Non-invasive Ventilation (NIV)
(Risk Associated: Misuse & overuse)

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Objectives

• Introduction.
• Goals of NIV.
• Advantages & disadvantages of NIV.
• Appropriate Use of NIV.
• Associated risks:
  (Misuse and Overuse)
Non-Invasive Ventilation (NIV)

• NIV has markedly increased over the last 50 years.
• NIV has now become an integral tool in the management of both:
  I. Acute and chronic respiratory failure,
  II. Both the home setting and in the critical care unit.
• NIV has not been used as a replacement for invasive ventilation.
Short term and long term support

• **Short Term:**
  – Hospital NC
  – BiPAP for acute respiratory distress

• **Long Term:**
  – Home O2 for chronic COPDers
  – CPAP for Obesity Hypoventilation Syndrome or OSA
The key to the successful application of NIV is in recognizing its capabilities and limitations.

Patient selection is crucial for the successful application of NIV.

A careful assessment of the patient and his or her condition determines if the patient is a candidate for NIV.
General consideration of NIV

• Keys to the success of NIV and improving clinical outcomes of patients are:
  – Careful patient selection.
  – A well designed protocol.

• The determinants of success are less dependent on these technical factors and relate more prominently to the appropriate primary clinical diagnosis.
Other consideration of NIV

- Staff learning curve and time requirements (nursing and respiratory therapy).

- The experience and expertise of front-line health care providers, cannot be underestimated.
Appropriate Location of application of NIV

• ICU (especially if possibility of intubation).
• Step-down unit (lower severity of illness). Moderately severe COPD (pH >7.30)
• Do-not-intubate status.
• Ward setting (not recommended if intubation is a consideration)
  – Suitable in specialized units.
  – Emergency department.
  – Local considerations, expertise may mirror ICU or step-down unit.
Consideration of absolute contraindications

- Coma.
- Cardiac arrest.
- Respiratory arrest.
- Any condition requiring immediate intubation.
- Potential for upper airway obstruction.
- Extensive head and neck tumors.
- Any other tumor with extrinsic airway compression.
- Angioedema or anaphylaxis causing airway compromise.
Other consideration of contra-indications

- Cardiac instability Shock and need for pressor support.
- Ventricular dysrhythmias.
- Complicated acute myocardial infarction
- GI bleeding - intractable emesis and/or uncontrollable bleeding.
- Inability to protect airway impaired cough or swallowing.
- Poor clearance of secretions.
- Depressed sensorium and lethargy.
- Status epilepticus.
Appropriate Patient Selection is Crucial
Early initiation of NIV is associated with decrease overuse and good outcome in appropriately selected individuals.
Appropriate Selection guidelines for NIV

- Appropriate diagnosis with potential reversibility over hours to days
- **Ascertained need for ventilatory assistance:**
  - Moderate to severe respiratory distress.
  - Tachypnea (>24/min for COPD, >30/min for hypoxemia.
  - Accessory muscle use or abdominal paradox
  - Blood gas abnormality.
  - pH < 7.35, PaCO2 > 45 or PaO2/FiO2 < 200.
Appropriate Selection guidelines for NIV

1. Alert & cooperative.
2. Hemodynamic stability.
3. No need for endo-tracheal intubation:
   to protect airways or to remove excessive secretions.
4. No acute facial trauma.
5. Properly fitted mask.
6. No multi-organ dysfunction.
Advantageous consideration of NIV

• Avoids the trauma associated with intubation and the complications associated with artificial airways.

• Reduces the risk of ventilator associated pneumonia (VAP).

• Reduces the risk of ventilator induced lung injury associated with high ventilating pressures.

• Less need for sedation.
Advantageous consideration of NIV

- NIV provides greater flexibility in initiating and removing mechanical ventilation.
- Permits normal eating, drinking and communication with your patient.
- Preserves airway defense, speech, and swallowing mechanisms.
Other Beneficial consideration of NIV

• less cost than invasive ventilation.
• Reduces need for invasive monitoring.
• Shortens stay in intensive care unit.
• Shortens hospital stay.
• Reduces mortality.
• Preserves airway defenses.
• Improves patient comfort.
Examples of Patients Interfaces
## Indicators of successful use of NIV

<table>
<thead>
<tr>
<th>Younger age.</th>
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</thead>
<tbody>
<tr>
<td>Lower acuity of illness (APACHE score).</td>
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<tr>
<td>Cooperative patient. Intact neurological function.</td>
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<tr>
<td>Good synchrony with ventilator. Intact dentition. Well-controlled air leaking. Able to control secretions.</td>
</tr>
<tr>
<td>Moderate hypercarbia (PaCO2 &gt;45 mmHG, &lt;92 mmHG).</td>
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<tr>
<td>Moderate acidemia (pH &lt;7.35, &gt;7.10).</td>
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<tr>
<td>Improvements in gas exchange and heart respiratory rates within first 2 hours.</td>
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</tbody>
</table>
Appropriate Patient Interfaces

- NIV support uses a variety of interfaces.
- It is based on patient comfort and efficacy.

- Nasal masks and orofacial masks are still the most commonly used interfaces.
- Orofacial masks are used almost twice as frequently as nasal masks.

