Title | Non-Invasive Ventilation (NIV)
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Version | 4
Related Documents | BTS Guidelines on NIV in Acute Respiratory Failure; EMRS SOP’s on awake transfers and Oxylog 3000
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Aims

To provide guidance on indications, contraindications, set up and manipulation of NIV appropriate for the EMRS

Background

NIV has been shown to be an effective treatment for Acute Hypercapnic Respiratory Failure, particularly in COPD.

Application

EMRS Team Members
SAS Paramedics

Patients appropriate for EMRS activation

COPD with a respiratory acidosis
(Cardiogenic pulmonary oedema unresponsive to CPAP)

Advice to GP prior to team arrival

ABG if available
Nebulisers – air driven
Physio- if available
Antibiotics / steroids
Dedicated NIV Masks are no longer used and the standard Facemasks used with a Facemask ring is adequate. These are found in the breathing pack within the main Medical Pack.

General comments on the use of NIV in the EMRS setting

Any decision on treatment must be based on the individual patient. If the decision of the EMRS Consultant is to use NIV, there are 3 main potential strategies:

1. Use at the referring centre only to attempt to improve a patient’s gas-exchange sufficiently to allow safe air transport without ventilator support.
2. As a method to optimise oxygenation prior to RSI
3. Use during transport to definitive care.

Strategy 3 warrants great consideration given the limitations of access to the patient whilst in-flight. The decision making process is multi-factorial including current condition, underlying pathology and co-morbidity in the patient. Distance/time to definitive care and likelihood of in-transit complications are also vital considerations to be made. As such, no concrete protocols can be set down for this decision and ultimately this benefit/risk analysis must be left to the EMRS Consultant in charge of the patient’s care.

Medical management on scene

Oxygen – provide to achieve a target SpO2 of 89-92%. Where the patient’s usual SpO2 is known, this should be the target for that patient.

From an EMRS point of view, NIV in the form of BIPAP may be indicated in:

1. COPD with respiratory acidosis (PCO2 >6kPa / 45 mmHg) (H+ 45-56 / pH 7.35-7.25) in whom maximal medical treatment has failed to produce a sufficient improvement.
2. Hypercapnic Respiratory Failure secondary to chest wall deformity (eg: scoliosis) or neuromuscular disease.
3. Cardiogenic pulmonary oedema unresponsive to CPAP

NIV should NOT be used in cases of:

a) Impaired consciousness/inability to protect own airway
b) Severe hypoxia
c) Patients with copious respiratory secretions or vomiting.
d) Recent Facial/upper airway surgery/burns/trauma
e) Upper airway obstruction
f) Recent GI surgery
g) Bowel Obstruction
h) Poor patient co-operation
i) Where the patient has a clear indication for endotracheal intubation and invasive ventilation.
j) Although mentioned in the BTS guidelines, in our EMRS setting, NIV is not a viable method of assisting ventilation in patients with chest injuries. Such patients are likely to require endotracheal intubation (ETI) for transport.

k) Acute pneumonia with hypoxaemia resistant to high flow O2 – a significant proportion of these patients will go on to require ETI in any case.

l) Asthma

**Before commencing NIV:**

1. ABG is mandatory before initiation of NIV (iSTAT available for this function)
2. A decision about tracheal intubation should be made should the trial of NIV fail.

Some patients may improve sufficiently on medical treatment to obviate the need for NIV. Their ABGs should be re-checked to confirm this if they are clinically improving.

Have a low threshold for ABG measurement in those patients with chest wall deformity or those with neuromuscular disease (SOB/tachypnoea may not feature prominently)

Please note that the minimum FiO2 deliverable by the Oxylog 3000 & 3000 plus ventilators is 40%. This may be worth considering when treating patients who are chronic retainers of CO₂.

