Non-invasive ventilation: A role in Palliative Care?

Palliative Medicine Rounds
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Objectives

- Review the mechanics of NIV
- Technical considerations
- Role of NIV in palliative care
- Importance of communication
What is NIV?

- Non-invasive ventilation (NIV)
- Non-invasive positive pressure ventilation (NPPV): BiPAP, VPAP, Bi-level
- “Bi” or variable: 2 levels of positive airway pressure (PAP), pressure support ventilation
- Delivery of mechanical ventilatory support without an invasive endotracheal or naso-tracheal tube, with a tight fitting face or nasal mask
- Patient is breathing spontaneously
- Machine senses patient’s inspiratory flow start to increase.
- It increases the inspiratory pressure (iPAP) applied so air flow is enhanced.
- Patient’s own inspiratory tidal volume is augmented
- Machine senses patient’s inspiratory flow is slowing or stopping....
- It reduces the applied airway pressure....
- So patient has less work of exhaling but maintains continuous positive expiratory pressure (ePAP)
- **Result:** allows patient to receive higher inspiratory pressure, but not have to work against higher expiratory pressure
Basic settings: iPAP, ePAP

Inspiratory pressure (iPAP): start 8-10 cm H$_2$O

Expiratory pressure (ePAP): start 5 cm H$_2$O

**Titrate to comfort**

Air flow is generated until airway pressure as sensed by the machine reaches a set target inspiratory pressure

BiPAP can only augment the patient’s respirations
- Tidal volume received by the patient depends on:
  - Airway resistance
  - Lung and chest wall compliance
  - Patient synchrony with the machine
  - Absence of air leak around the mask
- If needed, machine can be set to deliver a fixed respiratory rate
• BiPAP is different from CPAP
• **CPAP** delivers one continuous pressure throughout the entire respiratory cycle
• CPAP does not directly increase tidal volume of minute ventilation
• If CPAP is set too high…exhaling is uncomfortable because patient has to push against the pressure to exhale….↑ WOB
Physiology

How NIV works:

1. Inspiratory positive pressure augments natural tidal volume and increases minute alveolar ventilation
2. Expiratory pressure helps overcome intrinsic PEEP/over inflation and makes it easier to initiate next breath
• iPAP →
  • ↑ TV, ↑ FRC, ↑ O₂, ↑ min vent, ↓ WOB

• ePAP →
  • all of the same things above, PLUS airways do not collapse so CO₂ can escape and recruits more space for ventilation → ↓ pCO₂

• The difference between iPAP and ePAP = the level of pressure support
NIV Equipment: Interfaces

Irwin and Rippe’s Intensive Care Medicine, 7th edition, 2011
Irwin and Rippe’s Intensive Care Medicine, 7th edition, 2011
How to Apply NIV

- Explain technique to patient
- Choose correct interface and size
- Set pressures starting at low levels
- Place interface over face, holding it in place and start ventilation
- When patient tolerant tighten straps just enough to avoid major air leaks
- Set $F_iO_2$ on ventilator or add low flow $O_2$ into circuit, aiming for $SO_2 > 90\%$
• Set alarms- low pressure alarm should be above ePAP
• Be mindful and optimize patient’s comfort
• Reset pressures
  ✓ Increase pressure support to get expired tidal volume of 6 ml/kg or greater
  ✓ Increase ePAP to get SO$_2$ > 90%
• Protect sites of skin pressure
• Consider mild sedation if patient agitated
Monitoring

- Monitor the following q 30 min for 6-12 hrs then hourly:
  - Comfort
  - RR
  - $O_2$ saturation
  - Dyspnea
- Measure ABGs at baseline and within 1 hr from start of NIV
- Humidification if > 6 hrs on NIV
Advantages of NIV

• Compared to invasive mechanical ventilation
• **Select** patients, NIV avoids:
  • trauma of intubation
  • aspiration of gastric contents
  • hypoglossal nerve paralysis
  • arrhythmias and hypotension
  • ventilator associated pneumonia
Advantages of NIV

