One + all | we care

Royal Cornwall Hospitals NHS Trust

Non-Invasive Ventilation Use in Patients with Acute Hypercapnic Respiratory Failure Policy and Procedure

V4.1

May 2023

Table of Contents

Data Protection Act 2018 (General Data Protection Regulation – GDPR) Legislation

The Trust has a duty under the Data Protection Act 2018 and General Data Protection Regulations 2016/679 to ensure that there is a valid legal basis to process personal and sensitive data. The legal basis for processing must be identified and documented before the processing begins. In many cases we may need consent; this must be explicit, informed, and documented. We cannot rely on opt out, it must be opt in.

Data Protection Act 2018 and General Data Protection Regulations 2016/679 is applicable to all staff; this includes those working as contractors and providers of services.

For more information about your obligations under the Data Protection Act 2018 and General Data Protection Regulations 2016/679 please see the Information Use Framework Policy or contact the Information Governance Team

Royal Cornwall Hospital Trust rch-tr.infogov@nhs.net

1. Introduction

1.1. Non-invasive ventilation (NIV) in the management of acute hypercapnic respiratory failure represents one of the major technical advances in respiratory care over the past 20 years. It has been shown to improve survival, reduce need for invasive ventilation and ICU, reduce length of hospital stay, reduce complication rates, and reduce hospital costs[1].

1.2. This version supersedes any previous versions of this document.

2. Purpose of this Policy/Procedure

2.1. The aim of this policy is to provide guidance for all healthcare professionals involved in the delivery of acute NIV and to ensure that this is done both safely and effectively. This policy has been written in keeping with national evidence-based guidelines[2].

2.2. This policy is not intended for patients on long-term domiciliary NIV.

2.3. This policy is not intended for patients receiving high flow nasal oxygen (HFNO). please see High Flow Nasal Oxygen (HFNO) use outside intensive care.

3. Scope

This policy is intended for healthcare professionals involved in the decision to implement NIV (clinicians) and those delivering NIV (clinicians, trained staff).

4. Definitions / Glossary

4.1. The Following abbreviations will be used throughout this document:

ABG	Arterial blood gas.
BiPAP	Bilevel positive pressure ventilation.
CBG	Capillary blood gas.
CF	Cystic Fibrosis.
CPAP	Continuous positive pressure ventilation.
CCU	Coronary Care Unit.
CWD	Chest Wall Disease.
DBay	D Bay, Wellington Ward.
DECAF	Dyspnoea Eosinopeania, Consolidation, Acidemia, Fibrillation score.
EPAP	Expiratory positive airways pressure.
FFM	Full face mask.

FiO2	Fraction inspired oxygen concentration.
HR	Heart rate.
ICU	Intensive Care Unit.
ILS	Immediate Life Support.
IPAP	Inspiratory positive airway pressure.
IPPV	Invasive positive pressure ventilation.
NIV	Non-invasive ventilation.
NMD	Neuromuscular Disease.
OHS	Obesity hypoventilation syndrome.
OSA	Obstructive sleep apnoea.
pH	Acid base balance.
PaO2	Arterial oxygen tension.
PaCO2	Arterial carbon dioxide tension.
PEEP	Positive end expiratory.
PS	Pressure Support.
PtCO2	Transcutaneous carbon dioxide.
RR	Respiratory rate.

4.2. C1 Hamilton ventilators are used outside of critical care. It is mandatory for all staff delivering NIV to undergo training. Staff must complete the ESR online theory module, 000 Acute NIV and successfully pass all assessments. Attend the NIV study day and complete supervised practice sign off, achieving Level 3 competency.

5. Ownership and Responsibilities

5.1. This guideline has been developed by the RCHT NIV Group: Updated NIV working group.

Dr Meme Wijesinghe, Respiratory Physician (Lead).

Dr Karikalan Kandasamy, Consultant Cardiologist.

Dr Owen McCormack, ED consultant.

Katie Hill, Clinical Lead Respiratory Physiotherapist.

Rebecca Shuttleworth, Ward Manager Wellington.

Lynne Donohue, Critical Care Outreach Nurse.

5.2. It has been endorsed by Critical Care, Cardiology and Emergency Medicine Department.

5.3. Role of the Managers

Line managers are responsible for:

- Ensuring the policy is adhered to.
- Provisions are made to deliver the service.

5.4. Role Of Individual Staff

All staff members are responsible for:

- Delivering safe and effective NIV as stated in the policy.
- Ensuring they are up to date with training and competencies.

6. Standards and Practice

6.1. Principles of Non-Invasive Ventilation

6.1.1 Delivery of Care

Acute NIV should only be delivered in the following areas: Emergency Department Resus, Critical Care, D Bay Wellington, and Coronary Care Unit. For those patients in the ED who require NIV, a bed should be identified on Wellington, Critical or CCU and the patient must be transferred as soon as possible (see section 6.10). During office hours (Monday to Friday 0830 to 1630) the NIV outreach physio should be contacted on Bleep 3084. Out of hours critical care outreach should be contacted if the patients are outside Wellington or critical care.

