Prehospital improvised bronchodilator therapy of a patient on Bi-level Positive Airway Pressure therapy

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Abstract

Patients suffering acute breathlessness is a common emergency situation, many patients with airways disease require bronchodilator therapy with β-agonists. To assist the management of these cases paramedics are guided by guidelines drawn up by the Joint Royal Colleges Ambulance Liaison Committee (JRCALC). They provide guidance on the management of most situations paramedics are likely to encounter. However, there will be occasions when paramedics are called to deal with a situation which is outside of their experience and the JRCALC guidelines do not provide the appropriate guidance required to fully inform clinical decision making. In the UK telephone support from a physician skilled in the specific discipline they require is generally not available, so paramedics have become skilled at improvising. This case study describes such an improvisation, in the management of acute breathlessness in a patient who is on home Bi-level Positive Airway Pressure (BiPAP) therapy.

Key words

- COPD
- Nebuliser
- BiPAP
- Paramedic
- Non-invasive positive pressure ventilation

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On the 15th of June 2011 the Medical Director of the Scottish Ambulance Service approved the use of a T-piece in-line nebulizer device (Figure 1) for use by paramedics and emergency medical technicians (Scottish Ambulance Service, 2011). This internal communication indicated that instruction on its use would follow during mandatory updates and after such training, staff would then be deemed competent and authorised to use this device. Shortly after this directive, a call to attend a forty year old male having breathing difficulties was received by the Emergency Medical Dispatch Centre (EMDC) and was subsequently attended by the authors. Both authors had not yet attended the mandatory update referred to above and consequently did not carry the T-piece in-line nebulizer device.

On arrival it was found that the patient had a patent airway supported by a non-invasive Ventilation (NIV) device via nasal mask, was breathing at a rate of 30 breaths per minute, had a heart rate of 160 beats per minute with full, regular radial pulses and was ‘alert’ on the AVPU scale (AVPU: Alert, responds to Verbal stimulus, responds to Pain, Unresponsive).

He had increased the inspiratory pressure on the device from 18cmH20 (his normal day time inspiratory pressure) to 21cmH20 in an attempt to improve oxygen delivery. The patient’s medical history cannot be described fully to ensure patient confidentiality, but he had been receiving Bi-level Positive Airway Pressure (BiPAP) therapy (Figure 2) via this device for many years because of a neuromuscular condition and chronic obstructive pulmonary disease (COPD). BiPAP has been shown to improve ventilatory parameters in COPD whilst decreasing the work of breathing and transdiaphragmatic work (Vanpee et al, 2002) and has been shown to be effective in the treatment of acute respiratory failure in the emergency setting when used with other therapies (Goss, 2008). Supplemental oxygen is recommended in conjunction with BiPAP in cases of hypoxaemia (Scala, 2004).

Discussion

Further assessment found that the patient had bilateral inspiratory and expiratory wheezes and crepitations on auscultation of his anterior and posterior chest,
Clinical via a standard nebulizer device and mask, but this was impossible due to the patient’s reliance on BiPAP. The solution was to connect the oxygen connector from a standard oxygen mask (usually discarded when setting up such a mask to attach a nebulizer chamber) to the top of a nebulizer chamber and connecting this via a small length of oxygen tubing (about 10cms) to a connector on the BiPAP nasal mask (Figure 3). The inferior connector on the nebulizer was connected to an oxygen cylinder in the usual way and the oxygen delivered to the nebulizer at the required rate (6–8 litres per minute) (JRCALC, 2006a). Again, consideration was given to the BiPAP inspiration and expiration pressures. These showed no change (inspired: 21–14 cmH20 and expired: 4–4.1 cmH20). Mild expiratory and inspiratory wheezes were still audible on auscultation. Ipratropium bromide is an antimuscarinic bronchodilator and is indicated for patients suffering exacerbation of COPD (JRCALC, 2006a), 500mcg of ipratropium bromide was delivered using the same improvised method. A short time after commencing ipratropium bromide therapy SpO2 rose to 91% and respiratory rate reduced further. Supplemental oxygen into the BiPAP nasal mask was reduced to 2 litres per minute after complete delivery of nebulized ipratropium bromide. On arrival at hospital the BiPAP inspiration pressure was further increased to 24 cmH20. The improvised device was replaced with...
a T-piece in-line nebulizer and further salbutamol was administered. His symptoms improved further and on last seeing the patient his respiratory rate was 20 breaths per minute, heart rate was 146 beats per minute and SpO2 was 93%. He reported a significant easing of his symptoms.

**Conclusion**

This improvised method delivered moderately effective relief of the patient’s symptoms. Increased SpO2, decreased respiratory rate and decreased heart rate were observed, as well as a reduction in audible signs on auscultation. The authors recommend this method of improvised nebulization in the absence of a T-piece in-line nebulizer or similar device, but ambulance staff should make sure inspiratory and expiratory pressures are not adversely affected and that all decisions, actions, oxygen delivery rates and BiPAP pressures are recorded in clinical records. High priority should be placed on returning oxygen supplementation to a lower controlled level as soon as practicable after the delivery of nebulized drugs.

All reasonable steps have been taken to ensure patient confidentiality.