Detecting changes in the respiratory status of ward patients

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Summary

This article outlines the principles of respiratory assessment. It is intended to be a learning tool for all nurses, however, it may have more relevance for nurses on general wards. Such nurses, unlike those who work in intensive care units and accident and emergency (A&E) departments, do not have the advantage of frequent presence of medical staff and may have to intervene promptly and autonomously in response to detected changes.

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DETERIORATION IN a patient's respiratory status is the primary cause of critical illness and the most common reason for admission to intensive care (Moore and Woodrow 2004). Nurses should be proficient in conducting a thorough assessment of a patient's respiratory status. This will enable the identification of existing and potential problems and care can be planned accordingly.

A respiratory assessment may need to be carried out routinely when a patient with a known respiratory problem is admitted to a ward or unit. Respiratory assessments are also required when a patient's condition deteriorates or if he or she develops respiratory symptoms. The early recognition of a change in a patient's respiratory status is essential and should be accompanied by an appropriate response and early intervention (Ahern and Philpot 2002).

Causes of respiratory failure

Respiratory failure occurs when the pulmonary system is unable to meet one or two of its gas exchange functions: oxygenation and/or elimination of carbon dioxide (Ferns and Chojnacka 2006). There are a variety of causes of respiratory failure (Box 1). It is important that nurses consider non-respiratory causes of breathlessness as well as respiratory causes. Many respiratory and cardiac diseases have similar clinical manifestations and, for many patients, the two co-exist.

Respiratory assessment

It is important that nurses have a sound knowledge of the anatomy and physiology of the pulmonary system to carry out a respiratory assessment. Readers are referred to the work of Kindlen (2003) and Montague *et al* (2005), which contain comprehensive descriptions of the pulmonary system.

History taking If the patient's condition permits, respiratory assessment should begin with a patient history. History taking is vital and provides many clues to the cause of respiratory illness. Finesilver (2003) postulates that the physical examination only serves to reinforce the information derived from the history. It allows the nurse to assess the patient's mental state and whether he or she is orientated to time and place. Patients who are in respiratory failure can become confused as a result of severe hypoxia (Stillwell 2002). Patients who are in respiratory distress are usually anxious, irrespective of the cause of breathlessness.

Breathless patients can also become confused as a result of anxiety (Moore and Woodrow 2004). High levels of carbon dioxide can also cause increased drowsiness and confusion (Jevon and Ewens 2001). Fear can exacerbate breathlessness (Rao and Gray 2003), therefore, the nurse should do his or her best to make the patient feel comfortable and less anxious. Panic during an asthma attack can put patients at a higher risk of life-threatening attack (Kolbe *et al* 2000).

Although in reality there are obstacles, a quiet and calm environment is ideal for conducting a respiratory assessment. Patients with a

compromised respiratory status are dyspnoeic – this is the subjective feeling of 'air hunger', difficulty breathing and shortness of breath (Kennedy 2006). Dyspnoea has been identified as a significant preceding factor to adverse events (Considine 2005).

Where possible, closed questions should be used and patients should not be rushed as they may find talking difficult. When a breathless patient is unable to speak in full sentences because of the need to pause for breath, this is known as 'staccato speech' (Hudak *et al* 1998). This inability to talk in full sentences is clinically significant and in asthma it is considered a sign of a severe and/or life-threatening exacerbation (British Thoracic Society (BTS) and Scottish Intercollegiate Guidelines Network (SIGN) 2005). If a patient is unable to talk in full sentences the nurse should curtail the history taking and act to relieve the patient's respiratory distress.

The history component of a respiratory assessment should include: medical, surgical, social, family, drug and smoking history (Bourke 2003). To avoid the patient having to repeat him or herself, old notes and GP records should be accessed whenever possible. Known diagnoses are an important consideration when carrying out an assessment. A history of chronic obstructive pulmonary disease (COPD) should be considered when a patient's oxygen requirements are being assessed. Too much oxygen could be fatal for such patients as they may lose their hypoxic drive, retain carbon dioxide and develop respiratory acidosis.

Drug history is of particular importance if an asthma diagnosis is being considered. Beta blockers should be used with caution as they block the beta receptors in the smooth muscle of the airway and can cause bronchospasm (British National Formulary (BNF) 2007). The more cardioselective beta blockers can sometimes be used with less effect on the respiratory system. Eye drops, such as timolol maleate, also contain beta blockers and can be absorbed systemically.