6.1.1.1 In exceptional circumstances in emergency situations, NIV can be commenced outside one of these designated areas, but this must be done by a trained member of staff (Level 3 competency) A trained member of staff (Level 3 competency) must stay with the patient until they are transferred to a designated NIV area by a Level 3 competent practitioner (See appendix 3 for explanations of competencies).

6.1.1.2 To optimise the care of patients on NIV and to ensure NIV patients are nursed in one of the four designated NIV areas a bed on D Bay will be ring-fenced for NIV patients only. Patients identified as meeting “indications for referral to ICU” should be referred to ICU where appropriate.

6.1.1.3 If patients develop acute hypercapnic respiratory failure at any site outside Treliske their medical management should be optimised and if NIV is deemed appropriate, they should be discussed with

the respiratory consultant for Wellington (during the day) or medical registrar (out of hours) and transferred to Treliske if appropriate.

6.1.2 **Responsibility of patients on NIV**

6.1.2.1 Patients in ED Resus on NIV are under the care of the ED consultant until formally referred and accepted by the acute medical, respiratory, cardiology or ICU teams. This should be documented clearly in the medical notes.

6.1.2.2 Patients in Wellington will be under the care of the respiratory consultant covering Wellington and the general medical consultant out of hours.

6.1.2.3 Patient in CCU on NIV for cardiogenic pulmonary oedema will be under the care of the cardiologist covering CCU. Patients in CCU on NIV for a primary respiratory cause will be under the care of the respiratory consultant covering Wellington and the general medical consultant out of hours. An internal referral should be completed on Maxims in hours and the Wellington ward clerk should be informed. Out of hours the general medical consultant on call should be notified at handover or via switchboard.

6.1.3 **Modes and Devices**

6.1.3.1 Only C1 Hamilton devices are used to deliver acute NIV at RCHT unless instructed by and ICU or respiratory consultant. It is mandatory for all staff delivering NIV to undergo training. All ventilators outside ICU are fitted with a red plug. Only trained member of staff should remove a red plug.

6.1.3.2 Pressure support mode is the only mode of ventilation which should be used unless instructed otherwise by a respiratory or ICU consultant.

6.1.4 **Choice of interface**

An oro-nasal mask should usually be the first type of interface used. Occasionally nasal or “aviator” masks are used to improve compliance or reduce pressure areas on the nasal bridge.

6.1.5 **Supplemental Oxygen**

Oxygen enrichment should be adjusted to achieve SaO2 88-92% in most cases of AHRF treated by NIV, unless otherwise specified by the responsible consultant. Oxygen should be entrained through the machine. NIV settings should be optimised before increasing the FiO2, as gas exchange will improve with increased alveolar ventilation. Mask leak and delayed triggering may be caused by oxygen flow rates >4l/min which risks promoting or exacerbating patient-ventilator asynchrony. The requirement for high flow rates should prompt a careful check for patient-ventilator asynchrony. Humidification is not routinely required. (See appendix 4).

6.1.6 **Bronchodilator Therapy**

Nebulised drugs should normally be administered during breaks from NIV. If the patient is dependent on NIV, bronchodilator drugs can either be driven by oxygen or air driven. The latter is attached to the ventilator tubing, attached to the ventilator tubing. The Hamilton C1 can drive a nebuliser using 8L of oxygen via the ventilator however this function should be only used with caution.

6.1.7 **Sedation with NIV**

Sedation should only be used with close monitoring. Infused sedative/anxiolytic drugs should only be used in the ICU. If intubation is not intended should NIV fail, then small doses of IV morphine 2.5-5mg can be considered. Benzodiazepines e.g. sublingual Lorazepam 0.5mg, can be considered following senior review. Continuous intravenous sedation should not be used outside ICU.

6.1.8 **Sputum retention**

If any concerns with sputum retention a Respiratory Physiotherapy review should be requested. In patients with NMD, mechanical insufflation and exsufflation can be used, in addition to standard physiotherapy techniques, where cough is ineffective and there is sputum retention. Humidification may be of benefit to patients on NIV for greater than 48 hours who have evidence of retained secretions.

6.2. Management of acute hypercapnic respiratory failure (AHRF)

6.2.1. Please refer to flow diagram in Appendix4: Summary for providing acute NIV.

6.2.2. Controlled oxygen therapy should be used to achieve a target saturation of 88-92% in all cases of AHRF. Medical management should be optimised for at least an hour in most patients with AHRF.

a. For AECOPD treat with bronchodilators, steroids, and antibiotics where appropriate.

b. Identify potential reversible causes for T2RF e.g. opiates, pneumothorax.

6.2.3. The patients Covid and Flu status should be determined (See section 6.9).

6.2.4. A treatment escalation plan (TEP) must be discussed with all patients (and/or their families) prior to commencing NIV. This should be filed in the patient's notes and relevant members of the multidisciplinary team should be informed. Potential for recovery to quality of life acceptable to the patient must always be considered when making TEP decisions.

6.2.5. All patients must have a CXR to exclude a pneumothorax or other comorbidity excluding them from NIV but should not be delayed in life threatening situations. If a pneumothorax is identified a chest drain must

be inserted prior to starting treatment unless stated otherwise by an ICU or respiratory consultant.

6.2.6. The patient's consent should be sought wherever possible. Written information about NIV should be provided to patients and/or the relatives (See patient information leaflet, 'NIV: The Treatment Explained').

