Nasal Intermittent Positive Pressure Ventilation in Newborn Intensive Care Unit

Procedure Responsibilities and Authorisation

Department Responsible for Procedure	Neonatal Intensive Care Unit
Document Facilitator Name	Aira Javier
Document Facilitator Title	ACNM
Document Owner Name	Jutta van den Boom
Document Owner Title	Clinical Director
Target Audience	NICU medical and nursing staff

Procedure Review History

Version	Updated by	Date Updated	Summary of Changes
1	Arun Nair, SMO NICU and Aira Javier, ACNM NICU	Feb 2020	New procedure

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Contents

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1 Overview

1.1 Purpose

The purpose of this procedure is to guide staff in the use of Nasal Intermittent Positive Pressure Ventilation (NIPPV) to increase extubation success in preterm infants as an alternative to Nasal Continuous Positive Airways Pressure (nCPAP).

1.2 Overview

Nasal Intermittent Positive Pressure Ventilation (NIPPV) superimposes an intermittent peak pressure on CPAP and is delivered to the infant with a ventilator and midline CPAP prongs or mask. NIPPV can be achieved by a combination of PEEP and PIP and resp rate.

NIPPV, in particular when synchronized, improves extubation success in preterm infants, but does not seem to be beneficial for the primary treatment of RDS. NIPPV does not reduce the rate of death or BPD.

NIPPV is NOT a replacement for endotracheal ventilation, it should be seen as alternative to nCPAP. Sepsis and other pathologies should always be considered in infants with increased work of breathing or other respiratory deterioration. Intubation needs to be considered for these infants.

1.3 Scope

Medical and nursing staff working in the Neonatal Intensive Care Unit (NICU)

1.4 Patient / client group

NIPPV can be considered for infants after extubation with previous extubation attempts and/or on-going apnoeas. Those infants should be treated with an optimised dose of Caffeine Citrate (≥ 10 mg/kg/day). A high or increasing pCO_2 level is a sign of hypoventilation, and non-synchronized NIPPV might not sufficiently increase tidal volume. Intubation and ventilation should be considered for infants with high or increasing pCO_2.

1.5 Exceptions / contraindications

Any contraindications to CPAP is applicable to NIPPV.

1.6 Definitions (all abbreviations and special terms need definitions)

NIPPV	Nasal Intermittent Positive Pressure Ventilation
OGT	Orogastric tube
PIP	Peak Inspiratory Pressure
PEEP	Positive End Expiratory Pressure

CPAP	Continuous Positive Airway Presure
CMV	Continuous Mandatory Ventilation
ETT	Endotracheal Tube
ELBW	Extremely Low Birth Weight

2 Clinical Management

2.1 Competency required

Registered nurse who has completed Level 3 (NICU) ventilator orientation

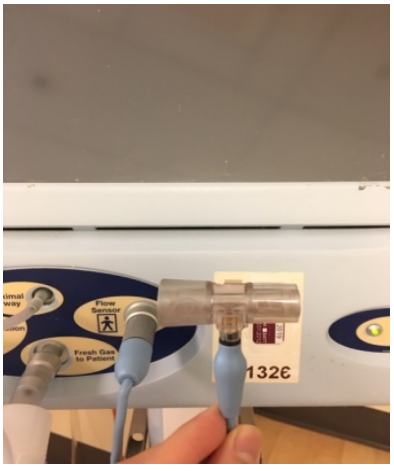
2.2 Procedure

NOTE: This ventilator is not designed to provide NIPPV. It can be used for this purpose until ventilator model that is designed to provide NIPPV is available in order to avoid intubation and the need for invasive positive pressure ventilation. The caregivers need to be informed about this.

2.2.1 NIPPV Set-Up

1. Remove swivel disc connector, flow sensor and test lung from the ventilator circuit. DO NOT remove yellow restrictor from blue tubing.

