Summary

Please see appendices 3, 4, 5 and 6.
1. **Aim/Purpose of this Guideline**

1.1. Respiratory distress is a major cause of admission to the Neonatal Unit; and in preterm neonates surfactant deficient lung disease remains a major cause of long term morbidity and mortality.

1.2. This guideline provides a framework for the management of neonates presenting with respiratory distress.

1.3. Preterm recommendations are based upon the European Consensus Guidelines on the management of Respiratory Distress Syndrome & the NICE guidelines for specialist neonatal respiratory care for babies born preterm.

1.4. Deviation from this guideline may be required in exceptional circumstances, the rationale for this should be clearly documented in the notes

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

1.6. **Data Protection Act 2018 (General Data Protection Regulation – GDPR) Legislation**

The Trust has a duty under the DPA18 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 can’t rely on Opt out, it must be Opt in.

DPA18 is applicable to all staff; this includes those working as contractors and providers of services.

For more information about your obligations under the DPA18 please see the ‘information use framework policy’, or contact the Information Governance Team rch-tr.infogov@nhs.net

2. **The Guidance**

2.1. All term neonates requiring admission for respiratory support should be managed as the flow sheet in Appendix 3.

2.2. All neonates born 32-35\(^{+6}\) requiring admission for respiratory support should be managed as the flow sheet in Appendix 4.

2.3. All neonates born <32 weeks should be managed as the flow sheet in Appendix 5.

2.4. Any neonate with suspected **Persistent Pulmonary Hypertension of the Newborn** should be managed as per **Persistent Pulmonary Hypertension of the Newborn (PPHN)**
2.5. **Sepsis** should be considered and treated, where appropriate, as per *Prevention, Diagnosis and Treatment of Early-Onset Neonatal Bacterial Infection*

2.6. Neonates being ventilated **must** have functioning IV access. **Newborn** neonates requiring invasive respiratory support should have UAC and UVC inserted.

2.7. **Hypotension** should be managed as per *Neonatal Hypotension Management – Clinical Guideline*

2.8. **Intubation** should be performed in line with *Neonatal Intubation and Management of the Difficult Airway Clinical Guideline*

2.9. **All neonates who are ventilated must have end tidal waveform capnography.**

2.10. **Ventilation:** The standard mode for neonates having invasive ventilation is Patient Triggered Ventilation (PTV) with Targeted Tidal Volume (TTV).

2.10.1. Suggested settings for neonates receiving PTV with TTV are:

2.10.1.1. VtE 5ml/kg (normal range 4-8ml/kg)

2.10.1.2. PEEP 5-6 cm

2.10.1.3. Backup rate 30 (>36 weeks), 40 (>36 weeks)

2.10.1.4. Trigger- 0.2 (24-28 weeks), 0.4 (28-32 weeks), 0.6 (32-36 weeks) 0.8 (>36 weeks)

2.10.1.5. Max PIP initially at 30. After 10 minutes on the ventilator circuit the Max PIP should be reduced to 5 mbar above the PIP required to deliver the set volume and give good chest wall movement.

2.10.2. Reduction of the backup rate in a neonate breathing spontaneously above the set rate will have minimal to no impact on the ventilator settings.

2.10.3. Babies not on Volume targeted ventilation should not be on PTV; they should be on SIMV.

2.11. Neonates with a large ETT leak or those who are muscle relaxed and are unstable should be managed on **Synchronised Intermittent Mandatory Ventilation (SIMV)** **without** TTV
2.11.1. Suggested settings for neonates receiving SIMV depend upon the neonates’ clinical status and the underlying pathology. The volume delivered by the ventilator must be documented.

