



Noninvasive Respiratory Support for Adults with Acute Respiratory Failure

Key Article

- *Noninvasive respiratory support for adult patients with acute respiratory failure: an official American Thoracic Society Clinical Practice Guideline. Am J Respir Crit Care Med. 2026; 22:2135-2158.*

Background

- Acute respiratory failure is a leading cause of hospital admissions and need for intubation and mechanical ventilation.
- Noninvasive respiratory support (NRS) offers an alternative to invasive mechanical ventilation.
- New evidence from RCTs (previously covered on CCPEM) has emerged, which warrant reevaluation of existing recommendations.
- This current ATS Clinical Practice Guideline seeks to provide an evidence-based framework examining NIRS use in adults within the spectrum of acute respiratory failure, ranging from the prevention of intubation to support following extubation.
- The guideline is structured around physiologic categories—acute hypoxemic respiratory failure, acute hypercapnic respiratory failure, preoxygenation during endotracheal intubation, and post-extubation support.

Guideline Committee Composition

- The panel included pulmonary and critical care physicians, emergency medicine clinicians, respiratory therapists, physical and occupational therapists, methodologists, and patient representatives with lived experience of acute respiratory failure.

Should we use HFNC, NIV, or CPAP versus standard oxygen therapy for patients with de novo acute hypoxemic respiratory failure?

- **Background**
 - Acute hypoxemic respiratory failure is a leading cause of admission to the ICU and is associated with high morbidity and mortality.
 - Standard oxygen therapy is often insufficient to correct severe hypoxemia and decrease work of breathing, and many patients require escalation to IMV.
 - Previous guidelines have suggested possible benefit of NIRS strategies for selected patients with acute hypoxemic respiratory failure; however, since those publications, new RCTs and several large network meta-analyses have provided updated evidence summaries.
- **Evidence**
 - The current guideline included 39 RCTs ($n = 7640$ patients) examining NIRS strategies in patients with de novo acute hypoxemic respiratory failure.
 - Pooled analysis demonstrated that HFNC may reduce mortality compared with standard oxygen therapy, whereas helmet NIV, facemask NIV, helmet CPAP, and facemask CPAP

had uncertain effects on mortality compared with standard oxygen therapy. HFNC had an uncertain effect on mortality compared to facemask NIV.

- For intubation, HFNC, helmet CPAP, and helmet NIV probably reduce the need for intubation, whereas facemask NIV and facemask CPAP may reduce the risk of intubation compared with standard oxygen therapy.
- Patient comfort may be highest with HFNC compared to standard oxygen therapy. Comfort differences for helmet and facemask NIV were small and variable, reflecting challenges with titrating appropriate ventilator settings, interface tolerance, skin injury, or noise.
- Evidence for other outcomes, including cardiac arrest, length of stay, and duration of noninvasive support did not demonstrate important between-group differences.

- **Recommendations**

- We recommend HFNC as compared to standard oxygen therapy for adults with de novo acute hypoxemic respiratory failure (strong recommendation, moderate certainty)
- We suggest NIV via facemask or helmet as compared to standard oxygen therapy for adults with de novo acute hypoxemic respiratory failure (conditional recommendation, low certainty)
- We suggest CPAP via facemask or helmet as compared to standard oxygen therapy for adults with de novo acute hypoxemic respiratory failure (conditional recommendation, low certainty)

PICO 2 - In adult patients with acute hypercapnic respiratory failure, should we use standard oxygen therapy, HFNC, NIV (via facemask or helmet), or CPAP (via facemask or helmet)?

