Nursing Practice

Review

BOX 1. RESPIRATORY FAILURE

<table>
<thead>
<tr>
<th>Type I</th>
<th>Type II</th>
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<tbody>
<tr>
<td>Hypoxia (low oxygen levels) with normal or low levels of carbon dioxide. A PaO₂ &lt;8 kPa on blood gas assessment is considered significant.</td>
<td>Hypoxia accompanied by hypercapnia (high carbon dioxide). A PaO₂ &lt;8 kPa and PaCO₂ &gt;6.5 kPa are considered significant.</td>
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</tbody>
</table>

Common causes
- Asthma
- Pneumonia
- Pulmonary oedema
- Pneumothorax
- Pulmonary embolism
- COPD

Common Causes
- Exhaustion following prolonged type I failure
- Severe asthma
- Neuromuscular disorders
- Respiratory depression due to medication
- Muscular dystrophies
- Encephalitis
- COPD

Carbon dioxide levels are normal in type I respiratory failure but high in type II. Both types of failure are seen in people with asthma and COPD.

Diagnosis
The standard method of diagnosis in respiratory failure is arterial blood gas assessment. Although there can be problems obtaining and testing arterial blood samples outside hospitals, portable capillary blood gas analysis is becoming increasingly available for patients with chronic respiratory failure in the community.

Pulse oximetry is often the first line of assessment or only available nursing intervention in both primary and acute care. Despite being unreliable in some circumstances, it remains a useful tool (Higgins and Guest, 2008).

Positive pressure ventilation
Normal breathing works by creating low pressure in the thorax and allowing air to flow into the space and equalise the pressure. This is known as negative pressure ventilation (Fig 1). Patients who are very ill and no longer able to use this system to breathe adequately may require assistance. This is positive pressure ventilation which can support self-ventilation or replace a patient’s normal breathing.

Adam and Osborne (2005) describe positive pressure ventilation as gas being mechanically driven into the airways under a positive pressure, allowing movement of gas from the mouth and/or nose via a secured airway (for example a tracheostomy or endotracheal tube) to the alveoli. This can reduce or replace the work of muscles used in breathing. Exhalation typically remains passive and dependent on the elastic recoil of the lungs. A small positive pressure is maintained in the airways on exhalation to maintain alveolar expansion, prevent further lung collapse, giving greater time for gas exchange and increasing oxygenation.

There are many systems of positive pressure ventilation. It can be invasive or non-invasive, the patient can trigger their own breaths, or all breaths can be entirely mechanical. However, the principle of air being forced into the lungs and then removed is common to all systems.

Because air moves in and out of the lungs, positive pressure ventilation can seem physiologically normal. However, it is the physiological opposite of the body’s normal means of negative pressure ventilation and is at the more extreme end of the spectrum of oxygen therapy. The side effects are numerous and can be severe. Risks are much higher in those receiving invasive positive pressure ventilation (see part 2).

When using this system of ventilation, both the inspiratory and expiratory pressures can be set and adjusted. This means the pressure of gas in the lungs oscillates between two preset pressure points. In non-invasive ventilation, this is commonly described as the inspiratory positive airway pressure and the expiratory positive airway pressure (Chapman et al, 2009).

Conclusion
This article has discussed the importance of respiratory support in hospitals. It has examined the normal physiology of breathing, respiratory failure and introduced positive pressure ventilation.

The second article will discuss in more detail the indications, practicalities and contraindications of a variety of oxygen therapies. It will highlight a spectrum of support for nurses that can act as a learning tool and an aid to respiratory assessment. NT

References

Don’t miss next week’s issue for part 2.

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