2.11.2. SIMV with PSV should not be used.

2.12. Blood gas monitoring must occur on all neonates receiving respiratory support

2.12.1. Ventilated neonates must have a gas at least 4 hourly. This should be documented along with the End Tidal CO2 reading

2.12.1.1. More frequent monitoring must occur in unstable neonates

2.12.1.2. A CO2 below 4.5 must be acted upon within 10 minutes and the gas repeated within 60 minutes.

2.12.1.3. Significant changes in ETCO2 should prompt a repeat blood gas.

2.12.1.4. Target PCO2 in preterm babies in the first 72 hours of life between 4.5kPa – 8.5kPa

2.12.1.5. Target PCO2 in preterm babies after 72 hours 4.5kPa-10kPa

2.12.1.6. PCO2 in term babies should be kept within normal physiological limits (4.5kPa-6kPa) unless directed by a Consultant or on tertiary advice

2.12.2. Babies on non-invasive respiratory support should have a blood gas at least 6 hourly until stable.

2.12.2.1. More frequent monitoring must occur in unstable neonates

2.12.2.2. A CO2 below 4.5 must be acted upon within 10 minutes and the gas repeated within 60 minutes.

2.12.2.3. Target PCO2 in preterm babies in the first 72 hours of life between 4.5kPa – 8.5kPa

2.12.2.4. Target PCO2 in preterm babies after 72 hours 4.5kPa-10kPa
2.12.2.5. PCO2 in term babies should be kept within normal physiological limits (4.5kPa-6kPa) unless directed by a Consultant or on tertiary advice

2.12.2.6. Once stable babies on non-invasive respiratory support should have a daily gas (if fully enterally fed) or twice daily gas (if on IV fluids or TPN)

2.13. Target saturations in Preterm babies are 91-95%. Term babies, in the absence of confirmed congenital cardiac disease, have target saturations of 95-99%. Deviation from these sats limits should occur only on medical advice.

2.14. Weaning of respiratory support should be managed as per Appendix 6. ongoing respiratory support.

2.15. Sedation and Muscle Relaxation

2.15.1. Routine opiate sedation in <32 week preterm neonates requiring invasive respiratory support is not indicated unless they are assessed to be in pain. Morphine is first choice in these patients. Morphine 100mcg/kg bolus followed by a continuous infusion (10-30mcg/kg/h)

2.15.2. In neonates >32 week gestation requiring invasive respiratory support morphine is the first choice for sedation. Morphine 100mcg/kg bolus followed by a continuous infusion (10-30mcg/kg/h)

2.15.3. Stop sedation for at least 1 hour, and assess respiratory effort, before extubation

2.15.4. Vecuronium bolus (100mcg/kg) followed by infusion is first choice for muscle relaxant in ventilated neonates

2.16. Caffeine: All neonates below 32 weeks, and all neonates <35 weeks requiring respiratory support should receive caffeine. Loading dose 20mg/kg and maintenance starting at 5mg/kg. Doses are as caffeine citrate.

2.17. Neonates with a murmur, or where there may be concerns about congenital cardiac disease should be discussed with a paediatrician with a cardiology interest or a tertiary neonatal consultant. Target saturations should not be changed except on the advice of tertiary consultant or if a diagnosis is made that precludes normal sats limits (e.g. TGA / Hypoplastic Left Heart)
2.18. **Dexamethasone** to aid extubation or weaning of respiratory support should only be given on advice of a tertiary neonatal consultant.

2.19. Respiratory support in patients with known/suspected Oesophageal Atresia / Tracheoesophageal fistula should occur ideally following discussion with a tertiary neonatal consultant.

2.20. **Management of Ventilation**

2.20.1. Changes to ventilation should only be made on the instruction of an ANNP/ Registrar or Consultant.

2.20.2. The standard increment change for TTV is 0.5ml/kg. Larger changes can be made when required. Smaller changes are rarely beneficial.

2.20.3. Neonates minimally ventilated, on PTV with TTV, who are not extubatable (due to concerns about airway / neurological conditions) should have a PEEP set to 6-7cm to prevent atelectasis.

2.20.4. All patients ventilated should have a CXR within 1 hour of intubation. Correct position of the ETT should be documented, or any change made to adjust the tube noted. Confirmation of ETT position can be done clinically and does not require a repeat CXR.

