneously resting the respiratory musculature. The improvement in gas exchange with BiPAP occurs because of an increase in alveolar ventilation. Externally applied expiratory pressure (eg, positive end-expiratory pressure [PEEP]) decreases the work of breathing by partially overcoming the auto-PEEP, which is frequently present in these patients. The patients generate a less negative inspiratory force to initiate a breathing cycle.

Inhalation and exhalation
In spontaneous mode, upon detection of inspiration, higher pressure is delivered until the flow rate falls below the threshold level. The expiratory pressure with bilevel pressure support is equivalent to the PEEP, and the inspiratory pressure is equivalent to the sum of the PEEP and the level of pressure support. In timed mode, biphasic positive airway pressure ventilation alternates between the inspiratory and expiratory pressures at fixed time intervals, which allows unrestricted breathing at both pressures. This differs from the spontaneous mode of BiPAP, which cycles on the basis of the flow rates of the patient's own breathing.

Supplemental oxygen can be connected to the device, but a higher flow of oxygen therapy is usually required.

NPPV is more effective in a relaxed patient and is not optimal in an anxious uncooperative patient or a patient fighting the ventilator. Patients must be adequately prepared with properly fitting masks, and the increase of the inspiratory and the expiratory pressures should occur gradually. Effectiveness should be determined clinically by improved respiratory distress, decreased patient discomfort, and improved results from arterial blood gas determinations.

N/B You will learn about arterial blood gases in week 3.

Notes

Clinical trials supporting the use of NPPV in patients with COPD exacerbation

NPPV is an effective means of treating patients with acute respiratory failure resulting from a variety of causes, as demonstrated by uncontrolled studies and prospective randomized trials. NPPV improves alveolar ventilation by increasing tidal volume. Most studies have used NPPV as an intermittent mode of support because the support is not delivered on a continuous basis, but rather for 6-18 hours per day. The duration of NPPV depends on each patient's clinical situation.

Most trials used inspiratory pressures of 12-20 cm water and expiratory pressures of 0-6 cm water and excluded patients with hemodynamic instability, uncontrolled arrhythmia, or a high risk of aspiration.

Recent prospective randomized studies strongly support the use of non-invasive mechanical ventilation in patients with severe exacerbations of COPD. In a large randomized trial (Brochard 1995) comparing NPPV with a standard ICU approach, the use of NPPV was shown to reduce complications, the duration of ICU stay, and mortality. Patients in whom NPPV failed had a similar mortality rate compared to the intubated group (25% vs 30%).

Wysocki and colleagues (1995) recently published the largest prospective randomized study comparing NPPV to standard treatment in patients with COPD exacerbation. NPPV was administered on the ward; the nurses were trained for 8 hours in the preceding 3 months. Treatment failed in significantly more patients compared to the control group (27% vs 15%); in-hospital mortality rates were significantly reduced from the use of NPPV (20% to 10%).

In addition, 3 Italian cohort studies with historical or matched control groups have suggested that long-term outcome of patients treated with NPPV is much better than that of patients treated with medical therapy and/or with endotracheal intubation.

***Cochrane Systematic Review* determined the efficacy of NPPV in the management of patients with respiratory failure due to an acute exacerbation of COPD**.

Fourteen studies were included in the review. NPPV resulted in decreased mortality (relative risk [RR] 0.52), decreased need for intubation (RR 0.41), and reduction in treatment failure (RR 0.48). The complications associated with treatment (RR 0.38) and length of hospital stay (mean, 3.24 d) was also reduced in the NPPV group. NPPV has benefit as first-line intervention in addition to usual medical care in all appropriate patients for the management of respiratory failure secondary to an acute exacerbation of COPD. Early NPPV is known to reduce the likelihood of endotracheal intubation, treatment failure, and mortality (Ram 2004).

Early use of NPPV to assess the outcomes of acute exacerbation of COPD was evaluated in those patients with respiratory muscle fatigue and mild respiratory insufficiency. The early use of NPPV on general ward improved arterial blood gas and respiratory pattern and decreased the rate of need for intubation in patients with acute exacerbation of COPD.

Severely altered level of consciousness (ALC) has been considered a contraindication to NPPV. A recent study compared the clinical outcome of patients with acute respiratory failure due to COPD exacerbations and different degrees of ALC. This study confirmed that NPPV was successfully applied to patients experiencing COPD exacerbations with milder ALCs, whereas the rate of failure in patients with severely ALCs was higher, but an initial and cautious attempt with NPPV may be performed (Scala 2005).

