

## Non-invasive Ventilation in Adults: A Brief Update

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### Abstract

The use of noninvasive ventilation and noninvasive continuous positive airway pressure by mask has increased substantially. The main indications are exacerbation of chronic obstructive pulmonary disease (COPD), cardiogenic pulmonary oedema, trauma, pulmonary infiltrates in immunocompromised patients, and weaning of previously intubated stable patients with COPD. In this mini-review article, we summarize the results of various studies in which noninvasive ventilation was applied and discuss the role and efficacy of noninvasive ventilation.

**Keywords:** Acute respiratory distress syndrome; Noninvasive ventilation; Respiratory failure

### Background

Noninvasive ventilation (NIV) refers to positive pressure ventilation

Signs and symptoms of acute respiratory distress	Gas exchange abnormalities
Indications	
. Moderate to severe dyspnea . RF $\geq$ 24 . Signs of increased work of breathing, paradoxical breathing or the use of accessory muscles	. pH $<$ 7,35 with PaCO <sub>2</sub> $>$ 45 mmHg . Hypoxemia with Pa O <sub>2</sub> /FIO <sub>2</sub> $<$ 200 mmHg
Contraindications to NIV	
.Severe upper gastrointestinal bleeding and postoperative esophageal surgeries. .Severe Encephalopathy (GCS $<$ 10) .Respiratory or cardiac arrest .High risk for aspiration and inability to clear secretions .Trauma, deformity, facial or neurological surgery .Patient decline .Unable to fit mask	.Unstable cardiac arrhythmia and hemodynamic instability .Organ failure .Upper airway obstruction .Inability to protect airway or cooperate .Severe psychomotor agitation and uncooperative patient. .Hypotensive shock .Total upper airway obstruction . Need for emergency intubation
Complications of NIV	
Related to the mask	Related airflow or pressure generated
.Discomfort .Claustrophobia .Edema or erythema .Ulceration of the nose bridge . Leaks	.Nasal congestion .Local pain .Nasal dryness and /or oral .Conjunctivitis .Gastric distension
Risk factors for failure of NIV	
Age $>$ 65 years Glasgow $<$ 11 Tachypnea ( $>$ 35 bpm) pH $<$ 7,25 APACHE $>$ 29 APACHE II score $>$ 12 at the time of extubation. Asynchrony with the ventilator Absence of teeth <u>Multiple organ failure</u> <u>Pneumonia</u> Cardiac failure as the cause of intubation. Chronic cardiac failure. Arterial partial carbon dioxide pressure $>$ 45 mmHg after extubation. Patients with neuromuscular diseases Obese patients	Excessive leakage; Agitation; <i>Hypersecretive patients</i> ; Intolerance by the patient; Lack of improvement in the first two hours: maintenance of tachypnea and respiratory distress, no improvement in PaCO <sub>2</sub> and pH. Chronic respiratory disease with ventilation $>$ 48 hours and hypercapnia during spontaneous breathing trial. Acute exacerbation of chronic obstructive pulmonary disease. Multiple comorbidities. Weak cough or stridor after extubation. Hypercapnia  More than one failure in the spontaneous respiration test

**Table 1:** GCS: Glasgow Comma Scale, RF: respiratory frequency.

delivered through a noninvasive interface (nasal mask, facemask, or nasal plugs), and it is used in patients with chronic hypercapnic respiratory failure caused by chest wall deformity, neuromuscular disease, COPD, posttraumatic hypoxemic respiratory failure, obesity hyperventilation syndrome, hypercapnic encephalopathy syndrome, non-hypercapnic respiratory failures or impaired central respiratory drive [1-5].

NIV has now become an integral tool in the management of both acute and chronic respiratory failure, in both the home setting, emergency room and in the intensive care unit [6-8].

The advantages of NIV over mechanical ventilation (MV) include the elimination of possible complications associated with endotracheal intubation, reduced incidence of infections related to MV, maintenance of speech and swallowing, greater comfort and flexibility of use to the patient as well as the preservation of the defense mechanisms of the airway [9-11].

The consensus of the American Association of Respiratory Care endorses the use of NIV if 2 or more of the criteria are present (Table 1) [12-17].

The main types of ventilation modes for noninvasive support are shown in Table 2 [15-17].

Modes	Description
BIPAP	. Flow cycled .Two pressure levels (IPAP and EPAP)
CPAP	. Spontaneous ventilation . Constant airway pressure

**Table 2:** Types of ventilation modes for NIV. BIPAP - bilevel positive airway pressure, IPAP - inspiratory positive airway pressure; EPAP - expiratory positive airway pressure.CPAP - continuous positive airway pressure.

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Level of evidence	Clinical condition
Level 1 - Recommendation based on randomized clinical trials and systematic reviews	Exacerbation of COPD Acute cardiogenic pulmonary edema Weaning and extubation in COPD patients Hypoxic respiratory failure in immunocompromised patients Hypoventilation syndrome of obesity Posttraumatic hypoxemic respiratory failure Weaning strategy in adults with respiratory failure Reintubation rate in patients undergoing cardiothoracic surgery Prehospital noninvasive ventilation for acute respiratory failure Acute respiratory failure due to chest trauma.
Level 2 - Recommendation based on systematic review of cohort studies	Patients who refuse intubation, terminally ill and on palliative care Extubation failure prevention in patients with COPD or acute cardiogenic pulmonary edema Community-acquired pneumonia in patients with COPD; Asthma Respiratory failure in postoperative (prevention and treatment)
Level 3 - Systematic review of case-control studies	Neuromuscular disease and kyphoscoliosis Partial obstruction of the upper airways Chest trauma Prevent or to treat perioperative <u>acute respiratory failure</u>
Level 4 - Number of cases (cohort study and case-control)	Cystic fibrosis Hypercapnic encephalopathy syndrome Amyotrophic lateral sclerosis. Non-COPD and non-trauma patients with acute hypoxemic respiratory failure Exercise tolerance in heart failure Acute respiratory failure in delirious patients

**Table 3:** Level of evidence and clinical condition. COPD: chronic obstructive pulmonary disease.

NIV is an important option in the management of patients who are at risk of or who have respiratory failure in the acute and chronic sharpened care setting (Table 3).

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