

## Respiratory Assessment for Nurses (part two)

### Introduction

Part one of Respiratory Assessment for Nurses outlined the importance of appropriate respiratory assessment to improve care outcomes for the acutely ill ward patient. Moreover, it is recognised that deterioration in physiological status is often not appreciated, nor acted on in a timely manner (NICE 2007, Cioffi 2000b, Considine and Botti 2004, Franklin and Matthew 1994, Massey et al 2008). Evidence suggests that clinical staff may lack the required knowledge and skills to perform a comprehensive respiratory assessment which ultimately has a deleterious effect on the potential to minimise adverse patient events (Harrison et al 2006, Considine 2005, Kause et al 2004, Massey et al, 2008). In the first part of this article, respiratory inspection and palpation were described and discussed. In this second article the skills of percussion and auscultation will be explained in order to equip cardiac nurses with a comprehensive systematic model for respiratory assessment.

### Percussion

Percussion is a key component of respiratory assessment that should be used in conjunction with auscultation to aid differential diagnosis (Mangione 2008). Percussion produces audible sounds (percussed notes) and palpable vibrations which can help to determine if the underlying lung tissue is filled with fluid, air or solid material (Douglas et al 2009). Pathophysiological changes occurring in the lungs as a result of conditions such as pneumothorax, pleural effusion and consolidation alter the characteristics of percussion notes which, when considered in the context of a comprehensive respiratory examination can assist with differential diagnosis. Percussion should be performed in sequence in the interspaces at 5cm intervals (avoiding the damping effect of the scapulae and ribs) over both sides of the chest, whilst paying close attention to the audible changes in percussion notes (Jarvis 2007) (figure 1). Percussion technique requires practice and can be difficult to master but good technique is important to extract accurate findings.

Figure 1: Sequence for percussion a) posterior b) anterior

Percussion of the anterior chest is usually carried out with the patient in a supine position, whereas the patient should be sitting upright (if possible) with their arms folded across the chest whilst examining the posterior chest wall. Correct technique involves hyperextending the middle finger of your dominant hand on the patient's chest with fingers slightly separated. With the tip (not the pad) of the opposite middle finger strike the middle finger placed on the chest wall with a loose swinging movement from the wrist (Douglas et al 2009) (figure 2). Remove the percussing finger quickly to avoid creating a dampened note.



Figure 2: Percussion technique

A sound knowledge of the underlying structures within the thoracic cavity is essential in order to determine abnormal from normal findings. For example, percussion of normal lung tissue should produce a resonant note whereas percussion over solid structures like the liver or heart will produce a dull note (Jarvis 2007) (figure 3). Conversely, dull percussion notes found over lung tissue could be indicative of abnormal lung density found in atelectasis, tumour and pleural effusion (figure 4). Obstructive atelectasis can be caused by secretions and or mucus plugs obstructing the bronchi resulting in collapsed, shrunken sections of alveoli (possibly an entire lung) that cannot take part in gaseous exchange, ultimately resulting in a ventilation/perfusion mismatch and hypoxaemia. Clinically, atelectic areas produce dull percussion notes and can be a common finding in cardiac patients due to chest pain, the use of opiate analgesia, surgical wound discomfort and immobility (Douglas et al 2009).

Whilst percussion is an integral component of respiratory assessment, it is prudent to note that percussion alone only sets into motion approximately a 5-7cm depth of outer tissue; thus, it is not able to reveal any changes in tissue density deeper than 5-7cm (Bickley 2008). For example, scattered dullness can be heard over healthy lung tissue in people who are obese or in athletes with a heavily muscular chest wall.