6.2.7. The decision to start acute NIV should be made by a doctor who is ST2 equivalent or above.

6.2.8. The RCHT NIV care plan and pathway must be followed and completed from selection of patients for NIV, initiation of treatment and monitoring whilst on NIV. This must be signed by the clinician and nursing staff delivering NIV.

6.3. Indications and contra-indications for acute NIV

6.3.1. NIV should be commenced when pH<7.35 and PaCO2 >6.5 persist or develop despite optimal medical therapy in the following conditions:

- Acute exacerbations of COPD.
- Acute exacerbations of bronchiectasis and CF bronchiectasis.
- Neuromuscular disease and Chest wall deformity.
- Obesity hypoventilation syndrome.
- Cardiogenic pulmonary oedema unresponsive to CPAP.

In patient with NMD or CWD, NIV should be considered in acute illness when vital capacity (VC) is known to be <1L and RR >20 even if normocapnic and not acidaemic.

6.3.2. Acute NIV should not be commenced on patients who do not fall inside these indications unless discussed with a consultant. Acute NIV is NOT used in patients with acute severe asthma exacerbations, pneumonia, or Covid Pneumonitis. Referral to ICU for IPPV should be considered where appropriate.

6.3.3. Absolute contraindications for NIV

- Severe facial deformity.
- Facial burns.
- Fixed Upper Airway obstruction.

6.3.4. Relative contraindications for NIV outside ICU:

- pH <7.15.
- Confusion/agitation.

- Cognitive impairment.
- Undrained pneumothorax.

6.3.5. Indications for referral to ICU:

- AHRF with impending respiratory arrest.
- NIV failing to augment chest wall movement or reduce PaCO2.
- Inability to maintain SpO2 85-88% on NIV.
- Need for IV sedation.
- Adverse features indicating need for closer monitoring.
- Possible difficult airway e.g. OHS, NMD.

6.4. Initiating treatment

6.4.1. The decision to start NIV should be made by a doctor at ST2 level or above. NIV should be initiated by a practitioner who is Level 2 competent or above.

6.4.2. The patient's height must be measured if unknown by the patient.

6.4.3. The patient should be sitting leaning forward, or in a semi-recumbent position when started on NIV. Mask size should be assessed using the templates provided with the masks. A full-face mask should be used for most patients for the first 24 hours followed by switch to a nasal mask for patient comfort when requested. Only non-vented masks and Hamilton consumables should be used. The Hamilton C1 has an expiration valve, permitting the release of carbon dioxide without (open) expiratory ports.

6.4.4. Patients should be commenced on an initial Pressure Support (PS) of 10cms H2O and positive end expiratory pressure (PEEP) of 5cms H2O. These pressures may not significantly improve gas exchange but allow acclimatization of the patient to the machine. The PS should be uptitrated over 10-30 minutes to a PS of 15-25cm H2O to achieve adequate augmentation of chest/abdo movement and slow respiratory rate.

6.5. Specific Disease Indications

6.5.1. **Acute Exacerbations of COPD**

Medical management must be optimised prior to starting acute NIV. Prognostic tools such as the DECAF score may be helpful to inform discussion regarding prognosis and with regard to the appropriateness of IPPV but with the caveat that such tools are poorly predictive for individual patient use. Severe acidosis alone does not preclude a trial of NIV in an appropriate area. Advanced age alone should not preclude a trial of NIV. Worsening physiological parameters, particularly pH and

respiratory rate (RR) indicate the need to change the management strategy. This includes clinical review, change of interface, adjustment of ventilator settings and considering proceeding to endotracheal intubation.

6.5.2. **Acute exacerbations of bronchiectasis and non-CF bronchiectasis**
Inpatients with non-CF bronchiectasis, medical management should be optimised. NIV should usually be tried before resorting to IPPV. In CF patients specialist physiotherapy is needed to aid sputum clearance. Before commencing CF patients on NIV, Dr Myers should be consulted.

6.5.3. **Neuromuscular disease (NMD) and chest wall deformities (CWD)**

6.5.3.1 Controlled oxygen therapy should be used in patients with NMD or CWD to achieve a target saturation of 88-92%. NIV should be trialed in acutely unwell patients with NMD or CWD with hypercapnia where appropriate, do not wait for acidosis to develop. Patients with NMD or CWD should be considered for NIV in acute illness when their vital capacity is known to be <1L and RR >20, even if normocapnic. Consider controlled ventilation as patients with NMD or CWD may be ineffective at triggering.

6.5.3.2 Please involve experienced senior clinicians when making TEP for patients with NMD and CWD.

6.5.3.3 Patients with NMD usually require low levels of pressure support; patients with chest wall deformity usually require higher levels of PS.

6.5.3.4 PEEP in the range of 5-10 is commonly required to increase residual volume and reduce oxygen dependency in both patient groups.

6.5.4. **Obesity Hypoventilation Syndrome**

Controlled oxygen therapy should be used in patients with OHS to achieve target saturations of 88-92%. High PS and PEEP settings are commonly required in patient with OHS e.g. PS >20, PEEP >8. Volume controlled modes providing NIV may be more effective when high inflation pressures are required. Many patients with AHRF secondary to OHS will require long-term domiciliary support.