A step-wise approach to the management of acute COPD exacerbation
A summary of all these studies shows that NPPV has been shown to offer better outcomes to patients admitted with acute exacerbations of COPD. A complimentary step-wise approach to these patients is recommended:

1. The first step is based on medical care with drug treatment and oxygen supplementation.
2. The second step is the early use of NPPV to prevent further worsening of the COPD and subsequent clinical deterioration. NPPV should be delivered to patients who have respiratory distress and develop moderate respiratory acidosis, ie, a pH of less than 7.30. NPPV should also be offered to the patients in whom medical therapy has failed, whose ventilatory function deteriorates, and those who are candidates for ventilatory assistance.
3. The final step is endotracheal intubation and mechanical ventilation. This should be reserved for patients who deteriorate despite NPPV or patients in whom NPPV is contraindicated.

The use of NPPV does not require longer nursing time, but longer respiratory therapist time is required in the initial period

Patient selection
Patients who are in acute respiratory distress and are at risk of needing intubation should be selected for non-invasive ventilation if they have a reversible cause of acute respiratory failure.

Notes

Guidelines for the use of NPPV in patients with acute respiratory failure

1. **Blood gas findings**
    a) Partial pressure of carbon dioxide in arterial gas (PaCO2) greater that 45mm Hg
    b) PH less than 7.35 but more than 7.10
    c) PaO2 and fraction of inspired oxygen (FIO2) less than 200

2. **Clinical inclusion criteria**
    a) Signs or symptoms of acute respiratory distress
    b) Moderate-to-severe dyspnoea, increased over usual
    c) Respiratory rate greater than 24 breaths per minute
    d) Accessory muscle use
    e) Abdominal paradox
    f) Gas exchange
    g) PaCO2 greater than 45 mm Hg and PH less than 7.35
    h) PaCO2 to FIO2 ratio less than 200 mm Hg

3. **Diagnosis**
    a) COPD exacerbation
    b) Acute pulmonary oedema
    c) Pneumonia

4. **Contraindications**
    a) Respiratory arrest
    b) Inability to use mask because of trauma or surgery
    c) Excessive secretions
    d) Haemodynamic instability or life-threatening arrhythmia
    e) High risk of aspiration
    f) Impaired mental status
    g) Uncooperative or agitated patient
    h) Life-threatening refractory hypoxemia (alveolar-arterial difference in partial pressure of oxygen (PaO2) < 60 mmHg with FIO2 of 1)

5. **Factors predictive of success**
    a) Younger age
    b) Lower acuity of illness (ie, acute physiology and chronic health evaluation (APACHE) score)
    c) Patient able to cooperate
    d) Ability to coordinate breathing with ventilator
    e) Moderate hypercapnia (PaCO2 > 45 mm Hg but <92 mm Hg)
    f) Moderate academia (PH>7.10 but <7.35
    g) Improvement in gas exchange and heart and respiratory rates within first 2 hours

Protocol for initiation of NPPV in patients with acute respiratory failure

1. Position the head of the bed at a 45 degree angle
2. Choose the correct size of mask and initiate ventilator at CPAP (expiratory positive airway pressure or EPAP) of 0cm water with a pressure support of 10 cm water
3. Hold the mask gently on the patient's face until the patient is comfortable and is full synchrony with the ventilator
4. Apply wound care dressing on the patient's nasal bridge and other pressure points
5. Secure the mask with head straps, but avoid a tight fit
6. Slowly increase CPAP to more than 5 cm water
7. Increase pressure support (i.e. inspired positive airway pressure or IPAP, 10-20 cm water) to achieve maximal exhaled tidal volume (10-15 mL/Kg)
8. Evaluate that ventilatory support is adequate, which is indicated by an improvement in dysponea, a decreased respiratory rate, achievement of desired tidal volume and good comfort for the patient
9. Oxygen supplementation is achieved through NPPV machine-to-machine oxygen saturation of greater than 90%
10. A backup rate may be provided in the event the patient becomes apeneic
11. In patients with hypoxemia, increase CPAP in increments of 2-3 cm water until FiO2 is less than 0.6
12. Set the ventilator alarms and backup apnoea parameters
13. Ask the patient to call for needs, and provide reassurance and encouragement
14. Monitor with oximetry and adjust ventilator settings after obtaining arterial blood gas results

Weaning from NPPV

In stable patients, weaning from NPPV may be accomplished either by progressively decreasing the levels of positive airway pressure or by discontinuing the therapy for increasing lengths of time. A combination of both strategies can also be used.