- Select patients, NPPV is:
  - Better tolerated
  - Requires less or no sedation
  - Permits short breaks
  - Promotes more rapid weaning
  - Shortens ICU LOS
  - Potential reduced resource utilization and costs
Utilization

- Rates of NPPV utilization increasing
- *Esteban et al*: worldwide survey > 20 countries, 1998-2004; > 1600 patients; overall increase of ~6% in NIV use
- NA use:
  - 2003: NPPV 20% of all ventilator starts (*Maheshwari*)
  - 2005-2007: NPPV 38.7% utilization rate (*Ozsancak*)
- Canadian study (*Sweet*): 1998-2003; only 66% patients meeting criteria for NPPV actually received it

*Irwin and Rippe’s Intensive Care Medicine, 7th edition, 2011*
## Indications for NIV in Acute Care

<table>
<thead>
<tr>
<th>Bedside Observations</th>
<th>Gas Exchange</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increased dyspnea- moderate to severe</td>
<td>Acute or acute on chronic ventilatory failure; PaCO(_2) &gt; 45</td>
</tr>
<tr>
<td>Tachypnea (&gt;24 in obstructive; &gt;30 in restrictive)</td>
<td>pH&lt;7.35</td>
</tr>
<tr>
<td>Signs of increased WOB, accessory muscle use, abdominal paradox</td>
<td>Hypoxemia (with caution); PaO(_2)/F(_i)O(_2) &lt; 200</td>
</tr>
</tbody>
</table>

Nava S, Hill J. Lancet 2009;374
# Contraindications for NIV in Acute Care

## Absolute
- Respiratory arrest
- Unable to fit mask
- Unable to protect airway

## Relative
- Medically unstable
- Agitated, uncooperative
- Unable to protect airway
- Swallowing impairment
- Excessive secretions
- Multiple (>2) organ failure
- Recent facial, upper airway or upper GI surgery
- Facial trauma/burns

Nava S, Hill J. Lancet 2009;374
Recommendations for NIV in Acute Respiratory Failure

**Level 1**
- COPD exacerbations; Cardiogenic pulmonary edema
- Immunosuppressed ptsns; Facilitation of wean/extubation in COPD

**Level 2**
- D-N-I status, End stage patients as palliative measures
- Prevent extubation failure (COPD,CHF), Community acquired pneumonia in COPD, Treatment postop respiratory failure

**Level 3**
- NM disease, kyphoscoliosis; Partial upper airway obstruction
- Thoracic trauma; Treatment ARF in asthma

**Level 4**
- Very elderly, > 75 yrs; Cystic fibrosis
- Obesity hypoventilation syndrome
Noninvasive positive pressure ventilation in critical and palliative care settings: Understanding the goals of therapy

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Objective: Although noninvasive positive pressure ventilation (NPPV) is a widely accepted treatment for some patients with acute respiratory failure, the use of NPPV in patients who have decided to forego endotracheal intubation is controversial. Therefore, the Society of Critical Care Medicine charged this Task Force with developing an approach for considering use of NPPV for patients who choose to forego endotracheal intubation.

Data Sources and Methods: The Task Force met in person once, by conference call twice, and wrote this document during six subsequent months. We reviewed English-language literature on NPPV for acute respiratory failure.

Synthesis and Overview: The use of NPPV for patients with acute respiratory failure can be classified into three categories: 1) NPPV as life support with no preset limitations on life-sustaining treatments, 2) NPPV as life support when patients and families have decided to forego endotracheal intubation, and 3) NPPV as a palliative measure when patients and families have chosen to forego all life support, receiving comfort measures only. For each category, we reviewed the rationale and evidence for NPPV, key points to communicate to patients and families, determinants of success and failure, appropriate healthcare settings, and alternative approaches if NPPV fails to achieve the original goals.

