NON-INVASIVE POSITIVE PRESSURE VENTILATION (NIPPV) PACKAGE

Tamworth Base Hospital
1. Definitions

NIPPV is a non-invasive means of delivering positive pressure ventilation and ventilatory assistance to a spontaneously breathing patient. The objective is to deliver adequate ventilation support without intubation.

It has been described as trying to breathe with your head out of the window of a speeding car.

NIPPV is also referred to as bi-level, bi-phasic, BiPAP or Vpap ventilation depending on literature and the manufacturer.

**BiPAP:** Bi-level Positive Airway Pressure. The patient breathes in one set pressure and out against another. It is a combination of:

**IPAP:** Inspired Positive Airway Pressure, and

**EPAP:** Expired Positive Airway Pressure.

**IPAP (Otherwise known as Pressure Support)**
- Increases tidal volume
- Reduces hypercapnia
- Reduces the work of breathing

**EPAP (Otherwise known as CPAP or PEEP)**
- Increases lung volume
- Improves oxygenation
- Maintains an open airway
- Reduces the work of breathing

NIPPV is not used on patients with an ETT tube insitu. Pressure support would be the most appropriate mode of choice.

2. AIMS

- Adequate non-invasive ventilatory support for hypercapnic respiratory failure (thereby avoiding endotracheal intubation with all its complications)

- Symptomatic relief of dyspnoea

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• Improvement of cardiac function in the presence of ischaemia and/or left ventricular afterload sensitivity

3. INDICATIONS
• Hypoventilation/Hypercapnic respiratory acidosis/Hypoxaemia
• Severe dyspnoea/Tachypnea
• Patients with ventilatory muscle dysfunction (neuromuscular/cystic fibrosis)
• Acute respiratory failure
• Pulmonary contusion and flail chest
• Asthma
• Chronic airway disease
• Post-operative atelectasis
• Obstructive sleep apnea/Cor Pulmonale
• Cardiogenic Pulmonary Oedema
• Post extubation Support
• Patient’s who are ‘Not for Intubation’

4. ADVANTAGES
• Intubation is avoided.
• Increases functional residual capacity.
• Decreases work of breathing.
• Improves alveolar recruitment.
• Patient does not necessarily need an ICU bed.
• Non-invasive – lower risk of infection.
• Mortality rates are lower.
• Intermittent ventilation
• Patient can eat, drink and communicate
• Ease of application and removal
• Patient can cooperate with physiotherapy
• Improved patient comfort
• Reduced sedation requirements
• Avoidance of complications of intubation

5. CONTRA-INDICATIONS
• Patient’s inability to maintain his or her own airway.
• Unstable facial fractures
• Excessive facial lacerations
• Laryngeal trauma
• Recent tracheal or oesophageal anastomosis
• Basal skull fracture
• Patient with recent GI surgery or at risk of GIT bleeds/ileus

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- Excessive secretions.
- Vomiting/ and or high aspiration risk
- Uncooperative or unmotivated patients.
- Cardiac or respiratory arrest
- Severe encephalopathy
- Coma

6. COMPLICATIONS
- Barotrauma
- Haemodynamic compromise/ Decreased cardiac output/Hypotension
- Aspiration
- Pneumothorax
- Gastric distention
- High level of anxiety
- Skin breakdown / pressure areas
- Facial/eye oedema
- Drying of mucous membranes (although this is limited through humidification/oral hygiene)

