PAKISTAN CHEST SOCIETY
STRIVING FOR PULMONARY CARE

Clinical Practice Guidelines

NON- INVASIVE VENTILATION

Pakistan Chest Society-2020

GUIDELINES ON

NON- INVASIVE VENTILATION

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PAKISTAN CHEST SOCIETY

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Message By The President Pakistan Chest Society (PCS)

Non-invasive ventilation (NIV) has revolutionized the management of respiratory failure in this century. It is simple to use and highly effective. It is used in acute care setting as well in the wards with excellent result. It is effective primarily as a mean of avoiding the need for endotracheal intubation, resulting in decrease hospital stay and financial cost. It is being used in different conditions and excellent results have been reported in acute exacerbation of COPOD. Beside it is also used in Hypoxemic respiratory failure, pneumonia, pulmonary edema etc.

PCS is fortunate to have dedicated members who always try to help the society in achieving the targets set for the promotion of health. I would like to congratulate the Dr. Irfan Malik and his dedicated team for their hard work without which it was not possible to bring this guideline into your hands. This guideline is covering every aspect required in the management of patient in need of NIV, including basics, indications, method of application, types, complications etc. This guideline is definitely an addition for the use of pulmonologists, physicians, PGs working in pulmonology and medical units.

PROFESSOR NISAR AHMED RAO

President Pakistan Chest Society

Message By The Chairman Guidelines Committee, Pakistan Chest Society (PCS)

It is a matter of great pleasure, pride and satisfaction that the first clinical practice guideline on **Non-Invasive Ventilation** has been published by PCS**.** Governing Council of PCS has mandated the Guideline committee to develop evidence based guidelines for important pulmonary diseases. Besides this document, guidelines on Asthma, Sleep apnea, Preoperative Pulmonary Risk Assessment, COPD and guideline on smoking Cessation have already been developed and will distributed during the 14th Biennial Chest Con 2020 in Karachi. It is very encouraging to note that PCS has been consistently working on developing and updating guidelines. These guidelines provide a highly valuable resource for the trainees and practicing physicians.

Non-invasive ventilation (NIV) refers to the provision of ventilatory support through the patient's upper airway using a mask or similar device. NIV has been shown to be an effective treatment for acute hypercapnic respiratory failure, particularly in chronic obstructive pulmonary disease. This has also effective in patients with chronic hypercapnic respiratory failure caused by chest wall deformity, neuromuscular disease, or impaired central respiratory drive. NIV can also use with cautions in various types of acute hypoxemic respiratory failure as well. This guideline provides a highly valuable resource for the trainees and practicing physicians involve in management of respiratory failure using NIV.

Finally, I would like to acknowledge the hard work of Dr. Irfan Malik and other members of the working group who has prepared this very informative document and the members of PCS guideline committee for reviewing the document. PCS remain committed to always endeavor for the achievement of the best possible clinical practice.

Prof. Muhammad Irfan

Chairman Guidelines Committee, PCS

Preface

First of all, I must thank Allah Almighty for showering His countless blessings upon me to accomplish the task of compiling the first PCS guidelines on Non- Invasive Ventilation.

Noninvasive mechanical ventilation (NIV) is widely used in the acute care setting for acute respiratory failure (ARF) across a variety of etiologies. This document provides recommendations for the clinical application of NIV based on the most current literature.

Noninvasive ventilation (NIV) refers to the administration of ventilatory support without using an invasive artificial airway (endotracheal tube or tracheostomy tube). The use of NIV has markedly increased over the past two decades, and it has now become an integral tool in the management of both acute and chronic respiratory failure, in home setting as well as in hospital set ups.

I want to pay my special thanks and gratitude to my team members for their technical input to complete this document. This document covers all major aspects of NIV including its modes, indications, contraindications, complications and its trouble-shooting.

This document summarizes the current state of knowledge regarding the role of NIV in respiratory failure. Evidence based recommendations provide guidance to relevant stakeholders.

I am very thankful to my mentors and teachers for their encouragement and boosting my confidence in describing this neglected era of pulmonary medicine. I must also pay my full regard to all my patients without whom it was impossible for me to solidify my knowledge on NIV.I hope this guideline will be very beneficial for the readers and it will provide them a clear track how to use this document for better outcome of their patients in ward and in ICU set ups.

Dr. Muhammad Irfan Malik

INTRODUCTION

Overview:

- The concept of applying ventilator support non-invasively had always been attractive because of relative simplicity and it spares intubation. Use of non-invasive ventilation is markedly increased over the past two decades and now has become integral tool in management of acute and chronic respiratory failure in both home setting and ICU.