Conclusions: This Task Force suggests an approach to use of NPPV for patients and families who choose to forego endotracheal intubation. NPPV should be applied after careful discussion of the goals of care, with explicit parameters for success and failure, by experienced personnel, and in appropriate healthcare settings. Future studies are needed to evaluate the clinical outcomes of using NPPV for patients who choose to forego endotracheal intubation and to examine the perspectives of patients, families, and clinicians on use of NPPV in these contexts. (Crit Care Med 2007; 35:932–939)

Key Words: intensive care; critical care; noninvasive ventilation; palliative care; end-of-life care
Palliative Use of NIV

- Classified use of NIV for ARF into 3 categories:
  1. NIV as life support with no preset limitations on life sustaining treatments
  2. NIV as life support when patients/families have decided to forego ETT
  3. NIV as a palliative measure when patients/families have decided to forego all life support, receiving symptom management only to be comfortable
Palliative Use of NIV

- Discussing goals of using NPPV….
- **Category 1:**
  - goal is to restore health; will use intubation if necessary and indicated
- **Category 2:**
  - Goal is to restore health without using ETT and without causing unacceptable discomfort
- **Category 3:**
  - Goal is to maximize comfort while minimizing adverse effects of opiates
Palliative Use of NIV

- 3 category approach has implications for location of therapy
- Either ICU or intermediate or step down unit
- For category 2 and 3 patients, may be able to develop policies and expertise outside of the critical care setting with close monitoring
- NPPV may also be considered in the hospice setting for those in category 3, for palliation of dyspnea; minimize adverse effects of opioids
## Evidence Supporting NPPV

### Table 4: Data on situations for NIV use as established by the SCCM [56]

<table>
<thead>
<tr>
<th>Situation</th>
<th>Category 1: life support without preset limits</th>
<th>Category 2: life support with preset limit (do not intubate)</th>
<th>Category 3: comfort measures only</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acute exacerbation of COPD</td>
<td>Multiple randomized trials and several meta-analyses showing benefit</td>
<td>Observational studies suggesting benefit</td>
<td>No data supporting use</td>
</tr>
<tr>
<td>Hypoxic respiratory failure in immunocompromised patient</td>
<td>Several randomized trials and one meta-analysis showing benefit</td>
<td>Observational studies suggesting benefit</td>
<td>No data supporting use</td>
</tr>
<tr>
<td>Acute respiratory failure with cardiogenic pulmonary edema</td>
<td>Two randomized trials and one meta-analysis suggesting benefit</td>
<td>Observational studies suggesting benefit</td>
<td>No data supporting use</td>
</tr>
<tr>
<td>Neuromuscular diseases</td>
<td>Two small uncontrolled observational studies suggesting possible benefit</td>
<td>No data supporting use in acute setting</td>
<td>No data supporting use</td>
</tr>
</tbody>
</table>
NIV in Palliative Care??

- DNR (DNI) ≠ no NIV

- Dyspnea is a difficult symptom to manage
- There will be times for some patients when NIV is appropriate
- Can be viewed as an extra tool in the palliative care toolbox
- The aim is not patient survival but symptom control
NIV in Palliative Care

- Goals of care need to be clear to both the patient and the clinician.
- Effective communication about risks and benefits
- Members of the palliative care team need to discuss NIV to avoid conflicts within the team
- Time limited trials- need to define success and failure
• **Symptom relief:**
  - Decreased work WOB
  - Decreased dyspnea

• **Buys time:**
  - Allows family members to arrive
  - Allows for individuals to cope with the deterioration

• **Improved level of consciousness:**
  - Preserved communication between patient and family
Advantages and Disadvantages of Palliative NPPV in ICU

**Advantages**
- Improves survival in some
- Can be incorporated into a strategy of continuous care
- Palliation: relieves the sensation of dyspnea
- Enables patient to communicate verbally
- ICU could be best place b/c if NIV fails then prompt initiation of opioids and anxiolytics; expert staff

**Disadvantages**
- Unreasonable persistence in “curable” treatment
- Results mediocre; can unnecessarily prolong dying
- Patient comfort, family satisfaction not been evaluated
- No study evaluated palliative NIV along chain of care
- High mortality rate in ICU; process in deciding whether to use NIV is complex, suboptimal; possible source of confusion, ambiguity, conflict and burnout

