Non-Invasive ventilation in acute medical care

What is Non-invasive ventilation?

Non invasive ventilation (NIV) is the provision of ventilator support through the patients upper air way using a mask or a similar device
Non invasive interface: nasal mask, face mask, or nasal plugs (rather than an invasive interface - endotracheal tube/ tracheostomy)

Selecting patients for NIV requires careful consideration of it's indications and contraindications.

This supports breathing by delivering positive pressure to the lungs.
The patient remains awake and can talk, eat, and cough (to some extent).

Types of NIV Indications

NIV/NIPPV

Acute Hypercapnic respiratory failure secondary to

- COPD
- Chest wall disease
- Neuromuscular disease
- Obstructive sleep apnoea
- Obesity Hypoventilation syndrome (OHS)

CPAP

Acute Hypoxemic respiratory failure secondary to

- Pulmonary Oedema
- Pneumonia (Mild to Moderate)
- Obstructive sleep apnoea
- Obesity Hypoventilation syndrome (OHS)

HFNO

Acute Hypoxemic respiratory failure secondary to

- Pneumonia (Mild to Moderate)

Contraindications

Absolute

- Cardiorespiratory arrest
- Need of emergency intubation
- Unable to maintain airway <GCS 7
- Uncooperative/extremely anxious patient
- Facial trauma or burns
- Patients with tracheostomy
- Undrained pneumothorax
- Recent facial, oesophageal or gastric surgery
- Severe Persistent vomiting'
- Bowel obstruction
- Toxic inhalation

Relative

- Hypotension
- Copious amount of respiratory secretions
- Inability to obey commands
- Recent ENT surgery
- Laryngeal trauma or recent tracheal anastomosis
- Epistaxis
- DNACPR in place

COPD
pH <7.35
pCO2> 6.5kPa (48.75mmhg)
RR >23
If persisting after optimizing initial medical therapy

NMD
pH< 7.35
pCO2 > 6.5kPa (48.75mmhg)
Respiratory illness with RR >20 and VC<1L

OHS
pH<7.35
pCO2 >6.5kPa (48.75mmhg)
RR >23 or Daytime pCO2 >6kPa and somnolent

Rule out absolute and relative contraindications.
ICU care is indicated in case of Cardiorespiratory arrest, failing NIV etc.

Initial Set up

Mask: Full face mask
Initial pressure settings
EPAP: 3cmH_2O(or high in OSA)
IPAP: 15cmH_2O (Ramp up IPAP over 10-30 min, upto 20-30, to achieve adequate augmentation of chest wall and slow RR)
(Do not exceed IPAP>30 and/or EPAP>8 without expert review)
Back up rate: 16-20
Inspiratory time: 0.8 to 1.2s in COPD and 1.2-1.5 sec in OHS, NM and CWD
I:E ratio: COPD 1:2 to 1:3, OHS/CWD 1:1

Use NIV for a maximum duration during the first 24 hours and plan to wean off after 48-72hrs according to the clinical improvement

ABG in 1 hour or sooner if any concerns

Red flags

pH< 7.25 on optimal NIV
Persistent high RR>25
New onset confusion or deterioration

Actions

Check patient asynchrony, mask fit etc.
Bronchodilators, Nebulization, Anxiolytics, Chest physiothrapy
Consider IMV

ABG Interpretation of patient on NIV/NIPPV

(1kPa=7.5mmhg) and Weaning off

pH/$PaCO_2$ improving
PaO_2 >52.5mmhg

Continue current settings
aim SpO_2 88-92% with controlled oxygen

Repeat ABG in 4 hours

pH/$PaCO_2$improving
PaO_2 <52.5mmhg

Increase FiO_2 or increase EPAP to max 8
(With a similar increase in IPAP to maintain tidal volume SpO_2 88-92%

pH/$PaCO_2$ not improving
PaO_2 >52.5mmhg

Increase IPAP as needed, by 2 every 5 mins
upto max 20cmH_2O
and aim sats 88-92% with controlled oxygen

pH/$PaCO_2$ not improving
PaO_2 <52.5mmhg

Increase IPAP as needed, by 2 every 5 mins
upto max 20cmH_2O
Increase EPAP/FiO_2
aim sats 88-92% with controlled oxygen

Repeat ABG in 1 hour or sooner if concerns

Consider NIV weaning once clinically stable for >24 hours

ACUTE PHASE: Respiratory distress and/or acute respiratory acidosis

Maximize NIV use with 3 cycles/day (morning, afternoon and night)

Resolution of respiratory distress and/or respiratory acidosis

Start NIV weaning with interruption of morning cycle

Recurrence of respiratory distress and/or respiratory acidosis

No

Continue weaning with suspension of afternoon cycle, and, for last, night cycle

Yes

Stop weaning, consider to re-increase NIV cycles

Continuous positive airway pressure

Initiation and weaning off process of CPAP

CPAP
Usual starting pressure: 5-8 cmH_2O

Signs of improvement
Stable breathing patterns,
Adequate oxygen saturation (SpO_2 >94%)
Minimal work of breathing (RR 12-16)

Weaning protocols
Pressure reduction
Cycling on and off

Weaning-Pressure reduction method

on CPAP:6, FiO_2 <30% and stable >12hrs

↓

Decrease CPAP by 1cmH_2O every 12 hrs
until CPAP 4cmH_2O for 24 hrs

↓

if Stable parameters
Stop CPAP and start nasal oxygen

↓ ↑

if deteriorates,
Escalate to previous step

High Flow Nasal Oxygen

HFNO indicated
Start at 30LPM and
FiO_2 100%

HFNO
Starting settings
FiO_2: 21%- 100%
Gas flow: 40-60L/min

SpO_2 at goal?
(Eg: 94%)

No

Increase flow rate
5-10 LPM max to
60LPM

SpO_2 at goal?
(Eg: 94%)

No

Consider IMV

Yes

Decrease flow in
increment of 5-
10LPM to 30LPM

Yes

Decrease FiO_2 in
increment of 5-10%
to 50%

SpO_2 at goal?
(Eg: 94%)

No

Return to prior FiO_2
and reassess

Yes

Decrease flow in
increment of 5-
10LPM to 10LPM

SpO_2 at goal?
(Eg: 94%)

No

Return to prior FiO_2
and reassess

Yes

Decrease flow in
increment of 5-
10LPM to 10LPM

SpO_2 at goal on 50%
and 10LPM?
(Eg: 94%)

No

Return to prior FiO_2
and reassess

Yes

Continue standard
NC oxygen therapy
and wean off

Abbreviations

NIV- Non Invasive Ventilation
NIPPV- Non Invasive Positive Pressure Ventilation
CPAP- Continuous Positive Airway Pressure
HFNO- High Flow Nasal Oxygen
OHS- Obesity Hypoventilation Syndrome
COPD- Chronic Obstructive Pulmonary Disease
NMD- Neuromuscular Disease
VC- Vital Capacity
CWD- Chest Wall Diseases
IPAP- Inspiratory Positive Airway Pressure
EPAP- Expiratory Positive Airway Pressure
LPM- Litres Per Minute
NC- Nasal Cannula
IMV- Invasive Mechanical Ventilation
RR- Respiratory Rate

Sri Lanka College of Internal Medicine