- **Background**

- Acute or acute on chronic respiratory failure occurs in the presence of ventilatory failure—when the respiratory system is unable to meet ventilatory demand and maintain adequate carbon dioxide clearance—resulting in respiratory acidosis.
- Chronic obstructive pulmonary disease exacerbations are the most common cause of hypercapnic respiratory failure; however, this can also occur in the context of asthma, cardiogenic pulmonary edema, obesity-related hypoventilation, drug-induced hypoventilation, or neuromuscular disorders that impair ventilatory mechanics.
- Noninvasive ventilation reduces inspiratory effort, improves alveolar ventilation, and corrects acidosis without endotracheal intubation.
- Randomized controlled trials and previous guidelines have established NIV as the standard of care for COPD exacerbations with acidosis, demonstrating reductions in intubation rates and mortality compared with standard oxygen therapy.
- High-flow nasal cannula has been shown to reduce anatomical dead space, provide mild increases in positive pressure, lower respiratory rate and work of breathing per minute, improve ciliary function and secretion clearance, and improve patient comfort.
- Recent RCTs have suggested that in certain populations with mild to moderate hypercapnia, HFNC may achieve outcomes comparable to NIV. High-flow nasal cannula may also be used between NIV sessions instead of standard oxygen therapy.

- **Evidence**

- This guideline included 42 RCTs ($n = 4763$ patients) evaluating NIRS strategies in patients with hypercapnic respiratory failure.
- Most trials enrolled patients with hypercapnic respiratory failure due to COPD with 6 in acute cardiogenic pulmonary edema and 4 with mixed etiologies.

- Participants had moderate hypercapnia (median pH = 7.31; mean PaCO₂, 65 ± 12 mm Hg) and a mean age of 71 years, and 38% were women.
- Studies were conducted across diverse settings—11 in wards, 10 in emergency departments, 10 in ICUs, 6 in mixed settings, and 6 trials did not report the setting.
- Of note, the majority of the HFNC studies were conducted in patients with mild hypercapnia. Most of the CPAP studies are older and included mixed populations or predominantly patients with ACPE.
- Pooled analysis demonstrates that HFNC reduces hospital mortality, while NIV and CPAP probably reduce mortality compared to standard oxygen therapy.
- The effect of NIV versus HFNC on mortality was uncertain
- Noninvasive ventilation, CPAP, and HFNC probably decrease the need for intubation compared to standard oxygen therapy.
- The relative effect on intubation between NIV and HFNC was uncertain
- Compared with standard oxygen therapy, NIV and HFNC probably shorten hospital length of stay, while CPAP may have little or no effect on hospital length of stay
- All 3 modalities may improve gas exchange compared with standard oxygen therapy
- Noninvasive ventilation and HFNC probably improve treatment tolerance, whereas CPAP may improve tolerance compared to standard oxygen therapy.
- No signal indicated excess harm with any modality.
- **Recommendations**
 - We recommend NIV via facemask as compared to standard oxygen therapy for adults with acute hypercapnic respiratory failure (strong recommendation, moderate certainty)
 - We suggest HFNC as an alternative to NIV as compared to standard oxygen therapy for patients with acute hypercapnic respiratory failure and mild acidemia (eg, pH > 7.25) if monitoring and escalation to NIV are promptly available (conditional recommendation, low certainty).

PICO 3 - In adult patients who are undergoing endotracheal intubation, should we use HFNC, NIV, or standard oxygen therapy to improve outcomes during the procedure?

- **Background**
 - Endotracheal intubation is a high-risk procedure associated with high rates of complications including severe hypoxemia, cardiac arrest, and mortality.
 - The goal of preoxygenation is to boost the oxygenation reserve, which increases the safe apnea time, while the patient is undergoing intubation and thereby reduce hypoxemia and other adverse events.
 - Traditional preoxygenation strategies, such as facemask or bag-valve-mask oxygenation, may be insufficient to maintain oxygenation in acutely ill patients with hypoxemia, which has led to several RCTs exploring alternate preoxygenation strategies for patients with respiratory failure requiring intubation.
- **Evidence**
 - This guideline included 15 RCTs (*n* = 3420 patients) examining noninvasive respiratory strategies in patients undergoing intubation.
 - The network compared 3 primary oxygenation strategies used for preoxygenation immediately before intubation: NIV (predominantly bilevel positive-pressure ventilation via facemask), HFNC, and standard oxygen therapy.
 - Facemask, bag-valve-mask, and non-rebreather oxygenation were grouped under standard oxygen therapy due to physiological and pragmatic equivalence.