6.5.5. **Pulmonary Odema**

Patients in pulmonary oedema should be managed on CCU. Patients who do not respond to standard medical treatment should be managed on CPAP first line and only put onto NIV if they fail to respond.

6.6. Care Plan, Care Pathway and Monitoring

6.6.1. The RCHT NIV care plan and pathway must be followed and completed from selection of patient for NIV, initiation of treatment and monitoring whilst on NIV. This must be signed by the clinician and nursing staff delivering NIV.

6.6.2. All patients receiving NIV require continuous cardiac monitoring for the first 24 hours of treatment. Thereafter the need for cardiac monitoring should be risk assessed.

6.6.3. RR, HR, level of consciousness, chest wall movement, ventilator synchrony, accessory muscle use, patient comfort, and SpO2 must be monitored and recorded at the following intervals:

- First hour: every 15 minutes.
- 1-4 hours: every 30 minutes.
- 4-12 hours: every 1 hour.

6.6.4. After 12 hours of treatment patients should have hourly observations whilst on NIV but this can be reduced in accordance with the NEWS policy whilst off NIV.

6.6.5. Observations must be recorded on the NIV Care Plan in addition to the NEWS chart.

6.6.6. A clinical assessment of mask fit to include skin condition and degree of leak (particularly onto the corneas) should be performed at the same time.

6.6.7. As a standard ABG should be taken and used to assist in the management plan at 1 hours, 4 hours or earlier if judged clinically necessary and again at 12 hours unless the clinical improvement in the patient obviates the need for further ABG analysis. Patients on NIV overnight should have an early morning ABG to aid weaning.

6.6.8. If the patient is not improving, please see “trouble shooting” appendix 5.

6.7. Weaning from NIV

6.7.1. Patients who appear to benefit from NIV during the first few hours of treatment should receive NIV for as long as possible with appropriate breaks for oral intake, during the first 24 hours. Attention should be paid to skin care on the bridge of the nose during this period. In patients in whom NIV is successful (pH≥ 7.35 achieved, resolution of underlying cause and symptoms, respiratory rate normalised) following an appropriate duration of treatment, it is appropriate to start a weaning plan. Gradual reduction of the duration of NIV should be determined by clinical improvement.

6.7.2. Initially weaning should be during the day with extended periods off the ventilator for meals, physiotherapy, nebulised therapy etc. Patients may require continued ventilation overnight if stable during the day. Early morning ABGs are required to monitor gas exchange. Most patients should be weaned within 2-3 days. Some patients may require long-term domiciliary NIV, but this decision should be made by the respiratory physician in charge of their care.

6.8. Palliation

Palliation of symptoms is appropriate in patients in whom standard medical treatment and NIV fails or where patients have chosen not to receive this treatment and where a decision has been made and documented not to escalate to intubation and mechanical ventilation. In exceptional circumstances NIV may be continued to palliate breathlessness but should not be initiated for this reason. Opioids and benzodiazepines can be used to treat breathlessness in this situation. Initiation of palliative care pathways should where possible include appropriate discussion with the patient and family.

6.9. Infection Control

6.9.1. All patients must have their Covid and Flu status determined prior to commencing NIV. Patients in which there is a low clinical suspicion of Coronavirus infection and who test negative can be managed in ED resus, CCU or D Bay Wellington if unsuitable for ICU. If there is a high suspicion of Coronavirus infection or if Covid testing is positive, patients must be nursed in ED resus room 1, or in Wellington SR 1 or 2. Staff should where PPE in keeping with current infection control guidelines. Whilst NIV can be commenced on patients with incidental Covid who have one of the indications for NIV stated in Section 6.5, NIV is not a treatment for Covid Pneumonitis. The appropriateness for CPAP or HFNO should be considered if the patient is for full escalation and discussed with the respiratory team and ICU, but it should not be commenced on Wellington.

6.9.2. Equipment should be cleaned according to manufacturer and Infection Control guidelines. A bacterial filter must be attached to the ventilator outlet port. This should be changed between patients and at 24-hour intervals. The filters in the machine's air entrainment mechanism should be changed when visibly dirty and between patients. Single patient use items should not be reused and should be disposed of appropriately. A system should be in place to enable traceability of equipment e.g. in the event of product failure to enable recall of equipment.

6.10. Transferring patients in Acute Hypercapnic Respiratory Failure

6.10.1. Prior to all transfers ensure:

- The patient has an NIV care pathway with completed prescription.
- The TEP is complete and up to date.

- SpO2, RR and work of breathing are within acceptable parameters and cardiovascular observations are stable.
- Ensure FiO2 source is available and adequate for transfer (2x full CD bottles).
- Obtain confirmation that ward is ready to receive the patient prior to departure.
- Ensure the lift can be held if required.

6.10.2. Transfer **OFF** NIV if:

The Patient is stable off NIV with appropriate oxygen therapy. Decision to be taken by level 3 competent person.

- Requires 1x ILS trained and 2x other staff (e.g. porter/HCA/ AP).
- Monitor HR, SpO2 and BP throughout transfer.

