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Review

Evidence for high flow nasal cannula as non-invasive respiratory support in premature infants: A literature review

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Introduction

Respiratory Distress Syndrome (RDS) is the most common cause of pulmonary insufficiency affecting premature infants. Studies show 92% of infants born at 24–25 weeks gestation, 88% of infants born at 26–27 weeks gestation, 76% of infants born at 28–29 weeks gestation and 57% of infants born at 30–31 weeks gestation present with the disease (EuroNeoNet, 2013). RDS is mainly a disease of premature infants and is due to lung immaturity and a deficiency of surfactant in the alveoli. This condition presents soon after delivery with cyanosis, tachypnoea, intercostal recession and grunting, with symptoms gradually worsening over the first 48 h. Treatment consists of providing respiratory support and administration of surfactant where appropriate (Sweet et al., 2013). Recent studies show that 50% of infants born at 26–29 weeks gestation with RDS will require intubation, mechanical ventilation and surfactant administration initially (Dunn et al., 2011). Though these measures can be life saving, adverse side effects such as barotrauma, volutrauma and alectotrauma can lead to chronic lung disease in these infants. For this reason early use of non-invasive respiratory support is recommended where possible to minimize lung injury (Sweet et al., 2013). This non- invasive support has been traditionally provided by Nasal Continuous Positive Airway Pressure (NCPAP) (Gang and Sinha, 2014). However, a new modality, Heated Humidified High Flow Nasal Cannula (HFNC) has been used internationally and is gaining popularity in Ireland and the U.K. (Ojha et al., 2013). In the past 2 years this modality has been introduced in the many NICUs and has been used for weaning from NCPAP. This device is favored by staff due to its ease of use and comfort. The question of what evidence supports the use of this new modality was the impetus for this literature review Four themes arose from the literature when this topic was examined, the lung mechanics involved, the use of HFNC as post extubation non-invasive support, high flow as a weaning mechanism from NCPAP and the issues surrounding comfort and nasal trauma. Therefore, the purpose of the review is to inform evidence based practice in the use of high flow nasal cannula in the neonatal intensive care unit (NICU).

Lung mechanics

NCPAP was originally demonstrated by Gregory and colleagues (Dunn et al., 1972) as a primary source of respiratory support. It involves the application of end expiratory pressure to a spontaneously breathing infant (Irwin Sherman et al., 2003). It increases the functional residual capacity, increases pulmonary compliance, prevents alveolar collapse, conserves surfactant, splints the airway and diaphragm and reduces mechanical obstruction (Jones and Deveau, 1997). On the other hand, HFNC is the delivery of >1itre/minute (l/min.) of properly conditioned gas to the upper airway (Cummings and Polin, 2015). It works differently than NCPAP, it reduces nasopharyngeal inspiratory resistance, provides washout of nasopharyngeal dead space, provides heated, humidified gas to the airway, improves secretion mobilization restoring mucocilliary function and provides positive airway distending pressure to improve lung compliance and gas exchange (Cummings and Polin, 2015; Frizzola et al., 2011; Saslow et al., 2006; Sreenan et al., 2001).

Seven studies in the search explored technical issues with regard to measuring the work of breathing using HFNC and NCPAP, 2 of which compared the 2 devices in common use (Optiflow and Vapotherm).

Sreenan et al. (2001) conducted a study of premature infants (n = 40), 28.7 ± 0.4 weeks, weight 1.256 Kg ± 66 g, in Canada comparing infants treated with ventilator generated NCPAP for apnea of prematurity with infants treated with nasal cannula using flow rates up to 2.5 l/min. The pressure generated was measured using an esophageal catheter and data was collected