3. **Monitoring compliance and effectiveness**

<table>
<thead>
<tr>
<th>Element to be monitored</th>
<th>In order to monitor compliance with this guideline it will be included in the neonatal clinical audit programme with findings presented at the Child Health directorate audit meeting. Any deficiencies/ action plan will be presented at the Clinical Governance meeting. Any clinical incident reports relating to this guideline will be monitored against it.</th>
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<tr>
<td>Lead</td>
<td>Neonatal Unit Governance Lead Consultant.</td>
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<td>Tool</td>
<td>Adherence to guidelines will be monitored as part of the ongoing audit process within the neonatal unit on a WORD or Excel template.</td>
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<td>Frequency</td>
<td>Within neonatal audit programme.</td>
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<td>Reporting arrangements</td>
<td>Any incident arising or audit findings out with the protocol will be presented at Child Health Directorate Governance meeting.</td>
</tr>
<tr>
<td>Acting on recommendations and Lead(s)</td>
<td>Any case where these criteria are not met will be discussed and additional training needs identified and acted upon.</td>
</tr>
<tr>
<td>Change in</td>
<td>Lessons will be shared with all the relevant staff/stakeholders</td>
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4. **Equality and Diversity**

4.1. This document complies with the Royal Cornwall Hospitals NHS Trust service Equality and Diversity statement which can be found in the ‘Equality, Inclusion & Human Rights Policy’ or the Equality and Diversity website.

4.2. **Equality Impact Assessment**

The Initial Equality Impact Assessment Screening Form is at Appendix 2.
# Appendix 1. Governance Information

<table>
<thead>
<tr>
<th>Document Title</th>
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<td>Date Issued/Approved:</td>
<td>20\textsuperscript{th} November 2019</td>
</tr>
<tr>
<td>Date Valid From:</td>
<td>December 2019</td>
</tr>
<tr>
<td>Date Valid To:</td>
<td>December 2022</td>
</tr>
<tr>
<td>Directorate / Department responsible (author/owner):</td>
<td>Chris Bell, Paediatric Consultant with interest in Neonatology</td>
</tr>
<tr>
<td>Contact details:</td>
<td>01872 252669</td>
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<tr>
<td>Brief summary of contents</td>
<td>Outline for respiratory management of babies on the neonatal unit</td>
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<tr>
<td>Suggested Keywords:</td>
<td>CPAP, High flow, Neonate, Respiratory support, Ventilation</td>
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<tr>
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<td>Medical Director</td>
</tr>
<tr>
<td>Date revised:</td>
<td>October 2019</td>
</tr>
<tr>
<td>This document replaces (exact title of previous version):</td>
<td>New</td>
</tr>
<tr>
<td>Approval route (names of committees)/consultation:</td>
<td>Neonatal Guidelines Group</td>
</tr>
<tr>
<td>Care Group General Manager confirming approval processes</td>
<td>Debra Shields</td>
</tr>
<tr>
<td>Name and Post Title of additional signatories</td>
<td>Not Required</td>
</tr>
<tr>
<td>Name and Signature of Care Group/Directorate Governance Lead confirming approval by specialty and care group management meetings</td>
<td>{Original Copy Signed}</td>
</tr>
<tr>
<td></td>
<td>Name: Caroline Amukusana</td>
</tr>
<tr>
<td>Signature of Executive Director giving approval</td>
<td>{Original Copy Signed}</td>
</tr>
<tr>
<td>Publication Location (refer to Policy on Policies – Approvals and Ratification):</td>
<td>Internet &amp; Intranet</td>
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<tr>
<td>Document Library Folder/Sub Folder</td>
<td>Clinical/ Neonatal</td>
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Respiratory Support in the Neonate Clinical Guideline V1.0

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**Version Control Table**

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<th>Changes Made by (Name and Job Title)</th>
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<td>October 2019</td>
<td>V1.0</td>
<td>Initial version</td>
<td>Chris Bell, Paediatric Consultant with Neonatal Interest</td>
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</table>

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

This document is to be retained for 10 years from the date of expiry.
This document is only valid on the day of printing