Figure 3: Expected percussion notes

Figure 4: Percussion notes

<b>Resonant</b>	Healthy lung tissue
<b>Hyperresonant</b>	Too much air present Emphysema or pneumothorax
<b>Dull</b>	Abnormal lung density Pneumonia, pleural effusion, atelectasis or tumour
<b>Stoney dull</b>	Pleural effusion or haemothorax

## Auscultation

The final component required to complete a comprehensive respiratory assessment is auscultation of the anterior and posterior chest wall. When performed in conjunction with percussion, auscultation can help to assess the condition of the surrounding lungs and pleural space (Bickley 2008). Auscultation can provide important clues to the identification of disease such as early congestive heart failure, pleural effusion and atelectasis; as such, it remains a key component of respiratory evaluation (Mangione & Duffy 2003).

Auscultation of the lungs comprises of three components (1) listening to the sounds created by air travelling through the tracheobronchial tree during normal, quiet breathing; (2) listening for any additional (adventitious) sounds and (3) listening to how the patient's spoken or whispered voice is transmitted through the chest wall when abnormalities are suspected (Bickley 2008).

Auscultation of the posterior chest wall requires the patient to be sitting upright, leaning slightly forward with their arms resting comfortably across their lap. Anterior chest wall assessment can be performed with the patient supine or in a sitting position (Jarvis 2007). Both the anterior and posterior chest wall should be auscultated with the diaphragm of the stethoscope over a large number of equal positions to ensure that localised abnormalities are not missed (figure 5 a & b). The examination should, where possible, be conducted in a quiet environment with the examiner's stethoscope placed on bare skin to avoid misinterpreting the rubbing sound of clothes with abnormal breath sounds. During the examination patients should be as relaxed as possible and asked to breathe deeply through their mouth whilst avoiding unnecessary prolonged deep breathing which may result in the patient feeling light headed.

Figure 5: sequence for auscultation of a) anterior b) posterior chest wall

The key to effective respiratory auscultation is to listen to the intensity, pitch and duration of the inspiratory and expiratory sounds throughout a full inspiratory and expiratory cycle. There are three types of breath sounds normally heard in adults; bronchial, bronchovesicular and vesicular breath sounds (Jarvis 2007, Mangione 2008). Each of the three normal breath sounds has its own particular characteristics (figure 6) and should only be heard in certain locations over the chest wall (figure 7 a & b). For example, bronchial breathing is classified as an abnormal finding if it is heard over the peripheral lung fields (Mangione 2008). Bronchial breathing found in abnormal locations can occur as a result of fibrosis, consolidation or compression which alters lung density increasing transmission of sound from the bronchi (solids and liquid transmit sound better than gases) (Mangione 2008). Bronchial breath sounds would be evident in patients with pulmonary oedema due to fluid filled alveoli.

The intensity of breath sounds is directly related to air flow and the tissue through which the sound has to travel. Therefore, diminished or absent breath sounds can occur in obesity, pneumothorax, or when the bronchial tree is obstructed (Douglas et al 2009). If breath sounds are decreased as a result of secretions, asking the patient to cough may resolve this.

Figure 6: Characteristics of breath sounds

Figure 7: Location of normal breath sounds

Added (adventitious) breath sounds are extra sounds that are heard over normal breath sounds. Adventitious sounds are generally categorised into three groups, crackles, wheezes and rhonchi (Bickley 2008, Jarvis 2007) (figure 8). The presence of added breath sounds frequently points to a diagnosis of pulmonary or cardiac conditions such as asthma, pulmonary oedema, early congestive heart failure and COPD (Mangione 2008). In the early stages of left sided heart failure, increased pressure within the pulmonary veins can cause interstitial oedema around the alveoli resulting in audible crackles in dependent lung regions (Bickley 2008). Course crackles result from air colliding with secretions and fluid in the trachea and bronchi and are commonly heard in patients with a depressed cough reflex such as the ventilated, post cardiac, surgical patient. Wheezes, when present, are commonly heard continuously throughout inspiration, expiration or both. Wheezes result from air being forced through narrowed or compressed airways as a result of swelling and inflammation classically seen in the asthmatic patient. Rhonchi are a lower pitched wheeze associated with secretions in the large airways as can be found in bronchitis.

