Noninvasive Positive Pressure Ventilation:
A Life Saver

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Webinar Goal
To provide evidence-based practices for properly initiating and managing noninvasive positive pressure ventilation (NIPPV) as a life saving intervention at the point of care.

Session Topics
- Explain basic NIPPV mechanisms of action
- Review the indications and contraindications for NIPPV
- Analyze select pathologic conditions with associated evidence for the use of NIPPV
Noninvasive Positive Pressure Ventilation

NIPPV is an alternative to invasive mechanical ventilation for patients who have acute or chronic respiratory insufficiency or respiratory failure and can no longer breathe adequately on their own. It is always delivered by mask.
Modes of NIPPV

- Continuous positive airway pressure (CPAP)
  - Only expiratory positive airway pressure pressures (EPAP) are set
  - More effective in hypoxemic vs hypercapnic respiratory failure

- Volume-limited
  - Seldom used
  - Set tidal volume with varying inflation pressures

- Pressure-limited
  - Inspiratory positive airway pressure (IPAP)
  - EPAP
  - Most commonly used
Pressure-Limited Uses

IPAP
- Pressure delivered on inspiration
- Comfort, synchrony, etc.

EPAP
- Pressure delivered on expiration
- Oxygenation

*Delta Pressure (ΔP):* \( IPAP - EPAP = \Delta P \)
Higher \( \Delta P \) increases \( CO_2 \) elimination
What does NIPPV do for the patient?

- Reduces the work of breathing and respiratory rate
- Unloads the respiratory muscles
- Lessens, or eliminates, diaphragmatic work
- Counterbalances auto-peep if present
Who benefits from NIPPV?

Indications

- Conscious and cooperative
- Subjective feelings of dyspnea with tachypnea >25 bpm
- Accessory muscle use
- $\text{PaCO}_2 > 45$ with pH ≤ 7.35
- $\text{P/F ratio} < 200 \text{ mmHg}$
- Proper mask fit
Who does not benefit from NIPPV?
Contraindications

- Unconscious or uncooperative
- Cardiac or respiratory arrest
- Hemodynamic instability
- High risk for aspiration
- Active upper GI bleeding
- Severe hypoxemia (PaO$_2$ <60 mmHg)
- Severe acidemia (pH <7.1)
- Facial trauma, surgery, burns
- Inability to properly fit a mask


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Which patient populations benefit from NIPPV?

**Recommended conditions**
- COPD exacerbation
- Acute cardiogenic pulmonary edema

**Conditions to consider**
- Asthma exacerbations
- Facilitating extubation in hypercapnic patients
- Do-not-intubate (DNI) patients
- Postoperative respiratory failure
- Immunocompromised


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NIPPV in COPD Exacerbation

Meta-analysis: 7 of 8 studies demonstrated significantly better outcome vs usual therapy

Consider NIPPV early in COPD exacerbation

- Lower mortality
- Lower intubation rates
- Lower treatment failure rates
- Decreased hypercapnia
- Decreased acidosis
- Less tachypnea


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NIPPV in Acute Cardiogenic Pulmonary Edema

30-day survival

<table>
<thead>
<tr>
<th>90%</th>
<th>85%</th>
<th>80%</th>
</tr>
</thead>
<tbody>
<tr>
<td>CPAP or NIPPV</td>
<td>85.00%</td>
<td>83.60%</td>
</tr>
<tr>
<td>Supplemental Oxygen</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Trend toward increased survival in cardiogenic pulmonary edema with NIPPV use

## NIPPV in Acute Cardiogenic Pulmonary Edema

Statistically significant differences in patient responses to treatment

<table>
<thead>
<tr>
<th>Variable</th>
<th>Standard Oxygen Treatment</th>
<th>NIPPV (N=702)</th>
<th>Odds Ratio (95% CI)</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dyspnea score</td>
<td>3.9</td>
<td>4.6</td>
<td>0.7 (0.2 to 1.3)</td>
<td>0.008</td>
</tr>
<tr>
<td>Pulse rate (beats/min)</td>
<td>13</td>
<td>16</td>
<td>4 (1 to 6)</td>
<td>0.004</td>
</tr>
<tr>
<td>Arterial pH</td>
<td>0.08</td>
<td>0.11</td>
<td>0.03 (0.02 to 0.04)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Arterial PaCO₂ (kPa)</td>
<td>0.8</td>
<td>1.5</td>
<td>0.1 (0.7 to 1.0)</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

*Mean change at 1 hr after start of treatment*


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Consider NIPPV in:

- Asthma exacerbation
- Planned postextubation
- Do not intubate
Consider NIPPV in:

Acute asthma exacerbation

Cochrane Review

- One study in the review
- Use of NIPPV with status asthmaticus is controversial
- NIPPV reduces hospitalizations
- NIPPV increases ED discharges
- Modality can be tried in select patients
- Class Two recommendation


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Consider NIPPV in:

Planned postextubation:  
Which patients benefit?

- Planned NIPPV diminishes risk of postextubation failure and 90-day mortality  
  - Secondary analysis showed the greatest benefit with hypercapnic patients
- Statistically significant 90-day survival advantage for patients with hypercapnia  
  - Confirmed the benefit for hypercapnic patients
Consider NIPPV in:
Do not intubate

Planned long-term results of NIPPV in patients with a DNI order

- 25% of DNI patients do survive the hospitalization
- Benefit greatest in:
  - COPD
  - CHF
  - Lower APACHE score
- Communication and goals of care discussion are essential

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Criteria for Discontinuation:
How do you know that this therapy is helpful?

☑️ “Eyeball” Test
How does the patient look?
- Less dyspnea, tachypnea, anxiety, discomfort

☑️ Success of NIPPV
Improvement of patient condition
- ABG
- pH
- pco2
- WOB

☑️ Failure of NIPPV
Failure to improve gas exchange
- pH and PaO2 falls
- No resolution of tachypnea
- Agitation leading to no cooperation

NIPPV: Nursing Care at the Bedside
Prevent complications

- Skin breakdown
- Gastric insufflation with IPAP > 20 cm H₂O
- Air leaks, ill-fitting masks
- Conjunctival irritation
- Ear pain
- Nasal or oral dryness
- Claustrophobia
- Monitor neurologic status
Summary

NIPPV:

- Can be considered for variety of pathologic processes
- Should not be applied indiscriminately
- Must be thought of as life support in the same manner as invasive mechanical ventilation—this saves lives if properly initiated and managed
- Standard of care for COPD exacerbation and cardiogenic pulmonary edema
Questions?
AACN Implementation Tools and Resources

Designed to help you apply these practices in your environment

- **Tools and Tactics**: A Blueprint for implementing evidence based care for patients using Noninvasive Positive Pressure Ventilation (NIPPV)
- **Bridging the Gap**: A Gap Analysis to evaluate practices in your unit for managing patients using Noninvasive Positive Pressure Ventilation
- **Tool**: Resources for you to use in implementing evidence based practice in the care of patients receiving noninvasive positive pressure ventilation

Find these tools on the Focus on NIPPV webinar information page at [www.aacn.org/webinars](http://www.aacn.org/webinars)
Implement Evidence-based Practices for Patients Using Noninvasive Positive Pressure Ventilation

1. Download the **Implementation Tools**.
   Find them on the Noninvasive Positive Pressure Ventilation: A Life Saver webinar information page at [www.aacn.org/webinars](http://www.aacn.org/webinars)

2. **Discuss** the tools and recommended practices with your colleagues

3. **Implement practices** that are suitable for your unit
References

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