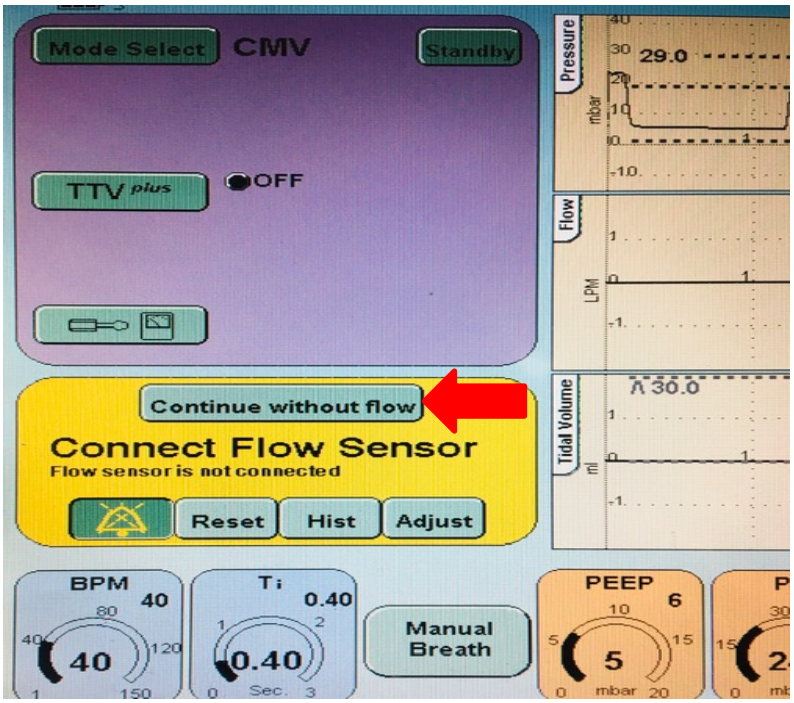
Swivel disc connector



Flow sensor & flow sensor cable

2. Connect blue inspiratory tubing and white expiratory tubing to CPAP trunk. Select an appropriate sized prongs/mask for the baby using the sizing template.

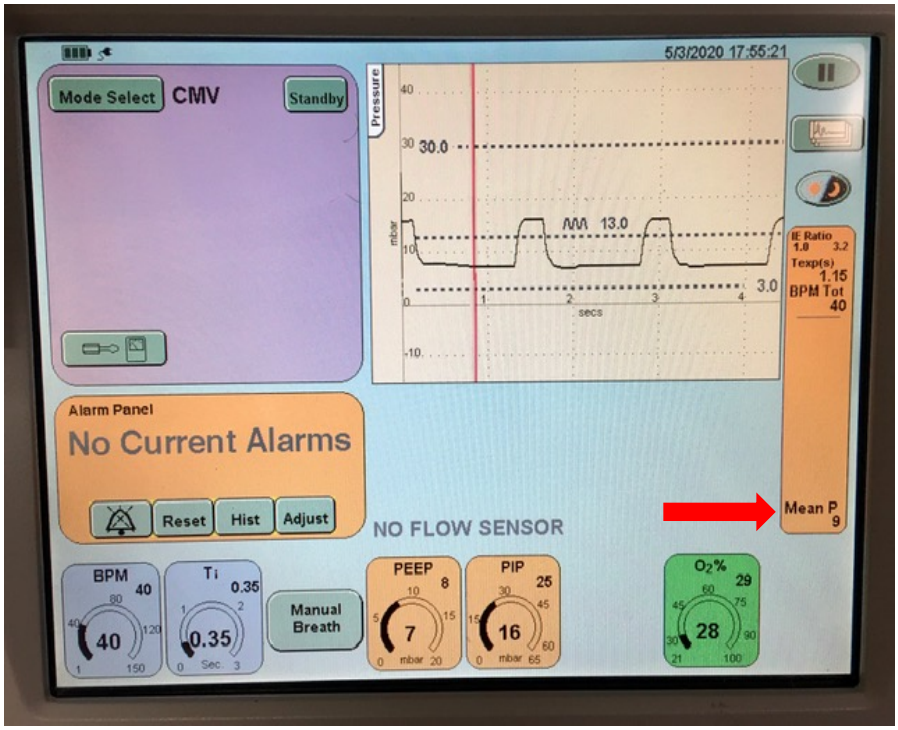
3. Change ventilator mode to CMV. Disconnect blue flow sensor cable from the ventilator. When “Connect Flow Sensor” alarm comes up, select “Continue without flow”



4. Adjust PIP and PEEP settings as charted.
5. If the baby is ventilated, use Neopuff to deliver ventilation while setting up.