6.10.3. Transfer **ON** NIV if:

The patient is newly established on NIV or unable to come off but is stable. Decision to be taken by level 3 competent person.

- Requires 1x ILS trained person +nurse+ other staff (e.g. porter/ HCA/ AP).
- Patient must be on a C1 Hamilton ventilator with 2x full CD oxygen bottles.
- May need to contact Wellington ward or Paediatric HDU if no C1 Hamilton available.
- Ensure adequate oxygen delivery and airway adjuncts available (grab bag).
- Monitor HR, SpO2 and BP throughout transfer.

6.10.4. **DO NOT transfer if:**

The patient is deteriorating, unstable and for full escalation.

- The patient will need to remain in resus.
- Escalate to outreach or critical care for further management and support.

6.11. Patients on Domiciliary Non-Invasive Ventilation

The management of patients on long-term domiciliary NIV or CPAP is outside the realms of this policy. However if patients on long term domiciliary NIV are admitted acutely and are ventilator dependent (i.e. requiring treatment >15 hours per day) they should be managed in Wellington D Bay or Critical care irrespective of their presenting complaint. Stable patients who can manage their own mask and ventilator as they would at home, can be managed on any medical ward.

7. Dissemination and Implementation

7.3. This policy will be disseminated throughout all relevant areas in the trust through lead clinicians, ward managers/sisters and managers.

7.4. Provision of training is provided by consultant respiratory physicians and the Learning and Development department. Training is mandatory for all staff delivering NIV.

8. Monitoring compliance and effectiveness

Information Category	Detail of process and methodology for monitoring compliance
Element to be monitored	All aspects of the NIV service in keeping with standards set by the British Thoracic Society (See website).
Lead	Dr Meme Wijesinghe.
Tool	British Thoracic Society (See website).
Frequency	Annually.
Reporting arrangements	A report is generated annually. This will allow us to benchmark our practice with the rest of the country.
Acting on recommendations and Lead(s)	Dr Meme Wijesinghe will disseminate audit results.
Change in practice and lessons to be shared	If deficiencies are identified, Dr Wijesinghe will identify how changes can be actions and improvements to service implemented.

9. Updating and Review

This policy will be reviews every three years.

10. Equality and Diversity

10.1. This document complies with the Royal Cornwall Hospitals NHS Trust service Equality and Diversity statement which can be found in the Equality Diversity And Inclusion Policy or the Equality and Diversity website.

10.2. Equality Impact Assessment

The Initial Equality Impact Assessment Screening Form is at Appendix 2.

Appendix 1. Governance Information

Information Category	Detailed Information
Document Title:	Non-Invasive Ventilation Use in Patients with Acute Hypercapnic Respiratory Failure Policy and Procedure V4.1
This document replaces (exact title of previous version):	Non-Invasive Ventilation Use in Patients with Acute Hypercapnic Respiratory Failure Standard Operating Policy V4.0
Date Issued/Approved:	27 April 2023
Date Valid From:	May 2023
Date Valid To:	May 2026
Directorate / Department responsible (author/owner):	Dr Meme Wijesinghe, Respiratory Medicine Consultant
Contact details:	01872 252779
Brief summary of contents:	The aim of this procedure is to provide guidance for all healthcare professionals involved in the delivery of NIV and to ensure that this is done both safely and effectively.
Suggested Keywords:	Ventilation, Respiratory Failure, NIV
Target Audience:	**RCHT:** Yes **CFT:** No **CIOS ICB:** No
Executive Director responsible for Policy:	Chief Medical Officer
Approval route for consultation and ratification:	RCHT NIV Working Group Respiratory Governance Group ICU Governance Group Cardiology Governance Group
General Manager confirming approval processes:	Rachel Pearce
Name of Governance Lead confirming approval by specialty and care group management meetings:	Siobhan Hunter

Information Category	Detailed Information
Links to key external standards:	None required
Related Documents:	1. Ram FS, Picot J, Lightowler J, et al. Non-invasive positive pressure ventilation for treatment of respiratory failure due to exacerbations of chronic obstructive pulmonary disease. Cochrane Database Syst Rev. 2004;3:CD004104. 2. BTS/ICS Guidelines of the Ventilatory Management of Acute Hypercapnic Respiratory Failure in Adults. Thorax April 2016 Volume 71 Supplement 2.
Training Need Identified?	No
Publication Location (refer to Policy on Policies – Approvals and Ratification):	Internet and Intranet
Document Library Folder/Sub Folder:	Clinical / Respiratory

Version Control Table

Date	Version Number	Summary of Changes	Changes Made by
20 Oct 12	V1.0	Initial issue	Meme Wijesinghe, Respiratory Medicine Consultant
13 Jun 14	V2.0	Complete rewrite	Meme Wijesinghe, Respiratory Medicine Consultant
Jan 2019	V3.0	Updated	Meme Wijesinghe, Respiratory Medicine Consultant
Feb 2023	V4.0	Full review and updated content. Transposed to accessible Trust template.	Meme Wijesinghe, Respiratory Medicine Consultant
May 2023	V4.1	Updated section 5	Meme Wijesinghe, Respiratory Medicine Consultant

All or part of this document can be released under the Freedom of Information Act 2000

All Policies, Strategies and Operating Procedures, including Business Plans, are to be kept for the lifetime of the organisation plus 6 years.