Definition:

- Non-invasive ventilation (NIV) means administration of ventilatory support through non-invasive interface (nasal mask, facemask, or nasal plugs) rather than invasive interface (endotracheal tube, tracheostomy).
- It is the best short term therapy to buy time for medical therapy and to treat rapidly reversible cause of respiratory failure.

Mechanism:

Non-invasive ventilation improves respiratory mechanics in patients with respiratory failure by following mechanisms:

1. Improve Oxygenation
    - Decrease atelectasis (open alveoli)
    - Improve functional residual capacity (FRC)
2. Improve Ventilation / Respiratory Acidosis
    - Improve compliance
    - Increase tidal volume
3. Decrease Work of Breathing
    - Unload respiratory muscles
    - Improve dyspnea

Advantages of NIV over Invasive Positive Pressure Ventilation (IPPV):

- Avoid trauma secondary to endotracheal tube
- Avoid need of sedation
- Allow for intermittent eating/drinking
- Reduce risk of ventilator associated pneumonia

- Oral patency (preserve speech, swallowing and cough)
- Reduce cost and length of stay

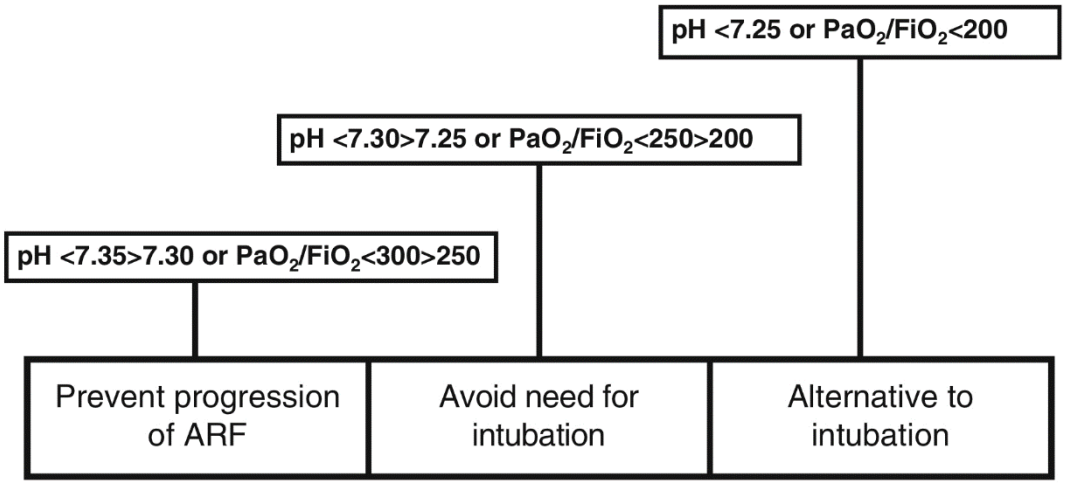
Disadvantages of NIV:

NIV is generally safe. Complications related to positive pressure ventilation (e.g barotrauma, hemodynamic instability) tend to be less common during NIV than invasive positive pressure ventilation. Most complications due to NIV are local and related to the tightly fitting mask:

- Systemic
    - Slower correction of gas exchange abnormalities
    - Gastric distention (occur in 2%)
    - Lack of airway access and protection
    - Unable to suction the bronchial tree
    - Aspiration
- Mask
    - Claustrophobia
    - Facial pressure sores
    - Eye irritation
    - Considerable medical and nursing expertise required

Patient Selection:
Selecting patients for NIV requires careful consideration of its indications and contraindications, which are discussed in this section.

Indications — a trial of NIV is worthwhile in most patients who do not require emergent intubation and have a disease known to respond to NIV, assuming that they lack contraindications.



Timing of application

PRINCIPLES OF NON-INVASIVE VENTILATION

- **Indications and contraindications of NIV:**

RECOMMENDATION

We recommend using NIV if it is clearly indicated otherwise the presence of adverse features increase the risk of NIV failure and should prompt the consideration of placement in intensive care unit.