A respiratory assessment should also involve a pain assessment. Pleuritic chest pain is usually sharp and localised. Unlike cardiac chest pain, a patient with pleuritic chest pain can often point to the exact place where he or she feels the pain. Pleuritic chest pain is often aggravated by coughing and deep inspiration. Patients should be asked to describe their cough and to estimate how long they have had it. It is important to find out if they are aware of anything that precipitates the cough. If their cough is worse at a particular time of the day, this may point towards a diagnosis. In asthma the cough may worsen at night, whereas a morning cough, known as a 'smoker's cough', is associated with COPD.

Patients should be asked about the colour, quantity and consistency of their sputum. They can be helped to quantify the amount of sputum by asking them to estimate in teaspoons. Some of the common diagnoses associated with particular types of sputum are listed in Box 2. However, it is important to note that, although these are common findings, there are many exceptions. For example, blood-stained sputum, although potentially a life-threatening problem (Finesilver 2003), could be the result of mucosal damage from frequent or forceful coughing (Mishoe and Welch 2002).

Observation When assessing patients, the nurse should evaluate their general appearance. This should include posture, skin colour, chest movement and 'work of breathing'. Work of breathing describes a patient's respiratory effort, and their breathing pattern and chest movements indicate this. If patients have increased work of breathing, they are having to work hard to breathe. The breathing can become laboured and noisy and this is a significant marker of respiratory distress (Bennett 2003). When this occurs, patients often use accessory muscles – scalene and sternocleidomastoid – to make breathing easier. Increased work of breathing causes the lungs to become hyperinflated and the diaphragm is flattened. Patients experiencing this can tire easily as a large inspiratory effort results in a small change in respiratory pressure (Bersten *et al* 2003).

The rate at which a patient is breathing and the pattern are of extreme significance. Goldhill *et al* (1999) found that respiratory rate was a key predictor of cardiac arrest and admission to intensive care. The respiratory rate should be ascertained by counting the number of breaths for a full minute. This is good practice for the care of

BOX 1

Causes of respiratory failure

Respiratory	Asthma, bronchitis, bronchiectasis, chest trauma, chronic obstructive pulmonary disease, interstitial lung disease, lung cancer, pneumonia, pneumothorax, pulmonary effusion, pulmonary embolism, pulmonary fibrosis and tuberculosis.
Cardiac	Atrial fibrillation, cardiogenic shock, heart block, heart failure (congested cardiac failure and left ventricular failure), myocardial infarction and pulmonary oedema.
Metabolic	Diabetic ketoacidosis and anaemia.
Neurological	Myasthenia gravis and Guillain-Barré syndrome.
Central nervous system	Drug and alcohol overdose, head injury and raised intracranial pressure.
Psychological	Anxiety, fear, pain and agitation.
Mechanical (reduced lung capacity)	Ascites, obesity and pregnancy.

all patients but it is of particular importance for patients who have irregular breathing patterns and critically ill patients – critically ill patients are at risk of sudden deterioration and a change in respiratory rate may be the first indication of this (Moore and Woodrow 2004). To obtain an accurate record the patient should be resting for five minutes before the rate is counted (Bennett 2003). It is important that a nurse considers what the patient was doing before any part of the respiratory assessment. For example, if the patient has recently undergone a position change, experienced pain or mobilised, this should be considered when observations are interpreted.

Patients may alter their breathing if they know that their respirations are being recorded. Nurses can avoid this by measuring the respirations after taking a manual pulse while staying in the same position. Measuring the pulse manually allows the nurse to assess the rate, volume and regularity of the pulse. Many patients with respiratory problems will be tachycardic as a result of the increased work of breathing and anxiety associated with breathlessness. Drugs used to treat respiratory problems, such as salbutamol and aminophylline, can cause tachycardia (BNF 2007).

A patient is described as tachypnoeic if he or she has a respiration rate of more than 20 breaths per minute. This is considered a key indicator of respiratory distress (Jevon and Ewens 2001, Rao and Gray 2003). However, respirations, as with all other vital signs, should be considered in relation to the patient's 'norm'. Many patients with COPD have a respiration rate of more than 20 breaths per minute at rest. It would be inaccurate to presume that such patients are in respiratory distress. Bradypnoea is an abnormally slow rate of breathing (less than 12 breaths per minute) that can also indicate a severe deterioration in a patient's condition. Extreme hypoxia can result in bradypnoea (Francis 2006), other causes include hypothermia and central nervous system depression.