**Controlled Document**

This document has been created following the Royal Cornwall Hospitals NHS Trust Policy for the Development and Management of Knowledge, Procedural and Web Documents (The Policy on Policies). It should not be altered in any way without the express permission of the author or their Line Manager.
Appendix 2. Initial Equality Impact Assessment Form

<table>
<thead>
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<th>Name of the strategy / policy / proposal / service function to be assessed</th>
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<td>Respiratory Support in the Neonate Clinical Guideline V1.0</td>
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<table>
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<tr>
<th>Directorate and service area:</th>
<th>New or existing document:</th>
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<tr>
<td>Neonatal</td>
<td>New</td>
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<table>
<thead>
<tr>
<th>Name of individual completing assessment:</th>
<th>Telephone:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chris Bell</td>
<td>01872 252669</td>
</tr>
</tbody>
</table>

1. **Policy Aim**

   *Who is the strategy / policy / proposal / service function aimed at?*

   Neonatal doctors and nurses working with neonates with respiratory distress

2. **Policy Objectives**

   Ensure consistent, evidence based management of neonates with respiratory distress

3. **Policy – intended Outcomes**

   To improve the well-being of patients by offering the appropriate management of patients

4. **How will you measure the outcome?**

   Audit/Multidisciplinary team weekly discussion/incidents/risk management

5. **Who is intended to benefit from the policy?**

   Patients

6a. **Who did you consult with**

   Workforce | Patients | Local groups | External organisations | Other
   --- | --- | --- | --- | ---
   x | | | | |

   Consultant led, Neonatal Guidelines Group

6b. **Please identify the groups who have been consulted about this procedure.**

   

7. **The Impact**

   Please complete the following table. If you are unsure/don’t know if there is a negative impact you need to repeat the consultation step.

<table>
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<tr>
<th>Equality Strands:</th>
<th>Yes</th>
<th>No</th>
<th>Unsure</th>
<th>Rationale for Assessment / Existing Evidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
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</table>

Respiratory Support in the Neonate Clinical Guideline V1.0

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| **Sex (male, female, trans-gender / gender reassignment)** | X | Any information provided should be in an accessible format for the parent/carer/patient’s needs – i.e. available in different languages if required/access to an interpreter if required |
| **Race / Ethnic communities /groups** | X | Those parent/carer/patients with any identified additional needs will be referred for additional support as appropriate - i.e to the Liaison team or for specialised equipment. Written information will be provided in a format to meet the family’s needs e.g. easy read, audio etc |
| **Disability - Learning disability, physical impairment, sensory impairment, mental health conditions and some long term health conditions.** | X | Those parent/carer/patients with any identified additional needs will be referred for additional support as appropriate - i.e to the Liaison team or for specialised equipment. Written information will be provided in a format to meet the family’s needs e.g. easy read, audio etc |
| **Religion / other beliefs** | X | All staff should be aware of any beliefs that may impact on the decision to treat. |
| **Marriage and Civil partnership** | X | |
| **Pregnancy and maternity** | X | |
| **Sexual Orientation, Bisexual, Gay, heterosexual, Lesbian** | X | |

**You will need to continue to a full Equality Impact Assessment if the following have been highlighted:**

- You have ticked “Yes” in any column above and
- No consultation or evidence of there being consultation - this excludes any policies which have been identified as not requiring consultation. or
- Major this relates to service redesign or development

8. Please indicate if a full equality analysis is recommended.  
   | Yes | No | x |
9. If you are not recommending a Full Impact assessment please explain why.

Not Indicated

| Date of completion and submission | 20th November 2019 | Members approving screening assessment | Policy Review Group (PRG) |

APPROVED

This EIA will not be uploaded to the Trust website without the approval of the Policy Review Group.