Indications for Continuous Positive airway pressure (CPAP):

Acute Hypoxemic Respiratory failure secondary to:

- Cardiogenic pulmonary edema
- Obstructive sleep apnea (OSA)
- Chest wall trauma
- Pneumonia
- ARDS
- Post-surgical

Indications for Bi-level Positive Airway Pressure (BiPAP):

Acute hypercapnic respiratory failure secondary to

- COPD
- Chest wall deformity
- Neuromuscular disorder
- Postoperative and post-transplant Respiratory failure
- To wean off Patient from invasive Ventilation
- Immunocompromised Patient
- Ceiling the treatment of patient undergoing Invasive ventilation

INDICATION OF NIV IN SPECIFIC CONDITIONS

- **Role of NIV in Acute Exacerbation of COPD (AECOPD)**

Recommendation:

For all patients who are admitted with AECOPD, the initial management should be optimal medical therapy, targeting the oxygen saturation of 88-92%

NIV is indicated in COPD patient if ABGs and clinical assessment show following parameters: PH < 7.35, PCO_2 > 49 mmHg, RR > 23, despite optimal medical therapy and controlled oxygen.

- **Role of NIV in Neuromuscular disorder**

Recommendation:

NIV is indicated if a patient with neuromuscular disorder has the following parameters: respiratory illness with RR>20, VC <1L, PCO_2 < 49 mmHg or PH< 7.35, PCO_2 >49 mmHg.

In neuromuscular disorder, hypoventilation is an important cause of respiratory failure and death. NIV Improve morbidity and mortality is such patient.

- **Role of NIV in Obesity Hypoventilation Syndrome**

Recommendation:

NIV is indicated in obesity hypoventilation syndrome (OHS) with the following parameters: PH < 7.35, PCO2 > 49mmHg, RR >23, Day time PCO2 > 49mmHg, somnolent.

- **Role of NIV in Asthma/Pneumonia**

Recommendation:

Non-invasive ventilation should not be used in patients with acute asthma exacerbations.

In such patients, refer to ICU for consideration of Invasive Mechanical Ventilation(IMV) if patient develops respiratory distress, pH < 7.35 and pCO2 > 49 mmHg.

- **Role of NIV in Non-CF bronchiectasis**

Recommendation:

In patients with non-CF bronchiectasis, NIV should be started in acute hypoxemic respiratory failure (AHRF) using the same criteria as in AECOPD.

- **Role of NIV in Cystic Fibrosis (CF)**

Recommendation:

In patients with CF, NIV is the treatment of choice when ventilator support is needed.

Chest physiotherapy is needed to aid sputum clearance in these patients simultaneously.

- **Role of NIV in ICU**

Recommendation

NIV is recommended to aid weaning from IMV in patients with AHRF secondary to COPD especially.

- **NIV in high-risk patients**

Recommendation

Prophylactic use of NIV should be considered to provide post-extubation support in patients with identified risk factors for extubation failure.

CONTRAINDICATIONS OF NIV:

Absolute contraindication

- Cardiac arrest
- Respiratory arrest
- Coma
- Severe facial deformity
- Facial burns
- Fixed upper airway obstruction

Relative Contraindication

- PH < 7.15 (pH<7.25)
- GCS < 8
- Confusion/ agitation
- Severe upper GI bleed
- Encephalopathy
- Inability to cooperate / protect air way
- Bowel obstruction
- Status epilepticus

TYPES OF NONINVASIVE VENTILATION:

NIV can be delivered using the same modes that are used for invasive mechanical ventilation, although certain modes are used

- **CPAP** (Continuous Positive airway pressure)
- **BiPAP** (Bi-level Positive Airway Pressure)

INTERFACE

Recommendation

We recommend appropriate training of staff involved in delivering NIV as a range of masks and sizes are available and to choose the mask for the patients best fit in.

Patient ventilator interfaces play a very important role in improving compliance of patient. 10-15% patient fail to tolerate NPPV due to mask interface. Poor mask fit may lead to asynchrony between patient and NIV as inspiratory effort may fail to be detected. Over tightening of head gear may lead to ulceration and poor compliance

Most commonly used mask is nasal, oro-nasal and full facemask

SUPPLEMENTAL OXYGEN THERAPY WITH NIV

Recommendation

Supplemental oxygen should be adjusted to achieve oxygen saturation of 88-92% in all causes of acute hypercapnic and hypoxic respiratory failure treated by NIV.

HUMIDIFICATION WITH NIV

Recommendation

Humidification is not routinely required. It should be considered if the patient reports mucosal dryness or if respiratory secretions are thick and tenacious.

BRONCHODILATOR THERAPY WITH NIV

Recommendation

Nebulized drugs should normally be administered during breaks from NIV. For patients requiring continuous BiPAP, nebulizer should be administered via high flow oxygen.

SEDATION WITH NIV

Recommendation

Sedation should only be used with close monitoring in an ICU setting for agitated or distressed patients.