This document is only valid on the day of printing.

Controlled Document

This document has been created following the Royal Cornwall Hospitals NHS Trust The Policy on Policies (Development and Management of Knowledge Procedural and Web Documents Policy). It should not be altered in any way without the express permission of the author or their Line Manager.

Appendix 2. Equality Impact Assessment

Section 1: Equality Impact Assessment (EIA) Form

The EIA process allows the Trust to identify where a policy or service may have a negative impact on an individual or particular group of people.

For guidance please refer to the Equality Impact Assessment Policy (available from the document library) or contact the Equality, Diversity, and Inclusion Team rcht.inclusion@nhs.net

Information Category	Detailed Information
Name of the strategy / policy / proposal / service function to be assessed:	Non-Invasive Ventilation Use in Patients with Acute Hypercapnic Respiratory Failure Policy and Procedure V4.1
Directorate and service area:	Respiratory, Specialist Medicine
Is this a new or existing Policy?	Existing
Name of individual completing EIA (Should be completed by an individual with a good understanding of the Service/Policy):	Meme Wijesinghe, Respiratory Medicine Consultant
Contact details:	01872 2527799

Information Category	Detailed Information
1. Policy Aim - Who is the Policy aimed at? (The Policy is the Strategy, Policy, Proposal or Service Change to be assessed)	The aim of this procedure is to provide guidance for all healthcare professionals involved in the delivery of NIV and to ensure that this is done both safely and effectively
2. Policy Objectives	The aim of this procedure is to provide guidance for all healthcare professionals involved in the delivery of acute NIV and to ensure that this is done both safely and effectively. This policy has been written in keeping with national evidence-based guidelines. This procedure is not intended for patients on long-term domiciliary NIV.
3. Policy Intended Outcomes	As above

Information Category	Detailed Information
4. How will you measure each outcome?	All aspects of the NIV service will be monitored in keeping with standards set by the British Thoracic Society. A report will be generated annually. This will allow us to benchmark our practice with the rest of the country.
5. Who is intended to benefit from the policy?	Patients with acute hypercapnic respiratory failure using NIV.
6a. Who did you consult with? (Please select Yes or No for each category)	• Workforce: Yes • Patients/ visitors: No • Local groups/ system partners: No • External organisations: No • Other: No
6b. Please list the individuals/groups who have been consulted about this policy.	**Please record specific names of individuals/ groups:** Respiratory Governance Group Elder Care Governance Group Cardiology Governance Group ICU Governance Group
6c. What was the outcome of the consultation?	Ratified
6d. Have you used any of the following to assist your assessment?	**National or local statistics, audits, activity reports, process maps, complaints, staff, or patient surveys:** No

7. The Impact

Following consultation with key groups, has a negative impact been identified for any protected characteristic? Please note that a rationale is required for each one.

Where a negative impact is identified without rationale, the key groups will need to be consulted again.

Protected Characteristic	(Yes or No)	Rationale
Age	No	
Sex (male or female)	No	
Gender reassignment (Transgender, non-binary, gender fluid etc.)	No	
Race	No	

Protected Characteristic	(Yes or No)	Rationale
Disability (e.g. physical or cognitive impairment, mental health, long term conditions etc.)	No	
Religion or belief	No	
Marriage and civil partnership	No	
Pregnancy and maternity	No	
Sexual orientation (e.g. gay, straight, bisexual, lesbian etc.)	No	

A robust rationale must be in place for all protected characteristics. If a negative impact has been identified, please complete section 2. If no negative impact has been identified and if this is not a major service change, you can end the assessment here.

I am confident that section 2 of this EIA does not need completing as there are no highlighted risks of negative impact occurring because of this policy.

Name of person confirming result of initial impact assessment: Meme Wijesinghe, Respiratory Medicine Consultant

If a negative impact has been identified above OR this is a major service change, you will need to complete section 2 of the EIA form available here:
Section 2. Full Equality Analysis

Appendix 3. Competency Framework for Acute NIV

LEVEL	DESCRIPTOR	EVIDENCE
Theory Achieved **Level 1**	Undertakes ESR No application to patient	Complete 000 ACUTE NIV E-learning module
Management of ACUTE NIV competence **Level 2**	Attends face to face study day simulation completed. Understands theoretical use of NIV and machine parameters. Can source, clean and test machine and ensure safe for use. Can navigate settings on user interface. Can appropriately size mask and set up circuit. No application to patient/sim	Sign off Level 2 competency matrix demonstrating safe management of NIV using simulation
ACUTE NIV Competence **Level 3**	Can initiate Acute NIV including adjustment and titration of settings. Can manage a patient, including referral to critical care and medical teams. May decide whether patient is stable for transfer on NIV.	Sign off Level 3 competency matrix demonstrating safe initiation and management of NIV for minimum of one patient with a continuous safe approach in the designated clinical area.