**Monitoring requirements:**

i) Continuous clinical evaluation, specifically:
   - Chest wall movement
   - Co-ordination of resps with ventilator
   - Accessory muscle use
   - Heart rate
   - RR
   - Patient comfort
   - Mental state

ii) Repeat ABG analysis as dictated by patients clinical condition – patient ideally to have an arterial line in situ

iii) Continuous ECG/SpO2 recording via Phillips MRX

**Infection Control**

1) Disposable Face masks should be used
2) A bacterial filter should be attached to the ventilator outlet during NIV and the external surface of the ventilator cleaned between patients

**Initiating NIV – General Steps**

1. Decide on management plan should NIV fail and document in the patient’s notes
2. Inform HDU/ICU of plan to initiate NIV and the potential need for its continued use and/or intubation and ventilation. Is patient already known in a particular unit?
3. Explain NIV to patient (including how to summon help)
4. Select an appropriate mask size
5. Set up ventilator (see below)
6. Attach monitoring to patient (see above)
7. Commence NIV, holding mask in place for first few minutes
8. Secure head straps
9. Reassess after a few minutes
10. Adjust settings if necessary
11. Continually reassess clinically and according to Ix
12. Success of NIV can be greatly improved by careful explanation and reassurance to the patient

NIV Set up Instructions specifically for Drager Oxylog 3000

The setup for BIPAP ASB: Setting screen 1

- Step 1: Change mode from IPPV to CPAP ASB (Assisted Spontaneous Breathing) by holding in the button for 5 secs. Please note that on the Oxylog 3000 plus ventilator, the equivalent softkey buttons are labeled VC CMV and spn CPAP respectively.
- Step 2: Accept the trigger at 3L/min
- Step 3: Set the PEEP (5mBar is default)
- Step 4: Set the ∆ASB (pressure support) to 5 to give 10/5 pressure support and work upwards according to response up to a maximum of 20mBar. Please note that on the Oxylog 3000 plus device this is called ∆Psupp.
- Step 5: Press “settings” to scroll to screen 2
- Step 6: Set the NIV to “ON” to allow for a large leak‡. On the Oxylog 3000 plus device screen 2 has a Tapn option. This should be left as “off”.
- Step 7: Press “settings” to scroll to screen 3
- Step 8: The last settings screen refers to screen brightness (reducing this can save significant battery power). All other setting options should be left unaltered.

*Note that 1mBar ≈ 1cm H2O
‡Note that when NIV is selected, the Oxylog 3000 will not deliver breaths if the patient becomes apnoeic.

Table 1: Typical initial ventilator settings for Bi-level pressure support in a patient with Acute Hypercapnic Respiratory Failure due to COPD:

<table>
<thead>
<tr>
<th>Function</th>
<th>Setting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mode</td>
<td>Spontaneous (CPAP ASB on Oxylog 3000)</td>
</tr>
<tr>
<td>EPAP (CPAP) (PEEP on Oxylog 3000)</td>
<td>4-5 cm H2O (≈5mBar on Oxylog 3000)</td>
</tr>
<tr>
<td>IPAP (pressure support)</td>
<td>12-15 cm H2O († to max tolerated to 20cm H2O)</td>
</tr>
</tbody>
</table>

† Note that when NIV is selected, the Oxylog 3000 will not deliver breaths if the patient becomes apnoeic.
Determination of treatment failure

a) Deterioration in patient’s clinical condition
b) Failure to improve ABGs
c) Development of new/worsening symptoms – eg pneumothorax
d) Intolerance of NIV
e) Failure of symptom control
f) Deteriorating level of consciousness
g) Patient/carer wish to withdraw treatment

Possible other interventions/adjustments if NIV failure:

A)

If PaO2 remains low, Consider:

↑ in FiO2

↑ in PEEP

B)

If PaCO2 remains high, Consider:

FiO2 adjustment to maintain SpO2 89-92% (or patient’s normal)
Ensure good mask fit – if on nasal change to face mask
Check triggers and consider ↑ PEEP
Ensure no re-breathing – check exp valve and consider ↑ PEEP
Check connections to ensure no air leaks

References