DURATION OF NIV

Recommendation

NIV should be maximally used in the first 24 hours depending upon the patient tolerance by keeping a check on complications.

NIV use during the day can be tapered in the following 2-3 days depending upon the PCO2 level before being discontinued overnight.

COMPLICATIONS OF NIV

Recommendation

We recommend that the patients should be frequently assessed to identify potential complications of NIV.

Minor complications are common but serious complications can occur. Some of the complications are:

- Hypoxia
- Pulmonary barotrauma
- Reduce cardiac output
- Vomiting and aspiration
- Pressure area
- Gastric distention

CARE PLANNING AND DELIVERY OF CARE

Recommedation

NIV services should be operated under a single clinical lead having working links with ICU

NIV should be arranged in a clinical environment with enhanced nursing and monitoring facilities that are beyond those of a general medical ward

Ideally a 2-4 bedded designated NIV unit, located within a medical high dependency area or within a respiratory ward with enhanced staffing levels, should be arranged

Areas providing NIV should have a process for audit and interdisciplinary communication.

MOUTHPIECES

Advantages	Disadvantages
• Useful in "rotating" strategy	• Vomiting and hypersalivation • Losses • Gastric distension • Talking is difficult

NASAL CUSHIONS

Advantages	Disadvantages
• Useful in "rotating" strategy • No nasal abrasions	• V_T cannot be monitored • Losses • Nasal irritation

NASAL MASKS

Advantages	Disadvantages
• Talking possible • Eating possible • Expectoration possible • Limited risk of vomiting • Minimal risk of asphyxia	• Losses if mouth open • Nasal abrasions • Not possible with nasal obstruction

FACE MASKS

Advantages	Disadvantages
• Reduced losses • Does not require much collaboration • Can be positioned according to patient's comfort	• Vomiting • Claustrophobia • Nasal abrasions (not with "total") • Talking and coughing are difficult

HELMETS

Advantages	Disadvantages
• Minimal losses • Does not require much collaboration • No skin abrasions	• Rebreathing possible • Vomiting • Noisy • Asynchrony with patient • Axillary discomfort

Pros and cons of the various interfaces

MODES OF VENTILATION:

MODE is most important setting In NIV which is related to the outcome of patient suffering from respiratory failure. Wrong MODE may lead to poor compliance and aggravating respiratory failure. Following are the MODES used:

A. Spontaneous (S)

B. Spontaneous/Time Mode (S/T)

C. Time Mode (T)

D. Pressure control Mode (PC)

E. Average Volume Assured Pressure Support(AVAPS) AE

Spontaneous Mode (S)

Therapy mode in which all breaths are spontaneous

Spontaneous/Timed Mode(S/T)

Therapy mode that is similar to S mode, but can also deliver mandatory breaths

Timed Mode (T)

Times pressure support therapy mode with all mandatory delivered breaths

Pressure Control Mode (PC)

Delivers assisted and mandatory breaths at a user-defined pressure.

Average Volume Assured Pressure Support (AVAPS)

- AVAPS automatically increase Pressure Support (PS) to maintain the target Tidal Volume (Vt).
- The IPAP level will not rise above IPAP Max; even if the target Vt is not reached.
- Conversely, as the patient effort increase, AVAPS will reduce PS, IPAP will not fall below IPAP Min; even if the target Vt is exceeded.
- AVAPS automatically adapts pressure support to patient needs to guarantee an average tidal volume.

Summary of Bi-level Modes & Breath Types

Mode	Breath Type	Ventilator Triggered Breath	Patient Triggered breath	Breath Target
CPAP	None	None	None	None
S	Spontaneous	None	Patient Triggered	Pressure (Bi-level)
S/T	Either Patient or Machine	Machine Triggered	Patient Triggered	Pressure (Bi-level)
T	Time	Controlled	None	Pressure (Bi-level)
PC	Either Patient or Machine	Controlled	Assisted	Pressure (Bi-level)

MONITORING:

Recommendation:

Monitoring should include continuous pulse oximetry and hourly respiratory rate, non-invasive blood pressure and assessment of consciousness level.

We recommend continuous monitoring of oxygen saturation and intermittent monitoring of PH and PCO2.

We recommend ECG monitoring if the patient has a pulse rate > 120 bpm.

Monitoring after applying NIV is very important and should be primarily on clinical assessment. In patients suffering from AHRF with sever acidosis (PH less than 7.20) may need clinical assessment after every 15 min.