Appendix 4. Summary for providing acute NIV

INDICATION FOR NIV

AECOPD
Optimise medical management and ensure SpO2 88-92%
Consider a trial off NIV if respiratory acidosis persists
pH <7.35
pCO2 >6.5
RR >23

Neuromuscular disease
Respiratory illness with RR>20 if usual VC <1 even if pCO2 <6.5
Or
pH <7.35 and pCO2 >6.5

Obesity Hypoventilation Syndrome
pH <7.35, pCO2 >6.5, RR>23
or
Daytime pCO26.0 and somnolent

Cardiogenic Pulmonary Oedema Unresponsive to CPAP

CONTRAINDICATIONS FOR NIV

Absolute
Severe facial deformity
Facial burns
Fixed upper airway obstruction
Relative
pH <7.15
(pH<7.25 and additional adverse feature)
GCS <8
Confusion
Agitation
Cognitive impairment (warrants enhanced observation)
Indication for referral to ICU
AHRF with impending respiratory arrest
NIV failing to augment chest wall movement or reduce pCO2
Inability to maintain SpO2>85-88% on NIV
Need for IV sedation or adverse features indicating need for closer monitoring and/or possible difficult intubation as in OHS, DMD.

NIV not indicated

Asthma/Pneumonia/Covid Pneumonitis
Refer to ICU for consideration/MV if increasing respiratory/rate/distress or pH<7.35 and pCO2>6.5

NIV SET-UP

NIV
The decision to start NIV should be made by a doctor at ST2 level or above, NIV should be identified by a practitioner who has completed level 3 NIV training
Mask
Full face mask (or own if user of NIV)
Initial Pressure Settings
PEEP 5cms (or higher if OSA known/expected)
PS in COPD/OHS/KS 20cm (15 if pH <7.25)
Up titrate PS over 10-30 mins to PS 15-25 to achieve adequate augmentation of chest/abdo movement and slow RR
PS should not exceed 25 or Peep 8* without expert review
PS in NM 5 (or 5 above usual setting)
Backup rate
Backup rate of 10-12. Set appropriate inspiratory time
I:E ratio
COPD 1:2 to 1:3
OHS, NM and CWD 1:2
Use NIV for as much time as possible in 1st 24 hours
Taper depending on tolerance and ABGs over next 48-72 hours

SEEK AND TREAT REVERSIBLE CAUSES OF AHRF

NIV MONITORING

Oxygenation
Aim 88-92% in all patients
Note: Home style ventilators CANNOT provide >50% inspired oxygen
Consider secretion burden, refer to chest physio/trial humidification
If high oxygen need or rapid desaturation on disconnection from NIV, consider IMV

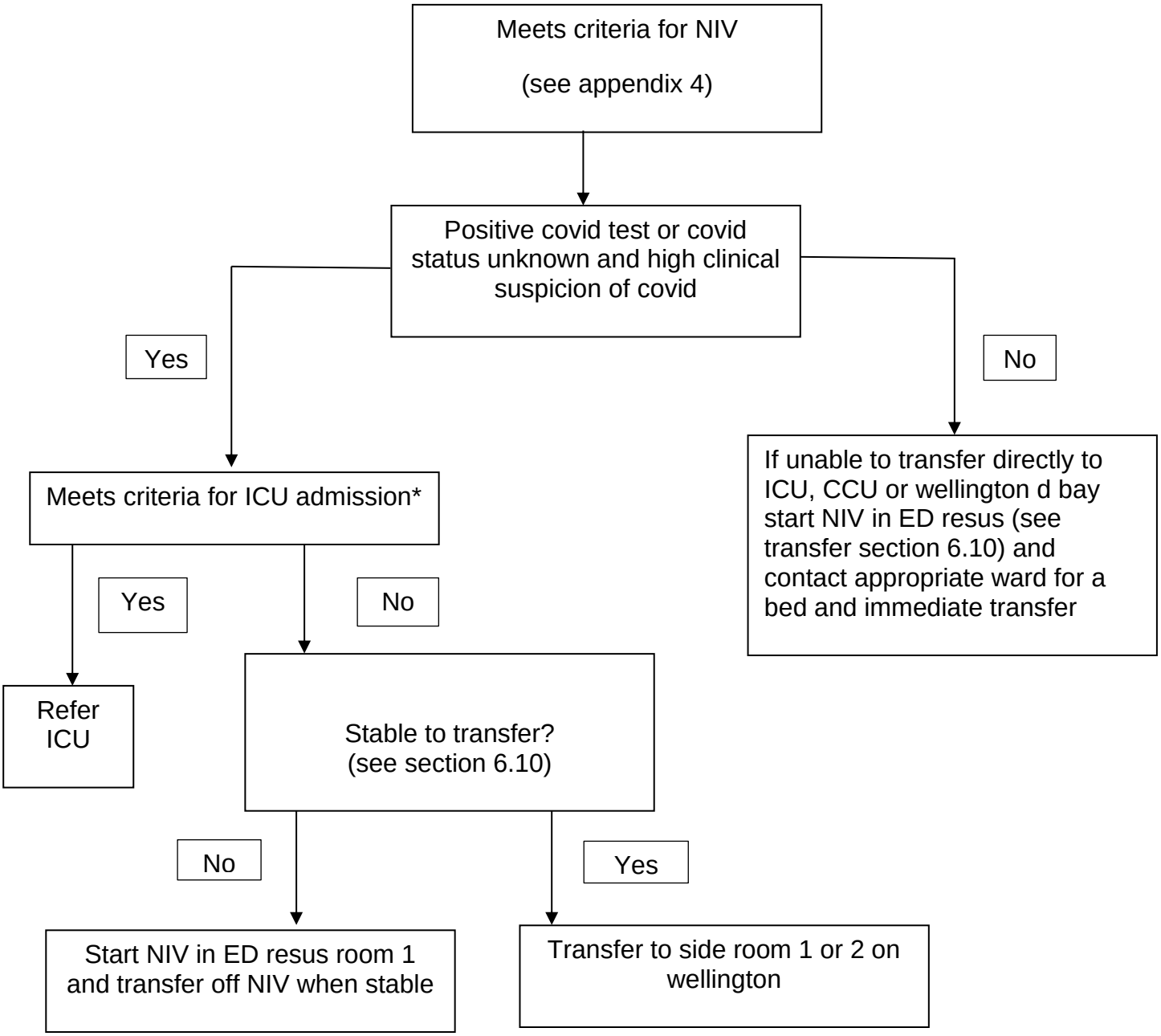
Red Flags
pH <7.25 on optimal NIV
RR persisting >25
New onset confusion or patient distress
Actions
Check synchronisation, mask fit, exhalation port: give physiotherapy/ bronchodilators
CONSIDER IMV