Adventitious breath sounds		
<b>Crackles</b>	Fine (high pitched)	Restrictive disease, pneumonia, heart failure and fibrosis
<b>Discontinuous, brief, non musical</b>	Course (low pitched)	Pulmonary oedema, pneumonia, secretions
	Early, middle or late inspiration	
<b>Wheezes</b>	Musical, often prolonged	Diffuse airway obstruction in acute asthma or chronic emphysema
	High pitched, hissing or shrill quality	
	May occur in inspiration and expiration	
<b>Rhonchi</b>	Low pitched with snoring quality	Secretions in large airways

Figure 8: Characteristics of adventitious breath sounds adapted from Jarvis (2007)

Transmitted voice sounds are not a routine part of respiratory assessment and are only assessed if abnormal bronchial or bronchovesicular breath sounds are heard. Transmitted voice sounds are assessed by asking the patient to say “ninety-nine”

and “ee” whilst listening in symmetric areas over the chest wall. Normally voice transmission is muffled and indistinct but pathology that increases lung density such as lobar pneumonia enhances the transmission of voice sounds (Mangione 2008). When listening to transmitted voice sounds, you are assessing for bronchophony, egophony and whispered pectoriloquy.

### Case study

Gita Kumar is 68 yrs old. Two days ago she underwent coronary artery bypass (two saphenous vein grafts and one internal mammary artery). Post operatively she developed a chest infection. She has a history of emphysema. This morning she has had her pleural chest drains removed but has not yet had a CXR. Over the next two-three hours she becomes increasingly unwell. She is complaining of chest pain, shortness of breath and is becoming increasingly anxious. Your assessment of her vital signs reveals the following information:

- BP180/90
- Heart Rate 150 BPM thready and weak pulse
- Respiratory rate 33 laboured and shallow
- Oxygen saturations 90% on four litres of oxygen

Based on the knowledge you have gained about respiratory assessment, what aspects of the assessment framework would you apply to this patient?

### Answer

You would use a systematic and logical framework that included:

- Inspection
- Palpation
- Percussion
- Auscultation

On inspection of Mrs Kumar you notice the following:

- She is sitting up and using her accessory muscles
- Chest expansion appears unequal and tachypnea and hypoxia are evident.
- She has central cyanosis

Based on the information gained from inspection, what aspect of the respiratory assessment would you perform next?

### Answer

Palpation

On palpation you identify the following:

- Unequal expansion of the left side of the chest
- Tactile fremitus is absent on the left side of the chest
- Right sided tracheal shift

What is your differential diagnosis based on the information gained so far?

**Answer**

- Pneumonia
- Pleural effusion
- Emphysema
- Pneumothorax
- Atelectasis

Percussion reveals the following:

Hyperresonant on the left and resonant on the right

What is your differential diagnosis based on the information gained so far?

**Answer**

- Emphysema
- Pneumothorax

Auscultation reveals the following:

Breath sounds absent and transmitted voice sounds on left side

Decreased breath sounds with inspiratory wheeze over all zones on the right side.

Based on the information gained what is your diagnosis?

**Answer**

- Left sided pneumothorax.

**Conclusion**

This paper has described and discussed the skills of percussion and auscultation

which complete the systematic model of respiratory assessment outlined in part one of the series. Nurses' close and continued monitoring of patients means that they are often the first to detect the early signs of physiological deterioration. Early identification of respiratory dysfunction plays an important role in preventing adverse events, promoting positive patient outcomes and improving patient care (Gardiner et al. 2007). A thorough and detailed respiratory assessment of patients is therefore essential in ensuring that a holistic and comprehensive model of care is delivered.

### Key Points

- Patients are more likely to deteriorate on wards and suffer a major adverse event.
- Changes in respiratory function are the most sensitive indicator of an impending adverse event.
- Auscultation and percussion skills are key components of respiratory assessment
- Respiratory assessment is now considered integral to the scope of practice of the cardiac practitioner

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