- **Clinical evaluation**
    - Assessment of patient comfort
    - Conscious level
    - Chest wall motion
    - Accessory muscle recruitment
    - Coordination
    - Respiratory and heart rate
- **Laboratory evaluation**

ABGs: Arterial blood gases should be checked routinely at 1, 4 and 12 hours after the initiation of BIPAP or more often if clinically indicated.

ECG: Important to see ongoing or old ischemic change

Electrolytes: Drowsiness and failure can be due to hyponatremia and hypokalemia. So it is important to send electrolytes like Sodium, Potassium, Magnesium, Calcium.

TARGET:

We have to reduce our target in patients with AHRF. As with time and improvement in primary disease the target itself starts improving. The initial target should be:

- PaO2 60 mmHg
- Saturation 85%-90%
- PH normal

TYPICAL INITIAL SETTING

Recommendation

If BiPAP is indicated, the patient should be referred to critical care physician by the A&E or medical unit

The critical care physician should decide, with other teams involved, if a patient is a suitable candidate for BiPAP in the ward according to the criteria above.

The critical care consultant must be involved if there is any doubt whether ward BiPAP is appropriate for any particular patient.

Initial documentation should include prescription for BiPAP and a management plan in the event of treatment failure (intubation or palliative management).

- MODE Spontaneous
- EPAP 4-5cm H2O
- IPAP 12-15cm H2O(to be increased as tolerated up to 30 cm H2O)

TROUBLE-SHOOTING OF NIV:

Recommendation:

We recommend that always check common technical issues have been addressed and ventilator settings are optimal, before considering NIV to have failed.

The BiPAP should be applied and started by trained ward nursing staff. If help is needed on commencing or during the therapy, critical care nurse in charge will be asked to provide *technical* problem solving.

During the first 12 hours of BiPAP in the ward, every two patients receiving BiPAP should be looked after by 1 nurse.

Non-invasive ventilation (NIV) has become an important part of support in patients with acute and chronic respiratory failure. Although NIV is well tolerated by most patients, it is not entirely free from serious adverse side-effects and complications. The most common side effects and troubleshooting problems with Non-invasive positive pressure ventilation are discussed as following:

1. **Mask intolerance:**

Mask discomfort is the most commonly encountered problem for patients adapting to NIV amounting to up to as many as 30–50% of patients, and is responsible for 12– 33% of NIV failure.

Remedies:

It should be ensured that mask fit is optimal and that minimal strap tension is used to control air leaking.

Different types of interfaces can be applied to encourage tolerability like nasal masks, oronasal masks, total face masks, nasal pillows, mouth piece and helmets.

Patients who require long term NIV use should be encouraged for gradual adaptation for weeks or months before giving up; which can include wearing the mask for brief, but progressively longer periods while watching TV or participating in another distracting activity.

2. **Claustrophobia**

Claustrophobia may present as minor discomfort to a frightening sense of inability to breath and suffocation. Claustrophobia not only causes difficulty to initiate, but also to continue NIV with a variable incidence that ranges from 5% to 20%.

Remedies:

Nasal masks are less likely to cause claustrophobia than face masks.

Using manual mask application (i.e. placing the interface gently over face, holding it in place and starting ventilation; and then tighten straps) also helps.

Patient should be reassured; mild sedation can also be used for better compliance.

3. **Nasal congestion or dryness:**

During NIV, nasal or oral dryness affects 10–20% of patients and nasal congestion 20–50% of patients, particularly when a nasal mask or nasal CPAP is used.

Remedies:

In-line heated humidification and heated tubing has become standard and has reduced the nasal dryness problem. The main types of humidification devices used, heated humidifiers and HMEs, are used for both short-term and long-term humidification during NIV.

Dryness may also respond to nasal saline and water based nasal gels.

Nasal congestion may be ameliorated by use of inhaled nasal glucocorticoids or antihistamine decongestant combinations.

Decreasing ventilator pressures slightly also helps in reducing nasal dryness and congestion.

4. **Secretion clearance:**

Patients with neuromuscular or chest wall disease, or ventilatory pump failure for any reason, can develop severe hypercapnia, difficulty clearing airway secretions with ventilation-perfusion mismatching, and ultimately acute on chronic respiratory failure.

Remedies:

There are both manual and mechanical methods to increase cough flows. The most effective method for generating effective cough flows for clearing airway debris is the use of mechanical insufflation-exsufflation (MIE). This can be used in combination with the manual thrusts of manually-assisted coughing. The goal is to fully inflate then fully empty the lungs in four to six seconds to clear airway debris while avoiding both hypo- and hyperventilation.