   Keep swivel disc connector at bedside in case baby needs to be reintubated to connect ETT onto ventilator tubings

2.2.2 NIPPV Settings

Ventilator Mode	SLE Ventilator with CMV mode.
Peak Inspiratory Pressure (PIP)	14 - 20 cm H_2O, in discussion with a consultant may be increased to 24 cm H_2O.
Positive End Expiratory Pressure (PEEP)	6-10 cm H_2O Note: Changes to PIP and PEEP settings should be discussed with and charted by the medical team **Aim for the achieved mean airway pressure (Mean P) to be the same as if the baby would be on CPAP**. 
Respiratory Rate (RR)	10 - 40 breaths/min, in discussion with a consultant may be increased to 60 breaths/min.
Inspiratory time (Ti)	0.3-0.5s, similar to Ti on the ventilator

Flow	8 L/min.
Flow sensor	Remove the flow sensor
Alarms	Cycle fail alarm, Low Pressure Alarm

2.2.3 Maintenance of NIPPV

High/low CO_2	NIPPV is **NOT** a replacement for endotracheal ventilation. If the infant is deteriorating, do not change the settings as if the infant was ventilated but rather intubate and ventilate. For NIPPV, there is minimal evidence in regards to the effect of adjusting pressures and rates, however you may adjust the settings to the maximum before resorting to invasive ventilation
O_2 concentration adjustment	This is done on the ventilator and **not** on the oxygen/air blender at the bed space.
Documentation/ Charting	Prescribe on NICU General Treatment Sheet (T1481HWF), NICU Respiratory Flow Chart (A1743HWF) and document in 'Level Three' respiratory chart (A1301HWF). Ventilator mode is charted as NIPPV to document it is not ventilation through an endotracheal tube.
Observations	Flow sensor & flow sensor cable are taken out so ventilator would not detect patient breaths. Observe respiratory effort, pattern. Regularly check correct placement of prongs/ mask.
Recordings	Record FiO_2, rate, pressures (PIP, PEEP and MAP), Ti and flow as well as vital signs hourly as per usual for 'Level Three' chart. Also document whether baby is using Prongs or Mask in Level Three Respiratory Chart.
Gastric Tube	A gastric tube needs to be in place and should be left on free drainage if NBM while the baby is on NIPPV. Discuss with medical team if on bolus/continuous feeds. (Decompress OGT in between bolus feeds or insert another OGT for venting if on continuous OG feeds)
Suctioning	Same for babies on CPAP; special considerations for ELBW babies- refer to ELBW protocol
Kangaroo Care	The same considerations for babies on CPAP; special considerations for ELBW babies-refer to ELBW protocol

2.2.4 Troubleshooting NIPPV

NIPPV is provided with a ventilator, therefore there is no "bubbling" noise.

Cycle Fail Alarm The cycle fail alarm threshold autotracks the PIP parameter. This is triggered when set PIP value is close or equal (0 to 5 mbar) to PEEP or CPAP value. **This alarm cannot be disabled** as this is a safety feature.