Tachypnoea is the most common abnormality in vital signs of patients admitted to intensive care (Ahern and Philpot 2002). However, despite the significance of this vital sign, anecdotal evidence demonstrates that this observation is most commonly omitted on observation charts. This lack of recording of vital signs is considered the greatest risk to critically ill patients (Chellel *et al* 2002). In addition to the respiration rate, the breathing pattern should be noted. The regularity and depth of respirations should be noted as well as the type of breathing pattern.

Cheyne-Stokes respiration is an irregular type of breathing pattern, which is interrupted by periods of apnoea. This often occurs in patients with head injury and those nearing end of life. Kussmaul breathing, which involves deep and rapid respirations, is often seen in patients with a metabolic acidosis. Hyperventilation is caused by anxiety. It involves a person over-breathing or breathing faster than is necessary.

A patient's posture can indicate the level of breathing difficulty that he or she is experiencing. Patients with increased work of breathing prefer to sit as upright as possible. They avoid lying flat, as this is likely to result in orthopnoea – breathing difficulties which are worsened when a person lies down. Patients with impaired respiratory function often adopt a tripod position. This involves the patient resting their arms on their knees, arms of a chair or a bedside table. This is a way of splinting the lungs to allow maximum expansion. It is a sign of impending decline in respiratory function (Cox and McGrath 1999).

A patient's chest movements also indicate the quality of breathing. Both sides of the chest should expand on inspiration. The movement should be equal and symmetrical. If the nurse cannot assess this by observing the patient, the chest movements can be felt by the nurse placing his or her hands on adjacent sides of the patient's chest. There are numerous causes of asymmetrical and uncoordinated chest movements. These include: chest trauma, pneumothorax and pleural effusion. Unequal chest movements also occur in flail chest – which occurs when there are multiple fractures of adjacent ribs (Mishoe and Welch 2002).

The colour and condition of a patient's skin and extremities can indicate chronic and acute respiratory failure. The patient should be observed for the presence of cyanosis. Peripheral cyanosis and central cyanosis have different clinical significance. Central cyanosis is the bluish discoloration of the skin and mucous membranes. This has more significance in a respiratory assessment as it indicates hypoxaemia, which is a low level of oxygen in arterial blood.

BOX 2

Sputum types and associated conditions

Type of sputum	Associated diagnosis
Green, thick and foul smelling	Infection
Blood-stained sputum	Tuberculosis, pulmonary embolism and lung cancer
White, thick mucoid sputum in the absence of exacerbation or infection	Chronic obstructive pulmonary disease and asthma
Pink, frothy sputum	Heart failure
Brown or brick coloured	Tuberculosis and infection

Bourke (2003) advises nurses to use this sign with caution as cyanosis is not a sensitive measure of hypoxaemia and is usually undetectable until oxygen saturations drop below 85%. Normal oxygen saturations are between 95-98%. In a patient with COPD, saturations between 90-93% are acceptable (National Institute for Clinical Excellence (NICE) 2004); however, saturations may be higher in many of these patients. Esmond (2001) highlights the problems in observing cyanosis in dark-skinned patients. The oral mucosa is the preferred site for observation of cyanosis in dark-skinned people.

Peripheral cyanosis is a less significant finding in a respiratory assessment. This form of cyanosis, which is associated with circulation problems, can be a long-standing problem. It is common in patients who are hypothermic and those with peripheral vascular disease.

Pulse oximetry This enables a rapid and constant monitoring of a patient's oxygenation. Pulse oximeters measure the oxygen saturation of haemoglobin in arterial blood. Unlike arterial blood gases (ABGs), which are invasive and often painful, pulse oximetry is a simple and non-invasive procedure. However, ABGs are required when monitoring the adequacy of ventilation, rather than oxygenation alone. Pulse oximetry is commonly used as a part of nursing assessments.

It is imperative that nurses who are responsible for undertaking pulse oximetry are aware of the limitations of this form of monitoring. Pulse oximeters have decreased efficiency when used on a patient whose oxygen saturations fall below 80% (Johnson 2004). The oximeters only provide a measure of oxygen and not carbon dioxide. In patients with COPD, the carbon dioxide levels may be rising as the patient deteriorates and becomes acidotic. This will not be detected by pulse oximetry, as the oxygen saturations may remain unchanged.

