Recognition, prevention and management of sputum retention

Tracheobronchial secretions are an important part of the respiratory system’s defence. The excess secretions that are cleared from the airways by coughing or huffing (Pryor and Webber, 1998) are known as sputum, the production of which is always abnormal. The colour, consistency, smell and volume of sputum provides information to support both the diagnosis and management of the patient’s clinical condition. Sputum retention occurs when patients are unable to clear secretions from their respiratory tract by themselves or with assistance.

Causes of sputum retention Effective removal of secretions from the respiratory tract depends on two key factors: the mucociliary transport system and the ability to cough (see p63).

People who smoke and those with conditions associated with the production of excess mucus – such as chronic obstructive pulmonary disease (COPD), bronchiectasis and cystic fibrosis – are at risk of developing sputum retention, especially during acute exacerbations of their disease. During exacerbations the sputum may become both more copious and more viscous and thus more difficult to expectorate. The strength and effectiveness of the cough can be reduced due to pain (especially after surgery), physical weakness, fatigue, and poor coughing technique and a dry mouth (Hough, 1992). Therefore, patients undergoing surgery with a history of smoking and/or chronic lung disease may be particularly vulnerable to the development of sputum retention.

Recognising sputum retention The clinical signs of sputum retention are respiratory distress with rapid, shallow and bubbly respirations (Matthews and Hopkinson, 1984). It should be suspected in patients where any of the following signs are present:

- Suspiciously quiet breath sounds;
- The patient says ‘there is something in my chest’, especially if there is a history of lung disease, recent surgery, or if the patient is dehydrated (Hough, 1992).

It is also necessary to differentiate between pulmonary oedema and sputum retention (Table 1).

Types of sputum retention

**Compensated phase** In the early phase of sputum retention patients compensate for the loss of respiratory function caused by the retained secretions by increasing their respiration rate. The patient’s skin colour and arterial blood gases may appear stable, especially if supplementary oxygen is prescribed, and any subsequent increase in levels of sputum retention and potential progression to pneumonia may not be recognised. Left untreated the patient becomes increasingly exhausted with increasing hypoxia (low oxygen levels in the tissues), hypercapnia (raised carbon dioxide levels in the arterial blood and tissues) and a reduced level of consciousness spiralling into the decompensated phase.

**Decompensated phase** This is characterised by increasing drowsiness, cyanosis, tachycardia, sweating and audible, bubbly respiration (Bonde et al, 2002a). Urgent intervention is required as retention of secretions in major airways may lead to obstruction of the bronchopulmonary tract and atelectasis (collapse of lung tissue). Failure to treat the condition can lead to pulmonary shunting, pneumonia, systemic sepsis, hypoxia, respiratory failure and exacerbation of cerebral and cardiac ischaemia (Bonde et al, 2002b).

Preventing sputum retention Strategies include hydration to thin the secretions and prevent a dry mouth; ensuring patients receive adequate pain relief; managing stress incontinence; and providing suction.

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**TABLE 1. DIFFERENTIATION BETWEEN PULMONARY OEDEMA AND SPUTUM RETENTION**

<table>
<thead>
<tr>
<th>Chest signs</th>
<th>Pulmonary oedema</th>
<th>Sputum retention</th>
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</thead>
<tbody>
<tr>
<td>Auscultation</td>
<td>Fine crackles, especially at bases of the lungs with or without wheezes</td>
<td>Scattered or localised crackles, with or without wheezes; may move with coughing</td>
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<tr>
<td>Sputum</td>
<td>Frothy white or pink</td>
<td>Thicker, more viscous; any colour</td>
</tr>
<tr>
<td>Other signs</td>
<td>Elevated jugular venous pressure (JVP)</td>
<td>Pyrexia</td>
</tr>
<tr>
<td></td>
<td>Peripheral oedema</td>
<td>History of existing chest disease, recent anaesthetic, aspiration, respiratory muscle weakness</td>
</tr>
<tr>
<td></td>
<td>Increased weight, positive fluid balance</td>
<td></td>
</tr>
<tr>
<td></td>
<td>History of previous cardiac disease</td>
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</tbody>
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Hydration  Dehydration is damaging to the cilia (Clarke, 1989) and adequate hydration – orally or intravenously – helps to thin the secretions, making them easier for the patient to expectorate.

Measures such as regular mouthwashes and sucking ice can help to prevent a dry mouth. Tenacious secretions sticking to a dry mouth cause an unpleasant sensation and may contribute to the development of sputum retention.

Damage to the cilia can be prevented by humidification of the respiratory tract via humidifiers and nebulisers. Hot water humidification provides a vapour that condenses in the patient’s upper airways, and is used for those whose upper airway has been bypassed by an endotracheal tube or a tracheostomy and those with a dry mouth who need assistance with coughing (Hough, 1992). Cold water humidification does not achieve atmospheric humidity and, therefore, does not provide enough moisture to humidify the airways.

It should also be remembered that oxygen has a drying effect and that humidification of high concentrations of oxygen is important, especially if there is an existing lung disease.