5. **Nasal bridge redness or ulceration**

Nasal skin lesions (i.e. erythema, ulcers) at the site of mask contact increase with longer NIV durations and can be a major factor that can limit the tolerance and duration of mask NIV.

Remedies:

Decrease strap tension, using foam rubber "spacers," silicone inserts or applying artificial skin (eg, Duoderm, Restore), or switching to alternative masks such as the foam inner seal, "bubble" mask or nasal "pillows."

Switch to oral nasal masks that fit under the nose and do not rest on the bridge of the nose.

Low potency corticosteroid creams, oral doxycycline or clindamycin lotion may be helpful to treat acneiform lesions.

Soft cloth liners that fit between the mask and the skin are also helpful.

6. **Gastric insufflation**

Aerophagia occurs in most NIV patients and gastric insufflation in 5% to 30–40% of patients. When gastric insufflation occurs during NIV, gastric distension compresses the lungs, thereby decreasing lung compliance and demanding higher airway ventilation pressure.

Remedies:

Inspiratory airway pressures higher than 20–25 cm H2O should be avoided.

High pressure NIV should also be carried out in an almost sitting position approximately half an hour after a meal and with routine gastric decompression care.

7. **Air leak**

Air leakage through the mouth is universal among users of nasal noninvasive positive pressure ventilation (NPPV) and patients can be successfully ventilated despite small air leaks. Large air leaks decrease the FIO2 and arterial oxygen saturation, and increase ventilator autotriggering, patient ventilator dyssynchrony, and rebreathing of exhaled gas, all of which increase chances of NIV failure.

Remedies:

Air leaks are negligible when a proper device for NIV is chosen and fitted.

Choosing an oral-nasal mask that seals under the chin may improve mask stability and reduce leakage.

A tighter fitting of the interface may alone improve leaks and ventilation but should be done cautiously due to skin discomfort.

Pressure-controlled ventilation causes less air leaks than volume-controlled ventilation.

A reduction in inspiratory pressure or tidal volume may also reduce air leaks.

Chin straps may also be applied.

8. **Failure to improve gas exchange and carbon dioxide rebreathing**

Failure to improve gas exchange after initiating NIV can be due to insufficient hours of use, unintentional air leak during inspiration, residual obstructive respiratory events, asynchrony, and insufficient support of minute ventilation.

Remedies:

Improvement may be accomplished by upward adjustments in inspiratory pressure or tidal volume, ventilator rate, duration of ventilator use, or a combination of these changes may be helpful.

Adjustment of the trigger sensitivity or upward adjustment of backup rate may be helpful if there is evidence of inability to trigger the ventilator.

Carbon dioxide (CO2) rebreathing may impair CO2 elimination and load the ventilatory muscles further. Lowering respiratory rate, increasing expiratory time, use of expiratory positive airway pressure (EPAP) greater than 4 cm H_2O, switching to a nonrebreather valve, or use of masks with in-mask exhalation ports may help.

Follow-up nocturnal monitoring in the sleep lab or at home is the optimal way in which to evaluate problems with NPPV.

FACTORS ASSOCIATED WITH SUCCESS OR FAILURE:

RECOMMENDATION:

We recommend changing the management strategy if there is worsening of physiological parameters, particularly PH and respiratory rate. This may include clinical review, change of interface, adjustment of ventilator settings and considering proceeding to endotracheal intubation.

The medical physician should inform critical care physician to consider patient transfer to critical care if patient shows signs of deterioration.

