nCPAP vs. Intubation for Premature Babies

“One additional infant could survive to 36 weeks without bronchopulmonary dysplasia for every 25 babies treated with nasal CPAP in the delivery room rather than being intubated” ¹

Then, why do we still intubate?

Ventilating premature neonates has been a challenge for a long time. The lungs of premature neonates have particular structural development, depending on the numbers of week at birth. They won’t have ability to produce surfactant and they have less surface area for gas exchange to occur. This is further complicated by apnea and the infant’s inability to maintain his FRC, because of the high work of breathing (WOB) needed just to overcome the opposing forces that resist lung inflation during spontaneous breathing. As result, we often see severe respiratory failure in premature neonates with the respiratory distress syndrome (RDS) ². Before ante-natal corticosteroids and surfactant, which appeared around 1970 ³, mechanical ventilation and intubation, or invasive ventilation, were the only choices to improve mortality in premature babies. Today, surfactant, corticosteroids and mechanical ventilation are still the standard of care for preterm infant, but non-invasive ventilation is increasingly being employed in neonatal units. Non-invasive ventilation has not been proved causing less mortality than invasive ventilation, but is proven to be safe and efficient.

“Invasive ventilation is a major risk factor for the development of broncho-pulmonary dysplasia (BDP) and ventilator induced lung injuries (VILI)” ². Mechanical ventilation has been associated with complications, even when it is on a short period; lung inflammation, reduced efficiency of endogenous surfactant, arrest of alveolar growth and development, volutrauma, shear injury/atelectrauma, biotrauma. ² Intubation is also traumatic and painful, it requires sedation and can be associated with “hemodynamic instabilities, airway emergencies, acute airway injury, colonization of the trachea, reduced ciliary movement, secretions, high resistance to air flow, and increased WOB. The endotracheal tube (ETT) bypasses the glottis and hinders the neonate's adaptive mechanism (grunting) for preserving the end-expiratory lung volume. The ETT also provides a direct route into the lower, sterile airway, which increases the risk of ventilator-associated pneumonia and sepsis.” ²
nCPAP vs. Intubation for Premature Babies

Non-invasive ventilation (NIV) has proven to be an efficient alternative to intubation and mechanical ventilation. First, it permits spontaneous ventilation and does not require invasive ETT. It improves gas exchange by increasing FRC, stabilizing chest wall, enhancing surfactant production and reducing work of breathing. Furthermore, it requires less sedation and will allow bonding. NIV’s first purpose is to prevent damages from intubation and mechanical ventilation, avoid VILI and prevent development of BDP. Some complications are associated to nCPAP; barotraumas, gastric distension, pressure sores, etc. nCPAP therapy has some limits, it is not yet proven capable of improving efficiently alveolar ventilation to new-borns with worsening conditions. “Approximately 50–67% of very-low-birth-weight premature neonates supported initially with CPAP develop severe respiratory failure requiring intubation and invasive ventilation” 2. This is where new modes, improved synchronization and better application will help to improve treatment.

The CNO brings that innovation. First, the medijet uses a modified benveniste valve, which is a virtual flow valve that will build the pressure wanted in a small reservoir contained in the generator. This principle will let the infant inhale and exhale without the usual amount of work needed to activate a mechanical valve. It will also allow an airway related pressure trigger, which is unique in nCPAP therapy. Synchronization is the key to improve alveolar ventilation in pre-term infant, because it allows increasing the pressure during inspiration and improving tidal volume while maintaining an adequate expiratory pressure for gas exchange.

The CNO is for all needs of NIV. It offers 5 modes of ventilation; nCPAP (with leak-assist), apnea-cpap, NIPPV, SNIPPV and HFO. This will help to address limitation of classical nCPAP, enlarging patient group from RDS and post-extubation to apnea-bradycardic patient, hypercapnia and all group of patients needing increased alveolar ventilation. We are in a good position of offering care-givers tools providing optimal care to pre-term and near-terms infants, and minimizing complications.

Bibliography
2. Neonatal noninvasive ventilation techniques: o we really need to intubate? Respiratory care • SEPTEMBER 2011 VOL 56 NO 9