7. TROUBLESHOOTING COMPLICATIONS

<table>
<thead>
<tr>
<th>Signs &amp; Symptoms</th>
<th>Causes</th>
<th>Interventions</th>
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<tbody>
<tr>
<td>Skin discomfort</td>
<td>Excessive pressure</td>
<td>Provide pressure relief</td>
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<tr>
<td></td>
<td>Skin reaction</td>
<td>Clean mask</td>
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<td></td>
<td></td>
<td>Change type of mask</td>
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<tr>
<td>Gastric distension, Abdominal pain</td>
<td>Air swallowing</td>
<td>Delay starting BiPaP for 2/3 hours</td>
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<td>Regurgitation</td>
<td>Poor fitting mask</td>
<td>Nil by mouth</td>
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<tr>
<td>Aspiration</td>
<td>Excessive air pressure</td>
<td>Administer antiemetics</td>
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<td></td>
<td>Eating and drinking prior to commencement</td>
<td>Adjust mask</td>
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<td></td>
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<td>Consider NG insertion</td>
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<tr>
<td>Cramps, pins and needles sensations, light headedness</td>
<td>Over ventilation causing respiratory alkalosis</td>
<td>Discontinue use and reassess</td>
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<td>Difficulty resting</td>
<td>Anxiety</td>
<td>Reassure</td>
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<tr>
<td>Claustrophobia</td>
<td>Inadequate ventilation</td>
<td>Adjust setting</td>
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<tr>
<td></td>
<td>Discomfort with mask</td>
<td>Reassure</td>
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<td></td>
<td></td>
<td>Minor sedation</td>
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<tr>
<td>Dryness, congestion</td>
<td>Drying effect of air flow</td>
<td>Add humidification</td>
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<td>Frequent eye and mouth care</td>
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Chest pain, dyspnoea
Low breath sounds
(unilateral)

Possible pneumothorax
Discontinue immediately
and prepare for
emergency interventions
– ie CXR and insertion of
intercostal catheter

7. Nursing Responsibilities:
   - Ensure hourly and PRN ventilation values/documentation
   - Check ventilation setting correspond with ventilation orders
   - Maintain adequate face/mask seal
   - Hrly observations, HR, RR, BP, SPO₂
   - Observe patients level of consciousness, chest wall movement, co-ordination of patient respiratory effort with the ventilator, work of breathing eg accessory muscle use
   - Pressure areas on the skin beneath the mask
   - Change tubing and device check every 7 days
   - Maintain patient comfort, oral, nasal and eye hygiene

THE VENTILATOR

At Armidale Rural Referral Hospital we have 3 types of NIPPV.

1. V60 BiPAP- 1 ED
2. Trilogy BiPAP – ICU
3. ResMed BiPAP x2 ICU (can be used on the ward)
4. Evita 4 Drager ventilator

Before you initiate NIPPV you should do:

- A complete history and physical examination.
- Monitor heart rate, skin colour, peripheral perfusion, use of accessory muscles, movement of chest wall.
- SpO₂, CXR, ABG’s.
- Nil by mouth.

MASK SELECTION

- Sizing of the mask is crucial. Select the smallest size to fit comfortably.
- The mask should fit from the end of the nasal bone to below the mouth and resting on the chin.
- Skin protection is required especially with full face mask, on the bridge of the

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nose and on the forehead.

- Patients with dentures, sometimes it is hard to achieve a good seal. Keeping the dentures in can help.

PATIENT CONSIDERATIONS

1. The most important part in the successful treatment of NIPPV is patient cooperation and compliance.
2. Be aware that they usually have severe dyspnoea and will be very exhausted and hypoxic.
3. You as the nurse need to be aware of all this. The best thing is to give the patient calm, clear instructions and information, sometimes needing a lot of patience.
4. Tolerance of the mask can be assessed by getting the patient to hold the mask against their faces and asking them to breathe with the machine at the pressures that have been set. Involving the patient throughout the process empowers them and allows them some control over all that is happening.
5. Reassure them that they may experience feelings of suffocation, their mouth will be dry and the mask does smell. Also they can feel very nauseous due to the high flow of oxygen.
6. Initially while the patient is getting used to the mask set the pressures very much lower that what is required slowly increasing them as the patient becomes accustomed to the mask this may take up to ten minutes. You could start with IPAP 4-5cmH20 and EPAP 2-3cmH20 even though it should be higher.
7. After a few hours, or when you can see they can maintain a patient airway the patient can eat. The patient may utilise a nasal mask or nasal prongs,

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BiPAP SETUP

Initial IPAP/EPAP Settings

Start 8/4 cmH20
Initial adjustments to achieve tidal volume of 5-7 ml/kg
Subsequent adjustments (on ABG investigation)
- increase IPAP by 2cmH20 if persistent hypercapnia
- increase IPAP & EPAP by 2cmH20 if persistent hypoxaemia
- Limit IPAP 20-25 cmH20 & EPAP 10-15cmH20
- Fi02 adjust to lowest level with an acceptable pulse oximetry value.

