Noninvasive Positive Pressure Ventilation

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KEYWORDS

• Noninvasive positive pressure ventilation • Continuous positive airway pressure
• Bilevel positive airway pressure • Respiratory failure

HOSPITAL MEDICINE CLINICS CHECKLIST

1. Obtain arterial blood gas (ABG) to determine the acid-base disorder at baseline; this will aid in the selection of a noninvasive positive pressure ventilation (NIPPV) modality. In the case of hypercapnic respiratory failure, an ABG should be repeated within an hour of initiating NIPPV and compared with baseline.
2. Enlist the help of a respiratory therapist whenever possible.
3. Knowledge of the patient's admitting diagnosis, as well as medical history (namely any history of cardiac or pulmonary disorders), will allow for the prompt initiation of the appropriate intervention.
4. A focused physical examination may yield critical information in the development of a full clinical picture.
5. Consider the need for intubation (invasive mechanical ventilation) sooner rather than later.
6. Evaluate for any contraindication to NIPPV before initiation.
7. Consider transferring patients requiring NIPPV to a higher level of care (ie, specialized care unit or intensive care unit), as they need close ongoing monitoring of their respiratory status.

DEFINITIONS

1. What is noninvasive positive pressure ventilation?

Noninvasive positive pressure ventilation (NIPPV) is a form of ventilatory assistance delivered via a noninvasive interface (ie, full face mask, nasal mask/pillows), as opposed to invasive ventilation that is delivered through an endotracheal tube or tracheostomy.

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2. What differentiates continuous positive airway pressure from bilevel positive airway pressure?

Continuous positive airway pressure (CPAP) is a mode of noninvasive ventilation that supplies a constant positive pressure during inspiration and expiration, which opens obstructed upper airways to allow ventilation, raises functional residual capacity, and potentially opens deluged alveoli in patients with cardiogenic pulmonary edema. CPAP also decreases preload by reducing the volume of venous return to the right heart[1] and decreases the left ventricular transmural pressure, causing a reduction in afterload and an increase in cardiac output in those with acute congestive heart failure (CHF).[2]

Bilevel positive airway pressure (BPAP) is a mode that cycles between inspiratory positive airway pressure (IPAP) and expiratory positive airway pressure (EPAP). This mode of noninvasive ventilation provides a combination of pressure support (via the higher IPAP) in addition to EPAP, and thereby reduces the work of breathing as it augments the patient's respiratory effort. By reducing the work of breathing and assisting in achieving higher tidal volumes, BPAP can improve hypercapnic respiratory failures during exacerbations of chronic obstructive lung disease (COPD), and assist in the management of CHF exacerbations.[3,4]

Potential benefits of NIPPV include improved gas exchange, decreased work of breathing, avoidance of intubation, facilitation of weaning/extubation, improved mortality, and decreased rate of nosocomial infections (in comparison with invasive ventilation). The magnitude of these benefits depends on the underlying cause of respiratory failure as well as patient variance.

INDICATIONS AND CONTRAINDICATIONS FOR NIPPV

1. What are the indications for NIPPV?

A trial of NIPPV is typically warranted in patients with respiratory failure who lack an indication for immediate intubation, without contraindications to NIPPV and especially if they have a condition responsive to NIPPV (ie, hypercapnic respiratory failure, acute exacerbations of COPD, acute cardiogenic pulmonary edema) (**Table 1**). Other

Table 1
Indications and contraindications for the use of NIPPV

Indications	Contraindications
No indication for immediate intubation	Indication for emergent intubation
No obvious contraindication to NIPPV	Inability to cooperate/agitation
Hypercapnic respiratory failure[a]	Severely impaired consciousness
COPD exacerbation[a]	Inability to protect airway or clear secretions
Cardiogenic pulmonary edema[a]	High aspiration risk/swallowing impairment
Hypoxemic respiratory failure due to causes other than cardiogenic pulmonary edema	Recent facial/upper airway/gastrointestinal surgery
Asthma exacerbations	Facial or upper airway trauma
Severe pneumonia	Upper gastrointestinal bleeding
Early weaning from mechanical ventilation	Copious airway secretions
Postextubation support	Anticipation of prolonged need for respiratory support

[a] These indications have the strongest evidence to support the use of NIPPV. Other indications have shown variable success in clinical trials.