Nebulisers produce a fine mist of droplets that can reach the small airways of the lungs, thereby providing moisture to help loosen and thin secretions. Nebulisers such as recombinant human deoxyribonuclease (Dnase) have been shown to increase mucociliary clearance. Oral cough expectorants and mucolytics may also be used to decrease the viscosity of tenacious secretions along with hot drinks.

Pain relief  A study of patients undergoing lung surgery found that smokers with a history of ischaemic heart disease and inadequate pain control were at high risk of developing sputum retention (Bonde et al, 2002a). The researchers also found that there was a trend towards sputum retention in those with a history of COPD and preoperative cerebrovascular accident.

Regular analgesia is, therefore, essential during the postoperative period and can be complemented by specific handling techniques. When patients are coughing postoperatively the nurse can support the wound and minimise pain by firmly holding the wound edges together while the patient is either sitting up in bed or over the edge of the bed. Combined with effective analgesia, this should ensure that patients are not afraid to cough. They can also be encouraged to use a pillow or towel to support the wound when coughing.

Other postoperative pain factors that may limit a patient’s ability to cough effectively include decreased levels of consciousness, general anaesthesia, narcotic analgesics, pleurisy, chest wall trauma, paralysed vocal cords, expiratory muscle weakness and poor airflow. Assessment of the effectiveness of a patient’s cough is, therefore, important for preventing sputum retention.

Physiotherapy  Physiotherapy can help patients to remove excess secretions by using active exercise to enhance mucociliary clearance. Breathing techniques, such as active cycle of breathing, body positioning and manual techniques, including percussion, shaking and vibrations, can also be used to loosen secretions and thus facilitate expectoration. Pressure devices including the positive expiratory pressure mask and intermittent positive pressure breathing can also be used.

Other devices that use the principle of oscillations such as oral high-frequency oscillation, high-frequency chest wall compression and the flutter valve are also available. The flutter valve is a hand-held, pipe-shaped device with a ball bearing in the central core that oscillates with respiration. It combines positive expiratory pressure with high-frequency oscillations.

Manual hyperinflation techniques may be required with some intubated patients (Pryor and Webber, 1998). The role of postural drainage in the management of conditions associated with chronic sputum production has been challenged, particularly when compared with the flutter valve (Fink, 2002; Bellone et al, 2000).

Patients whose cough is weakened, such as those with neuromuscular disease or terminal illness, can be assisted to cough by compressing the abdomen manually during exhalation. Some may be able to help themselves by sitting with a pillow pressed against their abdomen, then after a deep breath, bending forward while breathing out (Hough, 1992).

Stress incontinence Patients with stress incontinence or excess flatus may be too embarrassed to cough in case of an ‘accident’. Since this may contribute to sputum retention, patients who have these problems should be encouraged to contract their pelvic muscles prior to and during episodes of coughing.

Suction  Airway suction via the nose or mouth is usually necessary to clear secretions from patients with an endotracheal tube, tracheostomy or minitracheostomy or those with an oropharyngeal airway. However, suction should only be used when all other efforts to clear secretions have failed. It is an unpleasant procedure for the patient and can cause damage to the tracheal epithelium. This can be minimised by using an appropriate suction catheter and suction technique.

REFERENCES


Suction should not be performed on patients with stridor, severe bronchospasm, cerebrospinal fluid leak, clotting disorder, pulmonary oedema and recent pneumonectomy or oesophagectomy. Performing suction using force is unethical and illegal except in life-threatening situations (Hough, 1992).

Managing sputum retention If sputum retention occurs, nasal-tracheal suction may be successful in clearing some secretions. However, it is unpleasant for the patient and needs to be repeated frequently by an experienced health care professional.

Safe, comfortable suction can be achieved via a minitracheostomy – a small surgical opening in the trachea that provides a means of clearing secretions more easily while avoiding the more invasive measures such as bronchoscopy, intubation or tracheostomy. As soon as the patient is able to clear secretions independently without becoming exhausted the minitracheostomy can be removed and the small incision heals quickly. Cricothyroidotomy has also been used to treat sputum retention (Bonde, 2002a).

Patients in the decompensated phase of sputum retention require urgent intervention either in the form of bronchoscopy or endotracheal intubation and ventilation to avert respiratory distress. The measures discussed to loosen and thin secretions, to prevent further damage to the cilia and to facilitate expectoration should also be continued when sputum retention develops.

Clinical outcomes The short-term benefits of promoting effective clearance of sputum include:

- Increased sputum expectoration;
- Improved FEV ′ (forced expiratory volume at one second) and peak flow (the maximum rate at which air can be expelled from the lungs);
- Resolution of chest X-ray abnormalities;
- Improvement or resolution of associated problems, for example, dyspnoea.

The long-term benefits include:

- A reduction in the number of exacerbations;
- Fewer courses of antibiotics;
- Fewer and shorter periods of hospitalisation;
- A reduction in days lost from work or study;
- Improved quality of life.

It also prevents chest infection in postoperative patients who are at high risk (Pryor and Webber, 1998). Improved cough or huff techniques may also relieve problems such as fatigue, dyspnoea, syncope (loss of consciousness induced by a temporary, insufficient flow of blood to the brain), arterial oxygen desaturation or stress incontinence (Pryor and Webber, 1998).