Azoulay E et al. Intensive Care Med 2011;37
Evidence and Behavior for Palliative NIV Use

- **Nava S et al. Eur Resp J 2007**: European survey, 40% of NIV was solely as palliative treatment

- **Sinuff T et al. Crit Care Med 2008**: North American survey, attitudes of MDs and RTs re use of NIV for pts with ARF with DNI/DNR order; 62% MDs and 87% RTs included the potential use of NIV in their discussions

- >80% used NIV for COPD and CPO patients with DNR and nearing end of life; 59% for underlying cancer
Observational Studies

- Recent multi-centre study; 43% survived and discharged from ICU
- ~50% with COPD and 70% with CPO surviving at hospital discharge
- Better hospital survival if:
  - Higher level of baseline hypercapnia
  - Dx of COPD or CPO
  - Presence of strong cough and wakefulness
• **Schettino G et al. Crit Care Med 2005;33**
  
• Single-centre prospective observational study
  
• 131 patients
  
• Overall hospital mortality of 65%, poorer prognosis in those with advanced cancer (85%)
  
• COPD 63% & CPO 60% hospital survival rates
Underlying Respiratory Diseases

- NIV is effective in AE-COPD
  - Reduces intubation rates
  - Lowers mortality
  - Reduces length of stay
  - Improves symptom control
  - May reverse respiratory failure
- NIV is the first line therapy in patients with severe exacerbation of COPD and compensated respiratory acidosis

Curtis JR et al. Crit Care Med 2007;35
Neuromuscular diseases and neurological disorders which impair respiratory function

Respiratory complications produce burdensome symptoms

NIV is very helpful in the early phases
  ✓ Improves survival
  ✓ Improves QOL
  ✓ Decreases respiratory symptom burden

Progressive disease on home NIV….almost all continue tx even in terminal stages….eventually tracheostomy and home invasive ventilation
20-80% of patients with solid tumours have respiratory symptoms and dyspnea

Episode of ARF is the most common reason for ICU admission of a cancer patient

Mortality has decreased below 50% for those admitted to ICU; mortality is 75-80% if need intubation/ventilation

Intubation and ventilation are 2 major determinants of survival in critically ill cancer patients

Scala R, Nava S. European Respiratory Monograph 41, November 2008
Use of NIV in this immunocompromised population is promising because it decreases risk of VAP and is associated with marked improvement in survival.

Scala R, Nava S. European Respiratory Monograph 41, November 2008
Palliative use of non-invasive ventilation in end-of-life patients with solid tumours: a randomised feasibility trial

Stefano Nava, Miguel Ferrer, Antonio Esquinas, Raffaele Scala, Paolo Groff, Roberto Cosentini, Davide Guido, Ching-Hsiung Lin, Anna Maria Cuomo, Mario Grassi

Summary

Background Despite best-possible medical management, many patients with end-stage cancer experience breathlessness, especially towards the end of their lives. We assessed the acceptability and effectiveness of non-invasive mechanical ventilation (NIV) versus oxygen therapy in decreasing dyspnoea and the amount of opiates needed.

Methods In this randomised feasibility study, we recruited patients from seven centres in Italy, Spain, and Taiwan, who had solid tumours and acute respiratory failure and had a life expectancy of less than 6 months. We randomly allocated patients to receive either NIV (using the Pressure Support mode and scheduled on patients’ request and mask comfort) or oxygen therapy (using a Venturi or a reservoir mask). We used a computer-generated sequence for randomisation, stratified on the basis of patients’ hypercapnic status (PaCO₂ >45 mm Hg or PaCO₂ ≤45 mm Hg), and assigned treatment allocation using opaque, sealed envelopes. Patients in both groups were given sufficient subcutaneous morphine to reduce their dyspnoea score by at least one point on the Borg scale. Our primary endpoints were to assess the acceptability of NIV used solely as a palliative measure and to assess its effectiveness in reducing dyspnoea and the amount of opiates needed compared with oxygen therapy. Analysis was done by intention to treat. This study is registered with ClinicalTrials.gov, number NCT00533143.