- Most studies enrolled critically ill adults requiring endotracheal intubation in the ICU or emergency department, with 3 additional trials in surgical populations.
- Pooled analysis demonstrated that NIV and HFNC decreased the risk of peri-intubation hypoxemia compared to standard oxygen therapy.
- When compared head-to-head, NIV probably reduced hypoxemia compared to HFNC.
- There was little to no effect on mortality when comparing NIV or HFNC to standard oxygen therapy.
- There was an uncertain effect regarding first-pass intubation success comparing between modalities.
- Serious adverse events—including aspiration, cardiac arrest, and hemodynamic instability—were probably less frequent with NIV compared to standard oxygen therapy, whereas HFNC may have little or no effect on adverse effects compared with standard oxygen therapy.
- **Recommendations**
 - We recommend using HFNC or NIV via facemask as compared to standard oxygen therapy for preoxygenation in adults with acute respiratory failure undergoing endotracheal intubation (strong recommendation, moderate certainty)
 - We make no recommendation for or against HFNC compared with NIV for preoxygenation in adults with acute

PICO 4 - In adult patients who are extubated in the intensive care unit after critical illness, should we use HFNC, NIV (either through a facemask or helmet interface), CPAP (either through a facemask or helmet interface), or standard oxygen therapy to improve outcomes?

- **Background**
 - Extubation is a critical transition in the care of mechanically ventilated patients.
 - Despite clinical stability at the time of extubation, 10%-20% of patients require reintubation, which is associated with increased mortality, prolonged ICU stay, and complications such as ventilator-associated events.
 - Noninvasive respiratory support strategies have been studied in several RCTs for preventing and treating post-extubation respiratory failure and decreasing the need for reintubation, particularly in high-risk patients.
- **Evidence**
 - This guideline included 52 RCTs ($n = 9840$ patients) in the evidence summary evaluating post-extubation NIRS.
 - Nearly half of the trials were conducted in Europe.
 - Most studies assessed prophylactic use immediately after planned extubation.
 - Several trials specifically targeted high-risk groups such as those with obesity, chronic hypercapnia, or prolonged mechanical ventilation.
 - Across these studies, 25 RCTs focused on NIV, 26 on HFNC, 1 on helmet CPAP and 1 on a combination of NIV + HFNC as the main intervention.
 - Based on pooled analysis, NIV probably reduced re-intubation, while HFNC may reduce re-intubation compared with standard oxygen therapy. The effect of NIV versus HFNC on re-intubation was uncertain.
 - Both HFNC and NIV may reduce short-term mortality as compared to standard oxygen therapy with possibly no difference between the 2 modalities.
 - High-flow nasal cannula may reduce the need for tracheostomy with possibly no effect on hospital length of stay compared to standard oxygen therapy.

- Noninvasive ventilation probably increases discomfort compared with standard oxygen therapy and HFNC probably reduced discomfort compared with NIV. The impact of HFNC and NIV on adverse events, compared with standard oxygen therapy, was uncertain.
- Among high-risk patients, NIV was more effective than HFNC at preventing reintubation and post-extubation respiratory failure. HFNC reduced re-intubation when used prophylactically compared to standard oxygen therapy, but when HFNC was used as rescue therapy, it may increase the risk of reintubation compared to standard oxygen therapy. High-flow nasal cannula increased re-intubation risk versus NIV in rescue use but not when used prophylactically
- **Recommendations**
 - We suggest using HFNC or NIV via facemask as compared to standard oxygen therapy in patients extubated in the intensive care unit after critical illness (conditional recommendation, moderate certainty).
 - We suggest using NIV via facemask as compared to standard oxygen therapy or HFNC in patients extubated in the intensive care unit after critical illness at high-risk of extubation failure (eg, age 65 years and older, obesity, hypercapnia, prolonged mechanical ventilation, or severe illness, among others) (conditional recommendation, moderate certainty).
 - Those patients who are at very low risk (eg, oxygenating well, postoperative from nonthoracic or abdominal surgery, no previous respiratory or cardiac disease, short duration of IMV, good cough, and minimal secretions) could be extubated to standard low flow oxygen or even room air.