Pulse oximetry can provide false readings on patients who are hypothermic or peripherally shut down. Movement, nail varnish, bright overhead light and intravenous dyes used for imaging can also cause false readings. Pulse oximetry is contraindicated in patients who have high levels of carboxyhaemoglobin in their arterial blood, such as those who have been in house fires. Such patients may appear to have normal oxygen saturations because pulse oximeters measure the oxygen bound to haemoglobin and do not take into account the haemoglobin bound to carbon monoxide. Despite these limitations, pulse oximetry is used safely in a wide variety of settings to aid respiratory assessments.

In addition to observation for evidence of cyanosis and pulse oximetry, the nurse should note whether the patient is well perfused. Excessive sweating, diaphoresis, should be noted. This is a sign of acute respiratory and cardiac failure (Mishoe and Welch 2002). Oedema in the lower legs, particularly in the ankles, occurs in patients with both right-sided and left-sided heart failure. Patients with chronic respiratory failure are at risk of right-sided heart failure as a result of cor pulmonale. Patients with chronic respiratory failure can also develop increased curvature of the nail bed resulting in 'finger clubbing'. In extreme cases of 'finger clubbing', the fingers can be modelled into the shape of drumsticks.

Auscultation This is an important component of respiratory assessment. It involves listening to breath sounds with a stethoscope. Auscultation is a specialised skill that requires training and practice. It should only be undertaken by experienced practitioners (Docherty and Coote 2006). Unlike in the United States, where

TABLE 1

Adventitious breath sounds and associated conditions

Breath sound	Description	Associated conditions
Crackles	Similar to the sound made by rubbing two strands of hair together with fingertips. Caused by fluid in the alveoli.	Pulmonary oedema, congested cardiac failure, pulmonary fibrosis, bronchiectasis and pneumonia.
Rhonchi	Low-pitched gurgling sound caused by secretions in the upper or large airway. Passage of air partially obstructed by mucus or secretions. Can be cleared by coughing.	As above.
Silent chest	Caused by bronchoconstriction, bronchospasm and mucosal swelling so severe that air cannot pass through the airways. May indicate the need for intubation.	Life-threatening exacerbation of asthma (BTS and SIGN 2005). Acute deterioration in any respiratory condition.
Wheeze*	High or low-pitched musical sound produced by restricted airflow through a narrowed airway and increased airway resistance.	Asthma, chronic obstructive pulmonary disease, laryngeal or tracheal oedema, obstruction caused by a foreign body or tumour.
Stridor*	High pitched rasping sound heard on inspiration caused by obstructed airway.	Laryngeal or tracheal obstruction caused by a foreign body or laryngeal oedema.

* Often heard without the aid of a stethoscope

auscultation is considered a core nursing skill (Giddens 2007), in the UK nurses are generally not trained in auscultation. Consequently, the skill is usually only undertaken by those nurses who have intensive care experience and nurse practitioners who work in general practice, walk-in centres and minor injury units. However, the practice of listening to normal breath sounds, known as vesicular breath sounds, can be beneficial. This will enable a nurse to assess whether there is air entry into all lung fields and allow for prompt action in the case of absence of air entry.

Breath sounds that are abnormal or extra are known as adventitious breath sounds. These occur when air passes through narrowed airways, as a result of constriction or partial obstruction and when fluid that has accumulated in the lung or the chest cavity becomes inflamed (Cox and McGrath 1999). Although some nurses are not trained in detecting abnormal breath sounds, it is beneficial if they understand their significance. For example, if a nurse learns that a patient has 'crackles' it will be helpful to know that this is an indication of fluid in the lungs. This could influence how he or she positions a patient and could help to initiate a referral for chest physiotherapy. A summary of adventitious breath sounds and the conditions associated with them is provided in Table 1.

Conclusion

This article has highlighted the importance of nurses' knowledge and skills in respiratory assessment. Causes, signs and symptoms of respiratory problems have been discussed. Practical guidance on history taking and physical assessment of patients with respiratory conditions has been provided. The frequency of such assessments should be determined by the patient's condition and response to treatment.

This article has highlighted the need for a respiratory assessment tool that can be used by nurses. It is imperative that nurses are aware of the significance of the findings derived from respiratory assessments. Patients who have compromised respiratory function are at risk of rapid deterioration. Close observation and effective assessment of such patients enable nurses to plan care proactively. Predicting potential deterioration in this group of patients may be enough to prevent it in many cases **NS**

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