

Title: Respiratory Support Clinical Guideline: Premature infants < 36 weeks in Waikato NICU			
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1. Purpose of procedure:

Respiratory support for premature infants <36 weeks gestation in Waikato NICU.

2. Procedure:

Delivery Suite

NB: cross ref with “Newborn Resuscitation-Oxygenation”

For infants with respiratory distress or for inadequate respiratory drive, use CPAP with blended gas.

For infants requiring more than CPAP after 30 seconds of CPAP support, use T-piece positive pressure breaths after 30 seconds

For infants with inadequate respiratory drive after a further 90 seconds, intubate.
(Exceptions – infants requiring full CPR, or with specific congenital anomalies such as diaphragmatic hernia).

Do not intubate for purpose of giving prophylactic surfactant – this can wait until established in NICU, if still needed.

Early (< 48 hrs) NICU, preterm (gest < 36 weeks).

CPAP 6 cm pressure.

Ventilation indications (from SUPPORT study):

- FiO₂ > 0.5 to keep SaO₂ > 88% for more than 1 hour, or
- pCO₂ > 65 on a single blood gas within 1 hour prior to intubation, or
- Haemodynamic instability for > 4hours (requiring volume or pressure support), or
- Apnoeas requiring stimulation (>6 per 4hours, or one requiring positive pressure).

Surfactant indications:

- Meets intubation criteria and < 27 weeks, or
- Meets intubation criteria and Xray indicates HMD.
- In-Out surfactant (modified INSURE criteria) (Bohlin 2007)
FiO₂ 40-50% for more than 1 hour and Xray indicates HMD and age <48 hours.

Choice of ventilation, in preferred order:

- SIMV with Pressure Support and TTV
 - Back up rate minimum 20.
 - Inspiratory time = 0.3 sec
 - Termination sensitivity = 5%
 - PEEP = 5 cmH₂O
 - Max PIP = sufficient to deliver reasonable volume. Aim for 25% higher than required PIP to deliver tidal volume. Consider that required PIP > 25 is unusual, and perhaps indicative of need for HFOV.
 - Targeted Tidal Volume = 5ml/kg.

- SIMV with Pressure Support
 - Back up rate minimum 20.
 - Inspiratory time = 0.3 sec
 - Termination sensitivity = 5%
 - PEEP = 5 cmH₂O
 - PIP = sufficient to deliver reasonable volume. Consider that PIP > 25 is unusual, and perhaps indicative of need for HFOV.

- High Frequency Oscillatory Ventilation (HFOV)
 - Rate = 8-12 Hz
 - MAP = 6-16, be prepared to use recruitment manoeuvres to improve oxygenation.
 - Amplitude = sufficient to move the chest and maintain the pCO₂ in the desired range (45-60).

Alternative Weaning modes for consideration

- Pressure Support Ventilation (PSV) with Targeted Tidal Volume (TTV) (SLE ventilator)
Settings, as above but:
 - Back-up rate = 20
 - Max PIP = 25% higher than required PIP for tidal volume
- Pressure Support Ventilation (PSV) (SLE Ventilator),
Settings, as above but:
 - Back-up rate = 20
- Assist/Control (Bird ventilators).
 - Back-up rate = 20

No routine ETT suctioning (to avoid de-recruitment)– babies with HMD should not require suctioning in first 48 hours.

No routine paralysis

Extubation criteria (< 14 days of age).

Conventional: PCO₂ ≤ 45, and FiO₂ ≤ 35% and MAP ≤ 8.

HFOV: PCO₂ ≤ 45, FiO₂ ≤ 35%, MAP ≤ 8, and amplitude < (2 x MAP).

Passed “Spontaneous Breathing Test” : (see below)

Ensure baby is put back on ventilation or HFOV while setting up for extubation to avoid exhaustion.

Long term ventilation (> 14 days)

Continue to use SIMV or HFOV.

Extubation criteria: pH > 7.25, MAP < 10, and amplitude < (2 x MAP).

Extubate to CPAP, pressure 6-10 cm (to match previous MAP). Aim to reduce CPAP pressure to achieve 6 cm as soon as possible.

