

Guidelines for Initial Respiratory Management and CPAP

Highlights of Recommendations	Level of Evidence*
▪ Start CPAP immediately after birth in delivery room for infants $\leq 31\ 6/7$ weeks. ¹	A
▪ PEEP of 6 to 7 should be used for CPAP in the delivery room and for transport to NICU. ² Delivery room CPAP can be given via RAM cannula until admission to NICU.	E
▪ Hudson prongs are preferred as initial interface for infants with GA < 36 weeks, and for infants GA ≥ 36 weeks with significant respiratory distress indicated by $FiO_2 > 25\%$ or need for PEEP > 7. For infants with GA ≥ 36 weeks that require CPAP with $FiO_2 \leq 25\%$ and PEEP ≤ 7 , RAM cannula can be used as initial interface. ³ Infants can be transitioned from Hudson prongs to RAM cannula when PMA ≥ 32 weeks, and are comfortable with mild or no apnea on CPAP 5 with $FiO_2 < 25\%$.	E
▪ When extubating to CPAP, use CPAP 6 to 7. Wean PEEP only if FiO_2 is 21% for 2-5 days.	E
▪ Bubble CPAP should be used for CPAP as soon as possible. ⁴	B
▪ Consider routine use of gastric tube to vent stomach for infants on CPAP.	E
▪ Continue CPAP until at least 34 weeks PMA for infants with GA < 25 weeks and until at least 32 weeks PMA for infants with GA < 28 weeks, and following clinical criteria are met: FiO_2 of 21% on CPAP 5 without tachypnea, work of breathing, or significant apnea. For infants with severe growth-restriction or symptomatic chorioamnionitis: consider continuing CPAP for 1-2 weeks beyond other criteria. ⁵	B
▪ If oxygen or respiratory support is needed soon after discontinuation of CPAP, restart CPAP rather than nasal cannula oxygen. If re-initiation of CPAP is required, consider waiting at least 5 days before trialing off again.	E
▪ Consider use of RAM cannula for temporary relief of nasal septal injury.	E

¹ Metanalysis of 4 to 6 relatively large RCTs comparing initial use of CPAP after birth versus mechanical ventilation in very preterm infants showed a pooled benefit favoring the use of CPAP in terms of reduced risk of BPD or death.

Fisher HS, Buhrer C. Avoiding Endotracheal Ventilation to Prevent Bronchopulmonary Dysplasia: A Meta-Analysis. *Pediatrics* 2013;132:e1351-e1360. Schmolzer GM, Kumar M, Pichler G, Aziz K, O'Reilly M, Cheung PY. Non-invasive versus invasive respiratory support in preterm infants at birth: systematic review and meta-analysis. *BMJ* 2013;347:f5980.

² Both term and preterm infants likely to require higher PEEP soon after delivery to attain and maintain Functional Residual Capacity (FRC) during transition as fetal lung fluid is being removed.

Lista G, Caviglioli F, Castoldi F, Zimmermann LJ. Sustained inflation: Prophylactic or rescue maneuver? *Sem Fetal Neonatal Med.* 2016.

³ Multiple studies using simulated models to measure mean airway pressure generated with RAM vs Hudson CPAP interface show that RAM prongs provide lower mean airway pressure compared to Hudson prongs.

Gerdes JS, Sivieri EM, Abbasi S. Factors influencing delivered mean airway pressure during nasal CPAP with the RAM cannula. *Ped Pulm.* 2015;51:60-69. Iyer NP, Chatburn R. Evaluation of a nasal cannula in noninvasive ventilation using a lung simulator. *Resp Care.* 2015;60:508-512. Bailes SA, Fireston KS, Dunn DK, McNinch NL, Brown MF, Volsko TA. Evaluating the effect of flow and interface type on pressures delivered with bubble CPAP in a simulated model. *Resp Care.* March 2016;61(3).

⁴ Modest physiologic and clinical data, including small randomized trials suggests bubble CPAP has benefits over ventilator CPAP, particularly following extubation in infants < 30 weeks.

Gupta S, Donn SM. Continuous positive airway pressure: Physiology and comparison of devices. *Sem Fetal Neonatal Med.* 2016.