A summary of the results will be published on the Trust’s web site.
Appendix 3. Respiratory Support in Neonates 36 Weeks and Older

**Neonates 36 weeks and older**

- Antenatal Steroids whenever indicated
- Cord clamping delayed until 60 secs unless significant compromise at birth
- Manage as per NLS
- Requiring admission for respiratory Support at 30 mins of age

**FiO2 <50% at admission to NNU**

- Commence HFNC 8L
- Septic screen and IVAB
- CXR (4h if stable, earlier if concerns)
- Consider alternative diagnosis if FiO2 rising (PPHN/ Sepsis/ Pneumothorax / cardiac cause)

**FiO2 50% or more at admission**

- Manage as per PPHN guideline

**Ventilated**

- Manage as per ventilation section

**FiO2 rising >50%, respiratory unstable or poor gas exchange**

- Discuss with NNU consultant. Consider intuba
- Septic screen and IVAB
- CXR (4h if stable, earlier if concerns)
- Consider alternative diagnosis if FiO2 rising (PPHN/ Sepsis/ Pneumothorax / cardiac)

**FiO2 stable <50% and CVS stable**

- LISA if RDS on CXR and FiO2 >30%
- Wean Vapotherm as able
Appendix 4. Respiratory Support in Neonates 32-35 +6 Weeks

Neonates 32-35 +6 weeks

Antenatal Steroids & Mag Sulph whenever indicated
Cord clamping delayed until 60 secs unless significant compromise at birth
Commence facemask 6cm PEEP in 30% O2 immediately on transfer to resuscitaire
Manage as per NLS

Self-ventilating in air
- Admit NNU / TCW where appropriate
  - Low threshold to start HFNC if respiratory distress

Stabilised with face mask PEEP O2
- Admit NNU
  - Commence CPAP 6-8cm (if FiO2 >=40%)
  - Commence HFNC (if FiO2 <40%)
  - Septic screen, IV fluids/ TPN (& Caffeine if <34w)
  - Review within 1 hour

Ventilated
- Give surfactant 200mg/kg

Admit NNU
- PTV- Standard settings
  - TTV 5ml/kg. Rate 30-40. Ti 0.36. Max PIP start at 30
  - Septic screen, IV fluids/ TPN & Caffeine
  - Manage as per ventilation section

FiO2 <30% and stable gases
- Continue respiratory support
  - 4-6h gases first 24h

FiO2 30-60% & stable gases
- LISA 200mg/kg curosurf
  - CPAP 6-8cm if no improvement
  - Early CXR
  - Review 1 hour

FiO2 >60% and/or unstable
- Inform NNU Consultant
  - Intubate and Ventilate
  - Give 200mg/kg Curosurf
  - PTV- Standard settings
  - TTV 5ml/kg. Rate 30-40. Ti 0.36. Max PIP start at 30
  - Manage as per ventilation section

FiO2 reduced <30% and stable
- Manage as per Non-invasive respiratory support section

FiO2 >30% or unstable
- Consider
  - Alternative diagnosis (PPHN/ Sepsis/ Pneumothorax / cardiac cause)
  - Repeat LISA- 100mg/kg curosurf if stable (after 12h)
  - Intubation and Ventilation
Appendix 5. Respiratory Support in Neonates <32 Weeks

**Neonates < 32**

- **Antenatal Steroids & Magnesium Sulphate**
  - Cord clamping delayed until 60 secs unless significant compromise at birth
  - Commence facemask 6cm PEEP in 30% O2 immediately on transfer to resuscitaire
  - Manage as per NLS

- **Stabilised with facemask PEEP in <40% O2**
  - Admit NNU
  - Commence CPAP 6-8cm
  - Septic screen, IV fluids/TPN & caffeine
  - Review at 1 hour

- **Stabilised with facemask PEEP in 40% or more O2**
  - Admit NNU
  - Commence CPAP 6-8cm
  - Septic screen, IV fluids/TPN & Caffeine
  - Review once access obtained

- **Ventilated**
  - Give surfactant 200mg/kg

- **FiO2 30-50% and CVS stable with PaCO2 <8. No expected airway abnormality**
  - LISA 200mg/kg (see LISA protocol)
  - LISA procedure completed successfully FiO2 <=30% within 1 hour
  - Continue CPAP 6-8cm
  - Consider LISA further dose Curosurf (100mg/kg) after 12h if FiO2 increases >30% Manage as per Non-invasive respiratory support section