- Both have advantages and disadvantages in the application of NIV.
Nasal Masks

Respironics Contour Deluxe™ Mask

Dual density foam bridge forehead support

Thin flexible & bridge material

Dual flap cushion

360° swivel standard elbow
Full Face Masks

Most often successful in the critically ill patient

Respironics PerformaTrak® Full Face Mask
Nasal Pillows or Nasal Cushions:

Suitable for patients with:

- Anxiety disorder
- Skin sensitivities
- Need for visibility

Respironics Comfort Lite™ Nasal Mask
### Nasal vs. oro-nasal (full-face) masks: use and misuse

<table>
<thead>
<tr>
<th>Variables</th>
<th>Nasal</th>
<th>Oro-nasal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Comfort</td>
<td>++</td>
<td>++</td>
</tr>
<tr>
<td>Rebreathing</td>
<td>+</td>
<td>++</td>
</tr>
<tr>
<td>Lowers CO2</td>
<td>+</td>
<td>++</td>
</tr>
<tr>
<td>Permits expectoration*</td>
<td>++</td>
<td>+</td>
</tr>
<tr>
<td>Permits speech•</td>
<td>++</td>
<td>+</td>
</tr>
<tr>
<td>Permits eating</td>
<td>+</td>
<td>-</td>
</tr>
<tr>
<td>Function if nose obstructed</td>
<td>-</td>
<td>+</td>
</tr>
</tbody>
</table>
Worsening pH and arterial partial pressure of carbon dioxide (PaCO₂).

Tachypnea (over 30 breaths/min).

Hemodynamic instability.

Oxygen saturation by pulse oximeter (SpO₂) less than 90%.

Decreased level of consciousness.

Inability to clear secretions.

Inability to tolerate interface.
<table>
<thead>
<tr>
<th>Risks of Misuse &amp; Overuse</th>
<th>Corrective Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>1- Mask discomfort</td>
<td>• Check mask for correct size and fit.</td>
</tr>
<tr>
<td>Excessive leaks around mask</td>
<td>• Minimize headgear tension.</td>
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<tr>
<td>Pressure sores</td>
<td>• Use spacers or change to another style of mask.</td>
</tr>
<tr>
<td>2- Nasal and oral dryness or nasal</td>
<td>• Use wound care dressing over nasal bridge.</td>
</tr>
<tr>
<td>congestion</td>
<td>• Add or increase humidification.</td>
</tr>
<tr>
<td>3- Mouthpiece/lip seal leakage</td>
<td>• Irrigate nasal passages with saline.</td>
</tr>
<tr>
<td>4- Aerophagia, gastric distention</td>
<td>• Apply topical decongestants.</td>
</tr>
<tr>
<td>5- Aspiration</td>
<td>• Use chin strap to keep mouth closed.</td>
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<tr>
<td>Mucous plugging</td>
<td>• Change to full face mask.</td>
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<tr>
<td>6- Hypotension</td>
<td>• Use nose clips.</td>
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<tr>
<td></td>
<td>• Use custom made oral appliances.</td>
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<td></td>
<td>• Use lowest effective pressures for adequate tidal volume delivery.</td>
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<td></td>
<td>• Use simethicone agents.</td>
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<td></td>
<td>• Make sure patients are able to protect the airway.</td>
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<tr>
<td></td>
<td>• Ensure adequate patient hydration.</td>
</tr>
<tr>
<td></td>
<td>• Ensure adequate humidification.</td>
</tr>
<tr>
<td></td>
<td>• Avoid excessive oxygen flow rates (&gt;20 l/min).</td>
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<td></td>
<td>• Allow short breaks from NPPV to permit directed coughing techniques.</td>
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<tr>
<td></td>
<td>• Avoid excessively high peak pressures (&lt;=20 cm H\textsubscript{2}O)</td>
</tr>
<tr>
<td>Problem</td>
<td>Potential cause</td>
</tr>
<tr>
<td>---------------------------------------</td>
<td>------------------------------------------------------</td>
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<tr>
<td>Inspiratory trigger failure</td>
<td>Air leak</td>
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<tr>
<td></td>
<td>Autocycling</td>
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<tr>
<td></td>
<td>Increased work of breathing</td>
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<tr>
<td>Inadequate pressurisation</td>
<td>Pressure rise time too long</td>
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<tr>
<td></td>
<td>Pressure support too low</td>
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<tr>
<td>Failure to cycle into expiration</td>
<td>Air leak leading to &quot;inspiratory hang up&quot;</td>
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<tr>
<td></td>
<td>High end-inspiratory flow</td>
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<tr>
<td>CO₂ rebreathing</td>
<td>Single circuit with no true exhalation valve</td>
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<tr>
<td></td>
<td>High respiratory rate</td>
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<tr>
<td></td>
<td>No PEEP</td>
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<td></td>
<td>Large mask dead space</td>
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NIV has now become an integral ventilatory tool.
It can be used for short and long term management.
Appropriate patient selection is crucial for the successful application of NIV.
Early initiation of NIV is associated with good outcomes.
There associated risks with NIV to be considered.