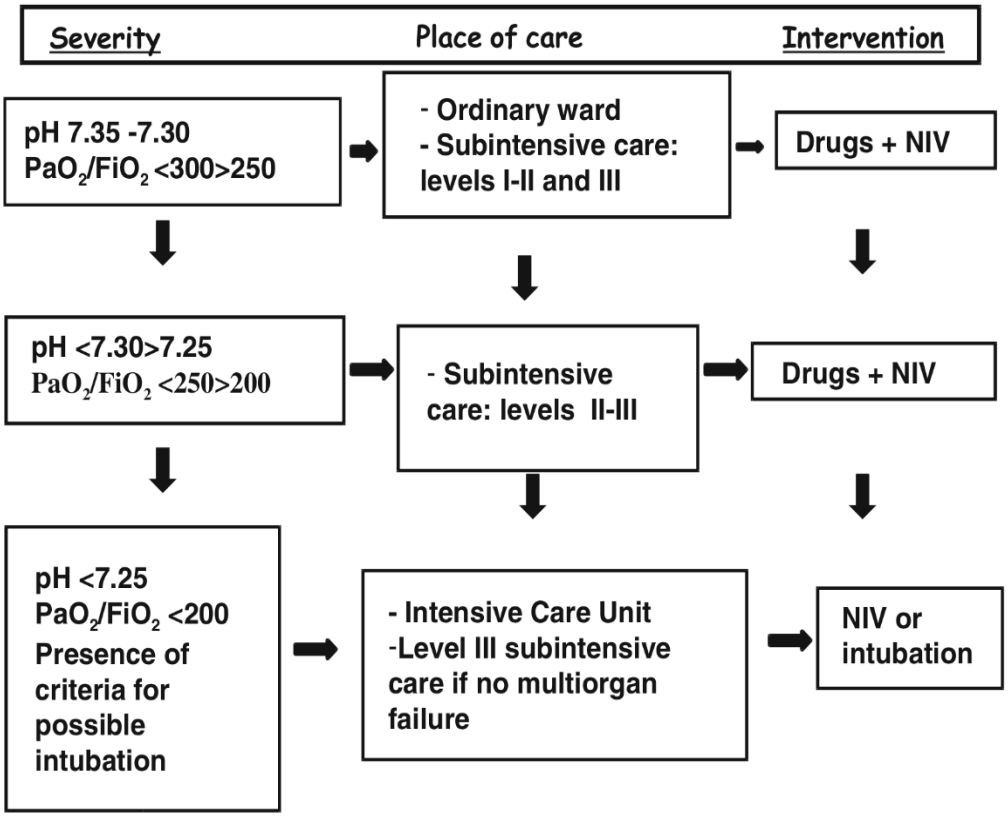
- **Success – indicators:**
    - High PaCO2 with low A-a gradient PH 7.25-7.35
    - Improvement in PH, PaCO2, and respiratory rate after 1hr of NIV
    - Good Level of consciousness
- **Failure – indicators:**
    - Severe Pneumonia
    - Copious secretion
    - Low BMI
    - Confusion or impaired consciousness
    - High severity score at commencement of NIV (SAPS II >30, APACHE II >20)
    - Minimal or no reduction in PH after 1- 2 hours
- **When to shift to ICU:**
    - Worsening ABGs after one hour of initiation of BiPAP therapy
    - No improvement of ABGs after 4-12 hours of initiation of BiPAP
    - Worsening of ABGs or clinical deterioration of patient at any time while on BiPAP
    - Respiratory rate > 35/min
    - Uncontrolled arrhythmias
    - Signs of heart failure
    - Patient requiring sedation and nursing management becomes difficult

INDICATIONS FOR DOMICILIARY NIV:

- Failure to wean from ventilator
- Acute hypercapnic respiratory failure secondary to
    - Spinal cord lesion

    - Chest wall deformity(scoliosis, thracoplasty)
    - Morbid obesity(BMI)
- COPD with
    - Recurrent AHRF(>3 episodes) requiring NIV
    - Intolerant to supplementary oxygen

GUIDANCE FOR USING WARD BASED NIV & PATIENT DOCUMENTATION



Flow-chart of the use of NIV in hospital

Protocol for initiation of noninvasive positive pressure ventilation:

1. Appropriately monitored location, oximetry, respiratory impedance, vital signs as clinically indicated
2. Patient in bed or chair at >30-degree angle
3. Select and fit interface
4. Select ventilator mode
5. Apply headgear; avoid excessive strap tension (one or two fingers under strap)
6. Connect interface to ventilator tubing and turn on ventilator
7. Start with low pressure in spontaneously triggered mode: 12 to 15 cm H2O inspiratory pressure; 4 to 5 cm H2O expiratory pressure
8. Gradually increase inspiratory pressure (10 to 30 cm H2O) as tolerated to achieve alleviation of dyspnea, decreased respiratory rate, increased tidal volume (if being monitored), and good patient–ventilator synchrony
9. Provide O2 supplementation as needed to keep O2 saturation >90 percent
10. Check for air leaks, readjust straps as needed
11. Add humidifier as indicated
12. Can consider mild sedation only in ICU set up.
13. Encouragement, reassurance, and frequent checks and adjustments as needed
14. Monitor occasional blood gases (within 1 to 2 hours) and then as needed

WEANING STRATEGY:

RECOMMENDATION

NIV can be discontinued when there has been normalization of PH and PCO2 and a general improvement in the patient's condition.