Passed "Spontaneous Breathing Test" : (see below)

Ensure baby is put back on PSV + TTV/ PSV or HFOV while setting up for extubation to avoid exhaustion.

Spontaneous Breathing Test (SBT) (ref Kamlin et al)

(established for infants with bw < 1250g)

ET CPAP for 3 minutes, observed. Failure = either of..

- Bradycardia > 15 seconds, or
- SpO₂ falls below 85% despite 15% increase in FiO₂.

Ongoing CPAP:

Aim for pressure of 6 cm only.

If higher pressures are to be tested, there should be a Sats-run on 6 cm and again on 8cm, each for 6 hours minimum. Taking into account the FiO₂ required, if there is measureable improvement on 8cm, then the higher pressure may be maintained, with attempts to reduce it to 6 cm again after 3 days. Reduction testing requires double sats-runs again.

If there is no measureable improvement on 8 cm CPAP, and the baby is less than 14 days of age, then ventilation is appropriate. For babies greater than 14 days, individualised care decisions are reasonable.

If there is clinical concern about the status of the baby on 6cm, such that the 6 hour sats-run assessment is not considered safe, then a blood gas should be assessed. If the pCO₂ is judged reasonable, then the sats-run assessment should continue to its end.

Standard Flow rate = 6 l/min; Greater flow rates must be justified on clinical grounds.

Style = mask and prong, even timing, no longer than 6 hours on mask.

Stopping CPAP

Infants < 36 weeks must be on 6cm CPAP to be considered for discontinuation.

If corrected gestation < 32 weeks:

- No use of nasal flow.
- If FiO₂ = 21% for > 48 hrs, and apnoeas requiring stimulation = nil last 24 hours then trial without CPAP in room air. If fail, then maintain CPAP 7 days before further trial.
- If FiO₂ > 21%, then continue CPAP

If corrected gestation 32 -35 weeks:

- If FiO₂ = 21% for > 48 hours, then may trial no support.
- If FiO₂ between 21 and 30%, may trial transition to humidified blended nasal flow 6 l/minute. If fail, then maintain CPAP 3 days before further trial.
- If FiO₂ > 30% (more than 4 hours in the last 24 hour period), then continue CPAP.

If corrected gestation \geq 36 weeks:

- Individualised care plan, but in general terms.
- if $FiO_2 = 21\%$ for > 48 hours, try no support. If fail, then humidified, blended nasal flow at 2 l/min.
- If $FiO_2 > 21\%$, expect successful transition to humidified blended nasal flow 6 l/minute. If fail, may still have brief periods of nasal flow for purposes of feeding experience.

Failure criteria

- apnoea – one profound, or 6 minor in 4 hours,
- $O_2 > 40\%$ for more than 30 minutes
- Excessive tachypnoea > 4 hours

Weaning blended nasal flow

Use sats-runs to determine adequacy of treatment. At least one sats-run is required at each step of reduction. Each sats-run should be of minimum 6 hours duration

Successful sats run = mean $> 93\%$, and time less than $90\% = <5\%$ (i.e. on the cumulative bar graph, use a drop line from 89%)

If ROP still active, successful sats run = mean $\geq 90\%$ and time less than $86\% \leq 5\%$ (i.e. on the cumulative bar graph, use a drop line from 85%).

If there is persistent unsatisfactory sats-run on maximum pressure (8 cm), with satisfactory pCO_2 , then consider using a minimum O_2 base (e.g. 25%) as an alternative to reintubation.

Reduce flow by 1-2 l/min at a time, trial every 3 days.

6. Evidence Level

7. Associated documents

Newborn Resuscitation-Oxygenation 0441

8. References

- SUPPORT study: *Early CPAP v Surfactant in Extremely Preterm Infants*, NEJM 2010, 362; 21.
- Kamlin et al, *Spontaneous breath test for extubation readiness. Arch Dis of Child Fetal Neonatal ed 2006 91:F180-3*
- Kamlin et al, *Spontaneous breath test for extubation readiness. Arch Dis of Child fetal Neonatal ed2008 93:F305 -6*
- Bohlin et al, *Implementation of surfactant treatment during continuous positive airway pressure. J Perinatology 2007 27: 422-427.*

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