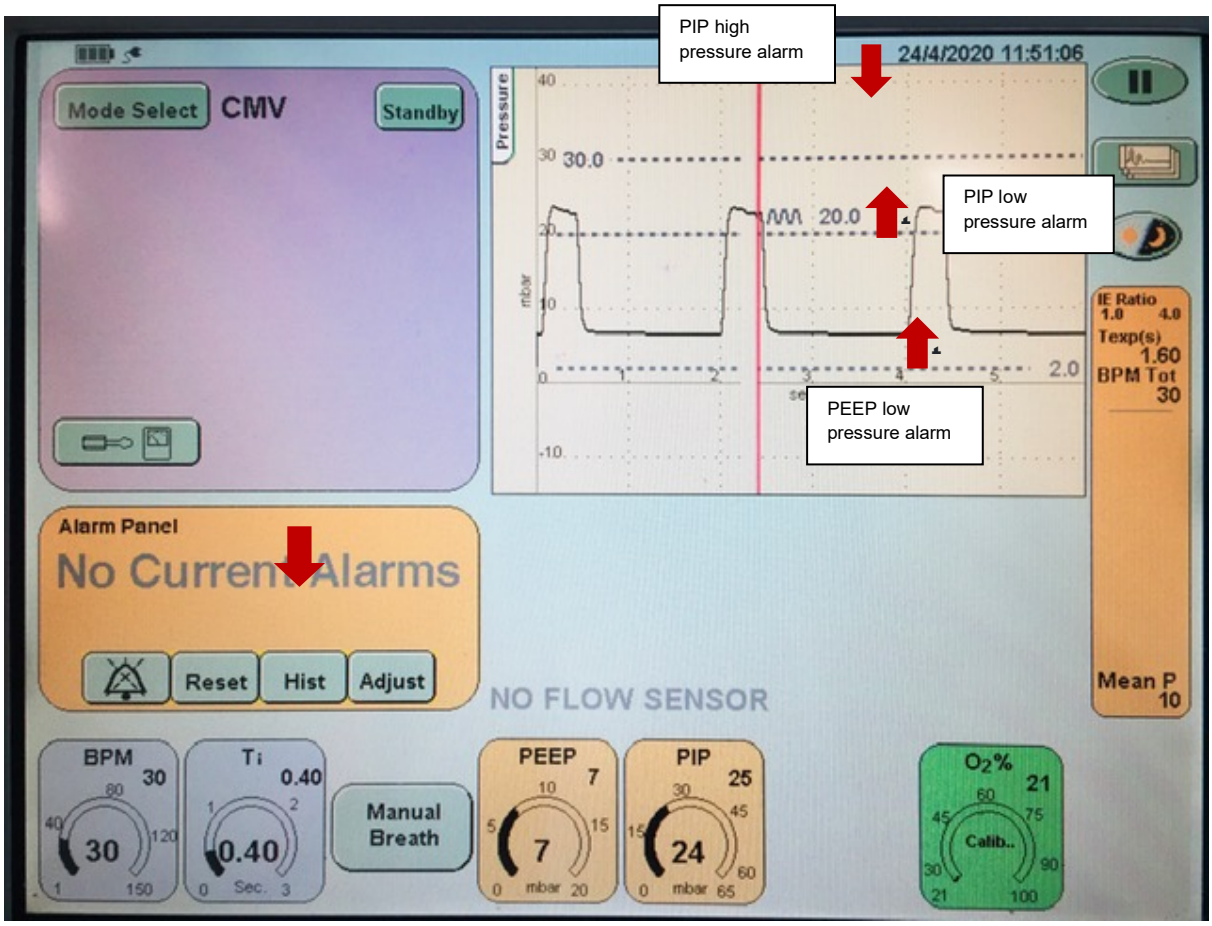
Low Pressure This is triggered when PIP or PEEP is below the set pressure alarm limits.

Actions for Cycle Fail Alarm/ Low Pressure Alarm:

- Check for tubing disconnection or leak in circuit.
- Ensure prong/mask is the correct size for infant and is properly fitted/ positioned.
- Consider using a duoderm patch for prongs to improve seal, and/or
- Use a second chin strap (blue chinstrap more preferable)
- For **Low Pressure Alarms**, **DO NOT** alter default PIP/PEEP pressure alarm settings on ventilator without discussing with medical team.

<u>Adjusting PIP/ PEEP alarm threshold:</u> (must be discussed with medical team)
The default setting is 5 mbar above & below PIP setting and 5 mbar below PEEP setting.

Press Adjust button, select the alarm threshold you want to adjust on the pressure waveform screen (press & hold the broken line) and use ⇧⇩ to change settings



2.3 Potential complications

Complications are similar to treatment with CPAP. Appropriate nursing care should prevent nasal septal erosion and nasal obstruction. The risk of nasal septal damage should be prevented with careful positioning of the prongs, close monitoring, or alternating with a CPAP mask. A nasopharyngeal airway is an alternative option to nasal prongs (see 'Nasopharyngeal CPAP'). However, studies have shown that for CPAP, short binasal prongs are more effective at preventing reintubation than single nasopharyngeal prongs.

Settling the infant can be difficult and time consuming. Make sure the prongs are in a good position and that the infant is positioned comfortably. Consider alternating prongs with mask and try non-pharmacologic comfort measures.

There have been concerns regarding NEC, feed intolerance, and intestinal perforation in association with NIPPV, but a recent Cochrane review could not confirm this[2]. Given that the airway pressures with NIPPV are higher than those given with CPAP, a gastric tube needs to be in place for gastric decompression while the infant is on NIPPV.

2.4 After care

Discard used equipment

3 Audit

3.1 Indicators

- Documented assessments and observations are available for all infants on NIPPV for every shift
- Re-intubation after commencement of NIPPV

4 Evidence base

4.1 Bibliography

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14. The Starship Guideline for NIPPV; https://www.starship.org.nz/guidelines/nasal-intermittent-positive-pressure-ventilation-nippv

4.2 Associated Waikato DHB Documents

- Waikato DHB NICU Medical ELBW Bundle of Care protocol (Ref. 6240)
- Waikato DHB NICU Nursing Continuous Positive Airway Pressure Nursing Management in Newborn Intensive Care Unit (NICU) procedure (Ref. 4939)