Appendix 5. Troubleshooting

Trouble Shooting	Information
Persistently elevated PaCO2	• Is there excessive mask leak? See below. • Is the circuit set up correctly? Check set up and identify leaks. • Is there re-breathing? Check expiratory port is patent. • Is the patient being over-oxygenated? Aim for SpO2 88-92%, especially when patients are off NIV. • Consider increase in Pressure Support, particularly if the patient is obese. • Is the patient spending sufficient time on the ventilator? Address compliance issues. • Consider reducing CPAP/PEEP.
Mask Levels	• Air leaks of <60% are acceptable. If above, check mask fit. Consider full face mask and customized foam or granuflex.
Asynchrony between ventilator and patient	• Ensure the correct tubing is used in the circuit. The tubing should be smooth on the inside to allow flow to be detected accurately by the machine. • If the patient is very tachypnoeic, increasing the Pressure support may help. • Ensure the rise time is as quick as possible.
Hypocapnia/ Alkalosis	• Minute ventilation is too high, reduce Pressure support and assess if ventilation is still required?
Difficulty inflating the chest. **Nasal problems**	• Poor expansion of the chest may be due to bronchospasm, mucus plugging, pneumothorax, consolidation, pulmonary oedema or rarely circuit tubing obstruction or kinking. Check the circuit. Clinical examination and CXR is required. • Rhinitis or nasal crusting/Bleeding? Consider short term use of ephedrine 0.5% drops for nasal stuffiness or ipratropium bromide drops for nasal streaming. For longer use consider humidification
Dry mouth	• Regular mouth care is essential. • Consider humidification.
Gastric distention	• Check for abdominal pain or distension during NIV. • Try to reduce pressure support if possible. • Consider a nasogastric tube, accepting a small leak will ensue.
Persistent hypoxaemia	• Check oxygen is being entrained into the circuit.

Trouble Shooting	Information
	• Consider increasing CPAP/PEEP if there is consolidation or the patient is obese. Pressure support will need to be increased to maintain pressure support. • Deteriorating clinical condition in the presence of hypoxaemia should lead to an urgent re-evaluation of the patient and consideration of referral to ICU for invasive intubation.
Patient position **Non-co-operation /aggressive behaviour**	• The patient should be positioned sitting upright with their head up. (Consider additional support if necessary). • This may be due to hypoxaemia or hypercapnia. Ensure constant supervision, as it may be necessary to hold the mask in place until the ABGs correct themselves before the agitation/confusion settles. This may be lifesaving. Relatives may be helpful. Sedation must be avoided without senior medical or anesthetic input. Haloperidol may be useful in reducing agitation. Benzodiazepines should be avoided.
Pressure ulcer prevention **VTE Risk**	• Nasal bridge soreness is a common problem. Padding or a change of mask should be considered. • The mask does not need to be fitted tightly as the mask and machine can compensate for a certain amount of leakage. • Assess for risk of VTE due to reduced mobility

Appendix 6. Operational Pathway For Delivery Of Acute Non-Invasive Ventilation



*Please note Covid Pneumonitis is not an indication for NIV. If the patients are for full escalation, they should be referred to ICU for consideration of other modes of ventilation

Appendix 7. Acute Niv Referrals To CCOT

Patient requiring acute NIV Mon-Fri 08:00am-16:00pm.	Patient requiring acute NIV out of hours Mon-Fri 16:00pm-08:00am or weekends.
Reviewed or discussed with Respiratory Consultant?	Senior medical review?
Consider transfer to NIV competent area if bed available.	Consider transfer to NIV competent area if bed available.
Staff in area with competencies = yes/no?	Staff in area with competencies = yes/no?
Yes = commence NIV as per pathway.	Yes= commence NIV as per pathway.
No = NIV Physio bleep holder bleep 3084.	No= Senior Nurse/Co-ordinator to discuss options with CCOT bleep 3504.
NIV bed destination?	NIV bed destination?