Severe but stable COPD

Evidence for the use of NPPV in patients with severe but stable COPD is less convincing. Enthusiasm was initially generated in the 1980s by the hypothesis that the intermittent use of negative-pressure ventilation in patients with severe but stable COPD would improve overall function by resting chronically fatigued respiratory muscles. Subsequent controlled studies have demonstrated no significant benefit.

Of the 4 controlled studies using NPPV for severe but stable COPD, only 1 has shown favourable results. This crossover study by Meecham Jones (1993) used a nasal BiPAP system nocturnally, and improvements were observed in daytime and nocturnal $PaCO_2$, total sleep time, and quality-of-life

scores after 3 months of NPPV use. Patients enrolled in this study had an average $PaCO_2$ of 57 mm Hg and an FEV_1 of 821 mL. Many patients with severe chronic COPD do not tolerate long-term PPV.

A trial of nocturnal NPPV is recommended in patients with COPD with severe hypercapnia ($PaCO_2$ >55 mm Hg), nocturnal oxygen desaturation, coexisting sleep disordered breathing, and possibly patients with frequent panic attacks, which may be relieved by using NPPV.

(Modified from Sharma 2006)

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Notes

Activity 16 (30 mins): Revise your work from week 1 on partial pressures and then write down all the millimetres of mercury (mm Hg) values that you can find in the above information. Now convert the readings into kilopascals (kPa). This is a useful exercise as kPa is now widely used in hospitals instead of mm Hg.

1 kPa = 7.5 mmHg

Example:
$Paco_2$ 4.5-6 kPa (35-50 mm Hg)
Pao_2 11-14 kPa (83-105 mm Hg)

Activity 17 (20 mins): Write down in the space provided when BiPAP and CPAP should be administered

Activity 18 (30 mins): Make a list of the words in the information on NPPV that you don't know and find out their meaning using a medical dictionary

Notes

Section 5: Psychosocial

We now need to consider our patient as a person and how that person is feeling with the diagnosis of COPD. Viewing our patient holistically will help us to provided a better service for people with COPD. If we can relate to the emotions that a person is going through we will also comprehend how it is affecting them mentally as well as physically. With this knowledge you will begin to realise why treating someone with COPD can be both challenging and rewarding as well as accepting why at times they are non-compliant (rebellious) to treatment.

How can physiotherapy help?

Physiotherapy can help reduce feelings of stress and anxiety and prevent problems such as hyperventilation and depression. There are a number of ways in which this can be done for example through;

- Listening to your patient's fears and anxieties
- Relaxation techniques
- Advice and education
- Progressive exercise programmes (hospital and home based)
- Breathing control
- Setting goals with the patient and their family
- Energy conservation, e.g. life style changes, pacing
- Maintaining good posture and gait (walking) pattern
- Reducing pain through Postural advice and the use of TENS
- Removing secretions

Getting your patient to mobilise (walk) is really important to maintain their functional activities of daily living (ADL). This simple but effective activity will also aid the clearance of secretions and improve your patient's respiratory capacity.

People with COPD often get into a vicious cycle of becoming frightened to move, so they remain immobile, which reduces their exercise tolerance and therefore increases their breathlessness when they do attempt to get to the toilet for example. The latter increases their fear of becoming more breathless and they become increasingly dependant and less active. Their social life stops because of this and soon they find themselves isolated. As they lose control of the situation their self-esteem is lowered and this is often when depression sets in. At this point it becomes a challenge to motivate your patient. You therefore need to treat your COPD patients at the earliest possible opportunity to prevent this vicious cycle from occurring.

EBP

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Notes

Activity 20 (20 mins): So that you will be better equipped to clinically reason an individual treatment plan we will be bringing in a person with COPD so that you can talk to them. This person will have attended a patient support group (PSG) so you will be able to find out more about the benefits of people attending such groups. You can also find out their experiences of physiotherapy and pulmonary rehabilitation (if they have had this service available to them). It is suggested that you read the following to increase your knowledge in this subject before coming to the patient panel.

COPD as a Stressful Life Event

Chronic illness demands continual psychological adjustment as the disease progresses through different stages from no symptoms to mild, then moderate and severe symptoms. Respiratory patients must cope with a wide variety of stressors including: shortness of breath, cough, sputum production, wheeze, pain, changing body image, loss of independence, social stigma, social isolation and uncertainty about the future.