Findings We recruited patients between Jan 15, 2008, and March 9, 2011. Of 234 patients eligible for recruitment, we randomly allocated 200 (85%) to treatment: 99 to NIV and 101 to oxygen. 11 (11%) patients in the NIV group discontinued treatment; no patients in the oxygen group discontinued treatment. Dyspnoea decreased more rapidly in the NIV group compared with the oxygen group (average change in Borg scale −0.58, 95% CI −0.92 to −0.23, p=0.0012), with most benefit seen after the first hour of treatment and in hypercapnic patients. The total dose of morphine during the first 48 h was lower in the NIV group than it was in the oxygen group (26.9 mg [37.3] for NIV vs 59.4 mg [SD 67.1] for oxygen; mean difference −32.4 mg, 95% CI −47.5 to −17.4). Adverse events leading to NIV discontinuation were mainly related to mask intolerance and anxiety. Morphine was suspended because of severe vomiting and nausea (one patient in each group), sudden respiratory arrest (one patient in the NIV group), and myocardial infarction (one patient in the oxygen group).
Palliative noninvasive ventilation in patients with acute respiratory failure

Abstract Over the last two decades, the increasing use of noninvasive ventilation (NIV) has diminished the need for endotracheal ventilation, thus decreasing the rate of ventilation-induced complications. Thus, NIV has decreased both intubation rates and mortality rates in specific subsets of patients with acute respiratory failure (e.g., patients with hypercapnia, cardiogenic pulmonary edema, immune deficiencies, or post-transplantation acute respiratory failure). NIV is also increasingly used as a palliative strategy when endotracheal ventilation is deemed inappropriate. In this context, palliative NIV can either be administered to offer a chance for survival, or to alleviate the symptoms of respiratory distress in dying patients. The literature provides information from 10 studies published between 1992 and 2006, in which 458 patients received palliative NIV. The technique was feasible, usually well tolerated, and half of the patients survived. The objectives of this review article are to define palliative NIV, to delineate the place for palliative NIV among overall indications of NIV, and to define the contribution of NIV to the palliative strategies available for patients with acute respiratory failure. Potential benefits and harm from NIV in patients who are not eligible for endotracheal ventilation are discussed. The appropriateness of palliative NIV should be reported in a study that relies on both quantitative criteria (rate of palliative NIV use and mortality) and qualitative criteria (patient comfort, end-of-life process, family burden, and health-care provider satisfaction).

Keywords ARDS and ALI: clinical studies · Critical care organisation · Ethics · Hematologic–oncologic issues in the ICU · Non-invasive ventilation · Pain management

Azoulay E et al. Int Care Med 2011;37
Summary

1. There is good evidence that NIV may be used in terminally ill patients with different objectives (categories)
2. Up to 30% end stage chronic respiratory patients are receiving NIV in the last days of life (COPD, CPO)
3. Also being applied to the end stage cancer patients with good effect
4. About 50% of DNI patients with ARF may be successfully treated and discharged from hospital (mainly if COPD, CHF)
• Goals of care need to be addressed frequently and clearly understood by the patient/family and clinicians
• Need to discuss potential risks and benefits clearly
• Members of palliative care team need to discuss and understand NPPV to avoid conflicts and misunderstandings
Need to discuss possible ethical dilemmas and unintended consequences associated with use of NPPV

Important for HCPs to review the benefits and burdens of palliative NPPV

Use principles to guide decision making regarding NPPV
Future Considerations

- Identify the prevalence of the three approaches for NPPV
- Evaluate outcomes with each approach
- Examine perspectives of patients, families, clinicians
- Look at system issues such as safety, life support resource utilization, quality EOL care
Palliative Use of NIV

- Are we navigating murky waters?? (T. Quill)

Thank you for your attention