CIRCUIT REQUIRED

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<table>
<thead>
<tr>
<th>Problem</th>
<th>Action</th>
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<tbody>
<tr>
<td><strong>Vision Keeps Alarming:</strong> &lt;br&gt;Possible cause: Alarm limits set inappropriately</td>
<td>1. Press the Alarm re-set button. 2. Look at the top section of the screen, the alarm status will tell you, i.e. High-pressure alarm. 3. Press the Alarms mode button on the front of the vision. 4. Change relevant alarm setting by selecting the parameter and using the central control knob, dial up or down as required.</td>
</tr>
<tr>
<td><strong>Learn Base Flow</strong> &lt;br&gt;For adding a nebuliser to the circuit</td>
<td>1. Attach the nebuliser and external gas source to the circuit. 2. Turn on the wall oxygen for the nebuliser to the required flow. 3. Press the Alarm Mode key. 4. Press “Learn Base Flow” for the ventilator to re-learn the circuit volume. 5. Takes approximately 2 minutes – No need to re-learn the base flow at the completion of the nebuliser.</td>
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<td><strong>Breath Delivery to SLOW/FAST</strong> &lt;br&gt;Possible Cause: IPAP Rise Time set inappropriately</td>
<td>1. Observe the patient/Vision screen to see if the breath delivery is to Fast/Slow. 2. Press the Parameter Mode button. 3. Press the IPAP Rise Time key. 4. Dial central control knob to alter breath rise time up or down as required.</td>
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<tr>
<td><strong>FLC Flashing on the screen OR Flow Drop through the circuit</strong> &lt;br&gt;Possible cause: Patient removing mask</td>
<td>1. If patient/staff removes the mask while the ventilator is on, FLC (Flow Limit Control) may flash on the screen and the gas flow will automatically drop. 2. Place the mask back onto the patient and within 1-2 breaths, flow will return to the desired rate.</td>
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<tr>
<td><strong>Unable to perform “Self Test” when starting the Vision</strong> &lt;br&gt;Possible Causes: Blocked Pressure Line, leaking circuit, C02 port covered</td>
<td>1. Ensure tubing/pressure line is smooth bore and the connector has a C02 port. 2. While performing the test, keep tubing still and ensure the C02 exhalation port is not covered. 3. Ensure there are no leaks from the circuit, change circuit as required. 4. Ensure the pressure line is clear of water/debris, change the pressure line if required. 5. Re-start “Self Test”.</td>
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Evita 4 NIV

The benefit of using the Evita 4 for non-invasive ventilation is the availability of the humidifier.

**Equipment required**

- Dragar ventilator (Non-Invasive software installed, indicated on front of machine)
- Ensure “Device check” is done
- Correctly fitted mask S/M/L CPAP mask with head strap
- Standard ventilator circuit

**Procedure/Instructions for use;**

**Set** Ventilator to ‘Standby’

**Touch** softkey ‘Tube?mask’

**Touch** softkey ‘Mask’ and confirm with rotary knob. Screen will change colour to a pale green in place of the standard blue and a mask symbol will appear in the status display.

**Select** mode of ventilation ‘PCA+Assist’ or ‘CPAP/PS’ as per normal

**Adjust settings**  
- **PEEP** = lower pressure level
- **Pressure Support** refers to **Pinsp** = upper pressure level which is the **PEEP + PS**
- **T insp** = inspiratory time
- **Oxygen** = set **FiO2** as ordered
- **Ramp** = controls the steepness of the increase from the lower pressure level to the upper pressure level (the time for the increase in pressure cannot be greater than set inspiratory time, this ensures that the upper pressure level is reached safely during inspiration). **Note** ‘Tinsp’ in NIV CPAP/PS is the Max inspiratory time allowed, NOT the set inspiratory time which would be set for invasive ventilation

**Press** the ‘standby’ key to activate the mode

**Set Alarms**  
- **apnoea alarm limit**’ to 20 secs (this must sometimes be set to off if the ventilator fails to detect resps/pt effort), **Set** ‘Tdisconnect’ to 20 secs, **Set** ‘Tv insp’ upper alarm to off, **Set** MV lower alarm limit to off.

**Set** The humidifier to mask

**Note:** If the ventilator is turned off whilst in NIV mode, it will automatically revert back to invasive ventilation when switched back on.

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