Along with these respiratory associated stressors COPD patients must also deal with changing environments, family pressures and other critical events that occur during this time of their life span. Although successful adaptation to the disease process (and critical life events) is normal, adverse psychological reactions can commonly occur at some time during the chronic disease process. Such reactions include - depression, anxiety/worry, panic attacks, irritability and confusion.

The word stress can be confusingly used to mean two different things. Sometimes the word stress is used to describe a stressor. A stressor is something that people perceive as a threat and that calls upon the individuals coping mechanisms. They include situations that cause uncertainty or where people feel a lack of control, or harmful or unpleasant situations that lead to stressful reactions (eg. "giving that presentation was very stressful").

At other times stress can be taken to mean the stress reactions that occur in response to the stress such as thoughts, feelings, behaviours and physiological responses (e.g. showing "signs" of stress).

Therefore stress is a process that can be seen as an interaction between the coping skills of the individual and the demands of his/her environment. The following account will use the 3-part stress model to try and explain some of what patients may experience and how PSG may help.

Physical and Psycho-social Stressors

As previously defined stressors are situations that put demands on coping skills. The COPD patient comes into contact with and must cope with a wide variety of physical stressors which include shortness of breath and other respiratory symptoms, environmental pollution, changes in temperature, exposure to infection/disease, taking medication and hospitals/medical clinics.

As we all live and function in a social context these attributes of our environment (psycho-social stressors) can also put demands on our ability to cope. The COPD patient must be able to manage the chronic disease while still trying to maintain effective relationships with their spouse, friends, acquaintances and health care staff. However, due to the disabling nature of the disease it can cause relationships to be strained and may result in many patients being socially isolated and not seeking treatment.

One of the aims of PSG's is to empower patients with better coping skills to deal with both the physical and psycho-social stressors. This can be achieved through encouraging patients to help each other and presentations from guest speakers to reinforce what they have already learned in pulmonary rehabilitation.

Psychological Stress Reactions

The psychological responses that COPD patients have to stress include the thoughts, feelings and concerns they have about their perceived threats. These are their interpretation of the situation and each patient can interpret the same situation in a different way. Such expectations of coping can become distorted in COPD as they may be based on past experiences in which patients did not cope well. Examples of some distorted and unrealistic interpretations include "This attack is going to become severe", "I'll end up in hospital," "I can't do anything any more because I get short of breath," "I'm a useless individual", "My life is not worth living."

These thoughts can lead to negative feelings such as anxiety, anger, tension, frustration, hopelessness and depression. In fact, two Australian based studies (including the Australian Lung Foundation) and other studies have shown that there is a significant prevalence of psychiatric morbidity in COPD. The prevalence of depression and anxiety in COPD can range between 40 - 90% compared to 8 - 20% in the normal population.

Such psychological disturbance can compound the disability and handicap faced by people with COPD, leading them to withdraw from life, becoming more socially and physically inactive which in turn enhances the psychological symptoms and a vicious cycle appears.

PSG's can give patients the opportunity to discuss their feelings and emotions (which in itself is extremely therapeutic) as well as physically getting out and participating in activities which are both enjoyable and rewarding. This type of treatment (support groups which incorporate activity) has been shown in clinical trials to be effective in alleviating anxiety and depression. The Australian Lung Foundation randomised control rehabilitation trial showed that small group rehabilitation and support significantly reduced psychiatric morbidity in the COPD sample.

Sedentary lifestyles can lead to deconditioning of muscles and reduced fitness. Many patients with COPD develop a phobia towards exercise due to shortness of breath, embarrassment, misinformation, anxiety and depression and a vicious cycle of inactivity can occur.

Notes

PSG's can provide an environment that encourages people to participate in physical exercise and also provide exercise classes. They can also encourage people to be more physically active by organising walks and tours for its members.

Another aim of PSG's is to change/modify the way people think about their disease. They may endeavour to change and replace the defeatist and negative attitudes and thoughts exhibited by many patients with a more positive outlook. Changing the way people think about their situation has been shown to effect the way they feel and thus we may be able to alleviate some of the feelings of depression, anxiety and hopelessness.

Physiological Responses to Stress
The body reacts to stress through a variety of physiological responses which include: Increases in heart rate, blood pressure, blood flow, tension in voluntary muscles, perspiration, depth and frequency of breathing and nausea, diarrhoea, hot flushes, cold chills.