⁵ Several studies, including small randomized trials have shown that discontinuation of CPAP is associated with greater rate of failure if discontinued at younger postmenstrual age, and this approach also supported in review of CPAP use by Columbia group.

Barnat N, Jensen EA, Kirpalani H. Duration of continuous positive airway pressure in premature infants. *Sem Fetal Neonat Med.* 2016. Sahni R, Schiaratura M, Polin RA. Strategies for the prevention of continuous positive airway pressure failure. *Sem Fet Neonat Med.* 2016.

Note: this is a general practice guideline, and does not represent a professional standard of care. Care should be revised for individual patients.

* Levels of evidence are based on guidelines from Oxford Centre for Evidence-Based Medicine; detailed definitions are available at <http://www.cebm.net/ocebm-levels-of-evidence/>. In general, the levels of evidence are as follows: Level A: systematic reviews of RCTs. Level B: RCTs or significant observational study. Level C: cohort study. Level D: case-series, case-control or historically-controlled study. Level E: physiologic or mechanism-based evidence.

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	<u>GA ≤ 31 6/7 weeks</u>	<u>GA ≥ 32 0/7 weeks</u>	
DELIVERY ROOM	<p>Resuscitate per NRP</p> <ul style="list-style-type: none"> Timed cord clamping at 30 seconds Use warming mattress, plastic wrap, hat <p>Respiratory Care</p> <ul style="list-style-type: none"> Start with FiO₂ of 30% Use T-piece resuscitator Apply CPAP immediately after birth <ul style="list-style-type: none"> Start with face mask if PPV likely Use RAM cannula as soon as possible Consider intubation if prolonged PPV, or significant apnea or work of breathing If able to support with RAM CPAP: <ul style="list-style-type: none"> Consider using PEEP of 7 Continue CPAP through transport to NICU 	<p>Resuscitate per NRP</p> <p>Respiratory Care</p> <ul style="list-style-type: none"> Start with FiO₂ of 21% If respiratory distress or persistent oxygen need noted, start CPAP with face mask or RAM cannula as soon as possible Consider intubation if prolonged PPV, or significant apnea or work of breathing If RAM CPAP required: <ul style="list-style-type: none"> Consider using PEEP of 7 Continue CPAP through transport to NICU 	<p>Troubleshooting CPAP</p> <p>If CPAP does not appear to be effective, consider the following:</p> <ul style="list-style-type: none"> Improper size/fit of prongs Need for chin strap or pacifier Nasal obstruction due to secretions Airway obstruction from flexed neck Gastric distension Too frequent handling
MECHANICAL VENTILATION	<p>Initial Intubation Criteria (first 24 hours of life)</p> <ul style="list-style-type: none"> Sustained FiO₂ > 30%, pCO₂ > 65, significant work of breathing, or significant apnea <p>Ongoing Mechanical Ventilation</p> <ul style="list-style-type: none"> Give Curosurf and start caffeine on admission Wean aggressively when able Repeat Curosurf q12 if FiO₂ > 25% Extubation criteria: <ul style="list-style-type: none"> FiO₂ < 30%, PIP < 20, rate < 20, and MAP < 9 Extubate to CPAP of 6 to 7 	<p>Initial Intubation Criteria (first 24 hours of life)</p> <ul style="list-style-type: none"> Sustained FiO₂ > 30%, pCO₂ > 65, significant work of breathing, or significant apnea <p>Ongoing Mechanical Ventilation</p> <ul style="list-style-type: none"> Give Curosurf and start caffeine on admission Wean aggressively when able Repeat Curosurf q12 if FiO₂ > 30% Extubation criteria: <ul style="list-style-type: none"> FiO₂ < 30%, PIP < 20, rate < 20, and MAP < 9 Extubate to CPAP of 6 to 7 	<p>Initial CPAP Interface</p> <ul style="list-style-type: none"> Initial interface: <ul style="list-style-type: none"> GA < 36 weeks: Hudson prongs GA ≥ 36 weeks: RAM cannula <p>Changing CPAP Interface</p> <ul style="list-style-type: none"> Transition from Hudson to RAM can be considered when all of the following: <ul style="list-style-type: none"> Post-menstrual age ≥ 32 weeks FiO₂ is less than 25% on CPAP of 5 Mild or no apnea Comfortable on CPAP RAM cannula can be used for temporary relief of nasal septal injury, with return to Hudson prongs as soon as possible. When transitioning from Hudson prongs to RAM cannula, increase PEEP by 1-2 cm. For infants on RAM cannula, transition to Hudson prongs for any of the following: <ul style="list-style-type: none"> PEEP need greater than 7 cm FiO₂ > 25% Increased work of breathing Frequent or severe apnea Any change in CPAP interface should be made with input from full clinical team.
CPAP	<p>Provision of CPAP</p> <ul style="list-style-type: none"> Hudson prongs preferred Bubble CPAP as soon as possible Wean PEEP only if FiO₂ is 21% for 5 days Consider use of gastric tube to vent stomach Consider use of chin strap to maintain pressure <p>Trialing off CPAP</p> <ul style="list-style-type: none"> GA < 25 weeks: continue CPAP until at least PMA 34 weeks, and clinical criteria below are met GA < 28 weeks: continue CPAP until at least PMA 32 weeks, and clinical criteria below are met Clinical criteria <ul style="list-style-type: none"> CPAP of 5 cm for at least 48 hours FiO₂ of 21% RR < 60 bpm for at least 24 hours No significant work of breathing Infrequent apnea (< 2 spells per 12 hours) Infants with severe growth restriction or chorioamnionitis: consider continuing CPAP for 1-2 weeks beyond meeting other criteria above <p>Reinitiating CPAP</p> <ul style="list-style-type: none"> Restart CPAP if two of the following noted: <ul style="list-style-type: none"> Increased work of breathing RR > 70 bpm Frequent (> 2 in 1 hour) or severe A/B/Ds Need for oxygen Abnormal blood gas If reinitiation of CPAP required, consider waiting at least 5 days before another trial off If nasal cannula oxygen is needed later in hospitalization, consider RT evaluation 	<p>Provision of CPAP</p> <ul style="list-style-type: none"> GA 32 to 35 6/7: Hudson prongs preferred GA ≥ 36: RAM cannula preferred <ul style="list-style-type: none"> Hudson prongs if FiO₂ > 25% or PEEP > 7 Bubble CPAP is preferred when possible Wean PEEP only if FiO₂ is 21% for 2 days Consider use of gastric tube to vent stomach Consider use of chin strap to maintain pressure <p>Trialing off CPAP</p> <p>Trial off CPAP when all of following are met:</p> <ul style="list-style-type: none"> Clinical stability <ul style="list-style-type: none"> On CPAP of 5 cm FiO₂ of 21% RR < 60 bpm No significant work of breathing Infrequent apnea (< 2 spells per 12 hours) Infants with severe growth restriction or chorioamnionitis: consider continuing CPAP for 1-2 weeks beyond meeting other criteria above <p>Reinitiating CPAP</p> <ul style="list-style-type: none"> Restart CPAP if two of the following noted: <ul style="list-style-type: none"> Increased work of breathing RR > 70 bpm Frequent A/B/Ds (> 2 in 1 hour) Severe A/B/Ds Need for oxygen Abnormal blood gas If reinitiation of CPAP required, consider waiting at least 5 days before another trial off 	<p>Avoiding Nasal Septal Injury</p> <ul style="list-style-type: none"> Use Duoderm or cannulaide over base of nasal septum. Insure it is dry & intact. Bridge of CPAP prongs should not touch nasal septum. Avoid excess pressure from prongs on internal nasal mucosa. <p>Weighing Infants on CPAP</p> <ul style="list-style-type: none"> In general, infants should be weighed without removal of CPAP when possible. Hold tubing off scale during weighing. When weighing with Hudson prongs, 30 grams should be subtracted from weight. When weighing with RAM cannula, no adjustment is needed. <p>Family Involvement While Infant on CPAP</p> <p>Families should be encouraged to alert providers when:</p> <ul style="list-style-type: none"> Water noted in tubing Bubbling not occurring Prongs/RAM not secured in baby's nares Nares appear erythematous or swollen

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