- **FiO2 >50% and/or PaCO2 >8. CVS Stable No expected airway abnormality**
  - Intubate and Ventilate
  - Give 200mg/kg Curosurf
  - PTV- Standard settings
  - TTV 5ml/kg. Rate 30-40. Ti 0.36. Max PIP start at 30
  - Manage as per ventilation section

- **FiO2 >50% and/or PaCO2 >8. CVS Unstable Expected airway abnormality**
  - Inform NNU consultant Urgent CXR
  - Intubate and Ventilate
  - Give 200mg/kg Curosurf
  - PTV- Standard settings
  - TTV 5ml/kg. Rate 30-40. Ti 0.36. Max PIP start at 30
  - Manage as per ventilation section

- **FiO2 >30% within 1 hour**
  - LISA procedure unsuccessful OR
  - FiO2 >30% within 1 hour
  - Consider Intubation and Ventilation
  - Give Curosurf (200mg/kg if first dose, 100mg/kg if second dose)
  - PTV- Standard settings
  - TTV 5ml/kg. Rate 30-40. Ti 0.36. Max PIP start at 30
  - Manage as per ventilation section

- **FiO2 >30% within 1 hour**
  - LISA procedure unsuccessful OR
  - FiO2 >30% within 1 hour
  - Consider Intubation and Ventilation
  - Give Curosurf (200mg/kg if first dose, 100mg/kg if second dose)
  - PTV- Standard settings
  - TTV 5ml/kg. Rate 30-40. Ti 0.36. Max PIP start at 30
  - Manage as per ventilation section

- **FiO2 >30% within 1 hour**
  - LISA procedure unsuccessful OR
  - FiO2 >30% within 1 hour
  - Consider Intubation and Ventilation
  - Give Curosurf (200mg/kg if first dose, 100mg/kg if second dose)
  - PTV- Standard settings
  - TTV 5ml/kg. Rate 30-40. Ti 0.36. Max PIP start at 30
  - Manage as per ventilation section
Appendix 6. Ongoing Respiratory Support

Ventilated Neonate needing Extubation

- **Term neonate with no underlying lung disease**
  - Exubate to air if good respiratory drive
    - *Gas 1h post extubation*

- **32-36 weeks or term with underlying lung disease**
  - Exubate to HFNC-2L / kg
    - *Gas 1h post extubation*

- **<32 weeks or significant lung disease**
  - Exubate to CPAP 6-8cm
    - *Gas 1h post extubation*

### Neonate on CPAP

- Once stable gases and FiO2 <30%
  - <32w: Wean 1cm every 24h
  - >32w: Wean 1cm every 12h
  - Wean more frequently if CO2 <4.5 but beware of rising FiO2

- Once CPAP 4cm H20 trial conversion to HFNC.
  - Restart CPAP if FiO2 increase >10% or PaCO2 increase >1KPa

### Neonate on HFNC

- <32 week neonates in <30% O2 with good gas exchange can wean 1L HFNC every 24h, if stable, to a minimum of 4L.
- <32 week neonates in 30% or more O2 with good gas exchange can wean 0.5L every 24h, if stable, to a minimum of 4L.
- 32-35 week neonates in <30% O2 with good gas exchange can wean 1L HFNC every 24h, if stable, to a minimum of 2.5L.
- 32-35 week neonates in 30% or more O2 with good gas exchange can wean 0.5L every 24h, if stable, to a minimum of 2.5L.
- Neonates >35 weeks can wean by 1L every 6 hours if stable.
- Neonates on 2.5L can have a trial in air or Low flow if stable. If this is not tolerated they should recommence high flow at 4L.
- Neonates with PDA/Congenital Cardiac Disease should not have their respiratory support routinely weaned without discussion with a local Paediatric Cardiology interest consultant.
- Babies can be weaned quicker, or removed from high flow earlier at the discretion of senior medical staff.