This represents the body's attempt to adapt to the increased load of coping with the stressor. It is the automatic self-protection mechanism (termed the "Fight or Flight Response") that prepares the body to fight the threat or avoid it.

In some instances these physiological responses can be misinterpreted or not dealt with soon enough and they can become out of control leading to a panic attack. As the precipitant of a panic attack is usually shortness of breath it is not surprising that many COPD patients suffer from such attacks.

Although strategies for coping with panic attacks are discussed during pulmonary rehabilitation, PSGs afford the opportunity to reinforce some of these strategies (e.g. diaphragmatic breathing, relaxation techniques) through practice and discussion.

What happens when the stress response continues?
Stress is a three-stage process

1. The Alarm Phase - the initial response of the body (i.e. the flight or fight response). Little thought involved
2. Stage of Resistance - Coping and Adaptation
3. Stage of Exhaustion - Shock and Lowered Resistance to Infection

If the stage of resistance (coping and adaptation) is not effectively performed this can lead to several psychological changes which include alteration in personality and cognition e.g.

- Increased difficulty in solving problems, worry excessively, misinterpret situation, irritability, easily frustrated, lack of energy, loss of interest, forgetful, insomnia, fear loss of control
- More aggressive – complain about care, become more demanding, argumentative, stubborn, stressful situations are increasingly avoided
- More passive – difficulty in making decisions, becomes increasingly isolated, waits to be taken care of

As a result of their COPD many patients have reduced oxygen levels in their blood stream. Oxygen is required by the brain in order for it to function properly and significantly reduced oxygen levels can cause deficits in short term memory, planning and organisation and concept formation. When this is accompanied by the cognitive problems associated with stress, it is not surprising that in a study, which was recently conducted by the Australian Lung Foundation, 81% of the COPD sample exhibited some form of cognitive deficit. 33% showed visual short-term memory impairment and 44% verbal short-term memory impairment. Therefore ongoing PSG's provide an opportunity to rehearse and review learned material and therefore enhance learning.

The more coping skills COPD patients can use, the more likely it is that they will be able to MAINTAIN, CONTROL AND COPE EFFECTIVELY with their disease and reduce the chances of psychological and cognitive disturbance.

Another psychological benefit of PSG's is that many patients' feelings of isolation and having to cope alone are ameliorated through social comparison. Patients are relieved, know that they are not the only ones with respiratory disease problems and that there are others who are just as sick as them, and have similar problems. Many of the patients view PSG's as self-help groups where they learn how to cope through listening to what others have done.

Summary

PSG's provide the ideal opportunity for COPD patients to learn how to cope more effectively by providing information, social comparison, reinforcement, encouragement and support in a caring environment, alleviating fears and anxieties, providing pleasurable and enjoyable activities and changing the way people think about their disease. Such interventions are aimed at decreasing depression and anxiety, improving quality of life and reducing length of stay and hospital admissions.

Notes

Activity 21 (30 mins): Now that you have read about psychosocial aspects of COPD see if you can identify problems that your patient's might present. Consider the effect on your patient's mobility and functional impairment and write your list in the space below.

Activity 22 (20 mins): Now you are ready to consider what questions you would like to ask the person with COPD attending the patient panel. Please use the space below to write down your questions.

Section 6: Case study

In this section you will draw together all that you have learnt in chapter two and during week 2 of the cardio respiratory unit to clinically reason the following case study. This will help you towards achieving your video-critique assessment for the cardio respiratory unit;

Activity 23 (1 hour): A 56 year-old man has been admitted to hospital with an acute exacerbation of COPD. He has been referred to you for respiratory physiotherapy and advice. This is his second admission in a year. He was diagnosed with COPD two years ago. He has noticed that his exercise tolerance is deteriorating and he is finding it increasingly difficult to cope with his job as a builder. He is anxious about his finances as he has a mortgage to pay and a family to support (he is the main earner). He has also attempted to give up smoking but he says he struggles with this as it helps him to relax and causes him to cough, which "gets rid of the phlegm".

Remember to use SMART goals (refer back to your previous work on problem orientated medical records (POMR) and EBP when clinically reasoning your treatment plan for the this patient.

Well done you have completed the workbook on COPD and you now have a solid knowledge base to help you to produce your product for week 2. This will also be enhanced with your own individual learning from the trigger at the beginning of the week. You can now progress to the next workbook and continue to build on your knowledge in respiratory physiotherapy.

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