- Weaning criteria
    - pH > 7.35
    - SpO2 88-92%
    - Respiratory Rate <30
    - Goal tidal volume achieved (aprox. 6-8 mls/kg achieved)
    - Patient clinically stable for more than 6 hours
    - Patient tolerating short periods off NIV for eating / drinking etc.
- Protocols
    - Reduce oxygen gradually until <4 litres / min is reached
    - Reduce EPAP gradually by 1 cm of H2O
    - Reduce IPAP gradually by 1 cm of H2O
    - Gradually increase period of time spent off NIV
- Monitoring
    - Vital monitoring
    - ABGs sampling as required
    - Saline nebulizers while on NIV
- Discontinue NIV
    - When the weaning criteria is maintained

Patient's Pathway

Pathway point	Aim	Recommendations
In A&E or medical ward: First seen by A&E or medical team Review by Medical and Critical Care team	To confirm diagnosis of exacerbation of COPD and recognition of patients suitable for ward NIV Appropriateness for escalation of treatment has been discussed (such as CPR, inotropes or intubation) or BiPAP as a ceiling of active treatment. Initial medical management for at least one hour Assess response to medical treatment and patient's tolerance to NIV	Baseline blood gases. Start medical treatment for one hour then repeat blood gases. Apply NIV if indicated and assess patient's tolerance to the mask. Prescribing NIV in patient's notes Prescription of patient's regular medications and medications for treatment of COPD as appropriate.
In AMU: Under care of AMU or respiratory ward medical and nursing staff Respiratory team may be involved in selected cases in AMU	24 hours of NIV at maximal pressure (20/5) with minimal interruption. Wean NIV over subsequent 48 hours Patient may need referral to respiratory physician if not already in AMU (e.g. patients difficult to wean off NIV)	ABG at 1, 4 and 12 hours of NIV. Repeat ABG at any time if significant clinical changes such as increasing narcosis
Critical Care input to patents on ward NIV: Regular medical input to patients on NIV in the ward in the first 4 hours Nursing support from critical care nursing staff for problem solving and technical issues with the equipment. Receive requests for review of patients on NIV throughout their stay in the ward	To provide support to AMU nursing and medical staff To assess patients regarding the need for transfer to critical care (patients who are not responding to NIV, needing sedation, or developing other organ failure, etc.)	Critical care team (outreach if available) to review ABG at 1 and 4 hours from initiation of BIPAP. Medical team to discuss difficult patients or patients who are not responding to NIV with a critical care registrar if the patient is candidate for escalation of treatment (for transfer to critical care intubation, etc.)

NIV Prescription Chart & Checklist

Must be completed by medical staff from parent team prior to commencement of NIV therapy

Patient details / label:
Name:

Age:

Department:

Does the patient have capacity to provide consent for this procedure / treatment? (Refer to Mental capacity Act 2005 and Codes of Practice) • If **YES**, the patient should provide consent. • If **NO**, the patient should be treated according to 'best interests'.	YES	NO
• If the patient has capacity to consent, has consent been provided? • If **NO**, treatment with NIV should not be provided.	YES	NO
IMPORTANT: To ensure optimum and appropriate treatment with NIV, all of the responses to the questions below should be YES.		
Is there a respiratory acidosis (i.e. pH <7.35 & $PC0_2$ >45mmHg) **secondary to acute exacerbation of COPD**, despite best medical therapy.	YES	NO
Has the patient been discussed with the on-call SpR / Respiratory Consultant If **YES**, with whom? …….. Which parent team is responsible for this patient?.....	YES	NO

Has the patient been referred to Critical Care SpR / Consultant? If **YES**, with whom?.....	YES	NO
Has the decision been made and documented regarding escalation of treatment should the NIV fail?	YES	NO
If the patient is a candidate for intubation and escalation of treatment in Critical Care, has this been discussed with the Critical Care SpR or Consultant?	YES	NO

NIV Observation Chart

- Record observations **hourly for the first 6 hours** on NIV and then **2hrly** after that
- Record ABG's as required by the patient
- Mark **changes to therapy** with an Asterisk*

Patient details / label:
Name:

age:

Department:

Date:

Time												
IPAP cmH_20												
EPAP cmH_20												
Resp rate												
0_2 litres												
Est V_t - Tidal volume / mls												
Est MV- Min volume / ltrs												
$Sa0_2$ (on monitor)												
ABG's (Time)												
pH												
$pC0_2$												
$p0_2$												
$HC0_3$												
BE												
$Sa0_2$ (on ABG)												

NIV MDT Evaluations

Date & Time:	Medical evaluation:	Print name & Signature
Date & Time:	Nursing evaluation:	Print name & Signature

Date & Time:	Physiotherapy evaluation:	Print name & Signature

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