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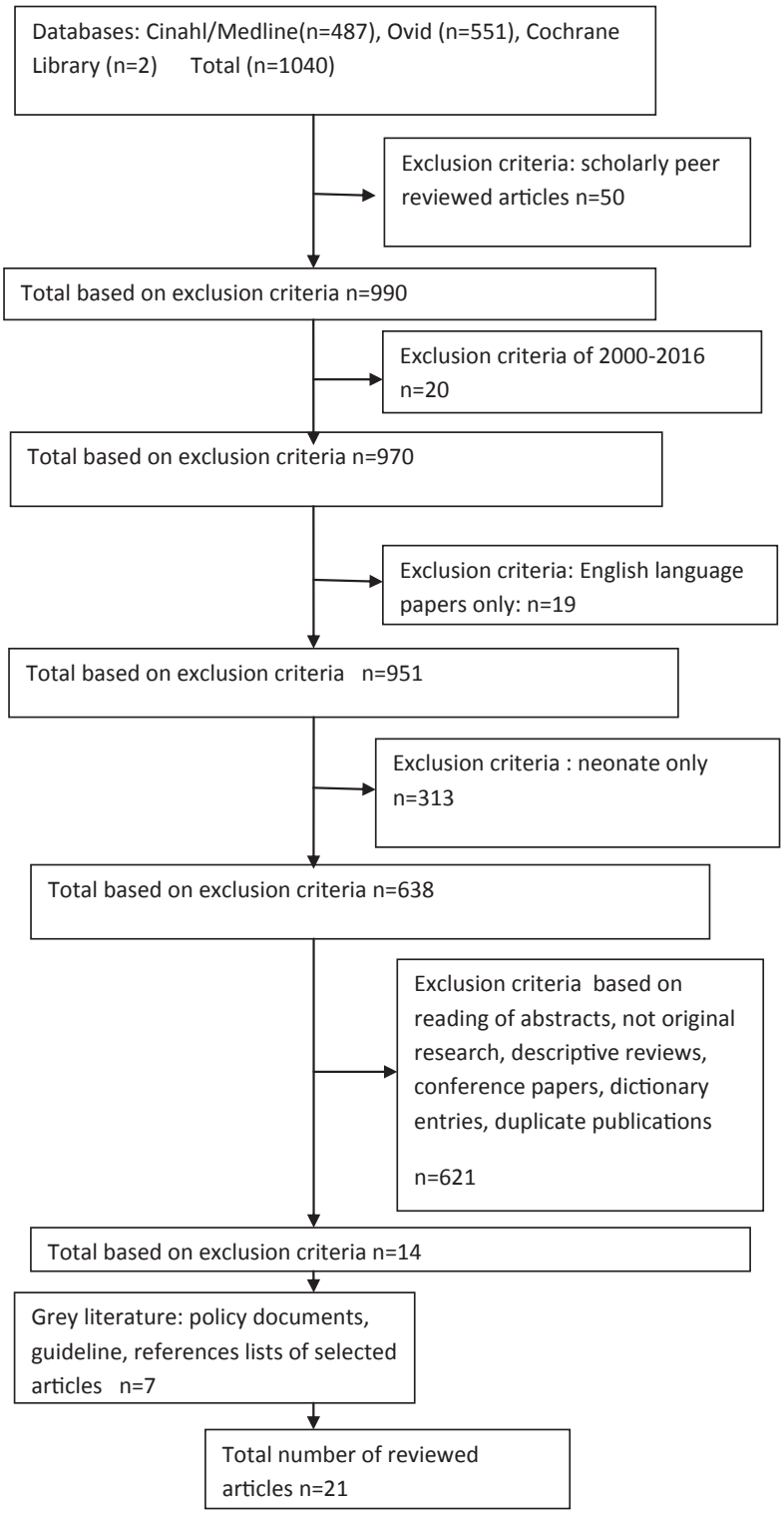
Literature Search for evidence for use of High Flow nasal Cannula:



over 2 six-hour periods. They demonstrated that their high flow device generated pressures comparable to NCPAP. The authors found that the pressure increased linearly and was weight dependant. However, since they did not measure the work of breathing or lung mechanics, they acknowledge that their findings are limited to apnea of prematurity and cannot be recommended as a means of primary respiratory support. In addition, recent studies question the reliability of esophageal catheters to measure delivered pressure, stating their preference for their use in measuring respiratory mechanics and favor the use of intrapharyngeal devices for pressure measurement (Wilkinson et al., 2008).

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